



Proceedings
Of

A MULTI-TRACK NATIONAL CONFERENCE

SLIETCON-2019

March 1-2, 2019



Organised by:

Sant Longowal Institute of Engineering & Technology

Deemed to be University Under MHRD, Govt. of India

Longowal (148106) Sangrur, Punjab, India

Held at:

National Institute of Technical Teachers Training and Research (NITTTR)

Sector 26, Chandigarh - 160019 India



MESSAGE FROM THE DIRECTOR

It is my immense pleasure to welcome you all to the **SLIETCON – 2019, A Multi-track National Conference**. For the first time in the history of SLIET a **multi-track national conference** is being held and that too outside Institute. SLIETCON-2019 provides an opportunity for the meeting of Researchers, Engineers, Scientists, and specialists in the various research and development fields of Engineering and Technology. The conference offers a premise for experts to gather and interact intensively on the topics of Food Engineering and Technology, Chemical Engineering, Computer Science and Technology, Electrical and Instrumentation Engineering, Electronics and Communication. I hope eminent speakers will cover all the themes from different perspectives. I am privileged to say that this conference will definitely offer suitable solutions to the various issues.



Today, the world is changing at a fast pace, and the borders between countries are becoming more and more transparent. The problems occurring in the society are more complex than those in the past. In order to solve these problems, we need a multidisciplinary approach on a global scale. The Central Government has already taken various initiatives in this direction and make in India is the one of the such initiative launched on 25th of September in 2014. The purpose of launching this campaign is to make India a destination of global manufacturing hub.

I am sure that such multi track conferences will come out with the recommendations which will be helpful to industry also. The success of this Conference is solely on the dedication and efforts of innumerable people who started working on the preparations for almost a year in many ways to make this Conference become a reality. I hope that this unique multidisciplinary conference will provide our participants with a truly transformative experience through a variety of knowledge and perspectives so that the complex problems in our society can be improved. Eventually I express my special thanks and appreciation to all.

PROFESSOR SHAILENDRA JAIN

DIRECTOR,

**SANT LONGOWAL INSTITUTE OF
ENGINEERING AND TECHNOLOGY,
LONGOWAL**



DEAN (ACADEMICS) MESSAGE

It is an honour for me to write a message for an **SLIETCON-2019, A Multi-track National Conference**. The tracks selected by the Conference are particularly ones which deserve praise and compliment. I extend my warm welcome to all the participants from around the country to attend an event which is of a prime significance.



Universities exist to create new knowledge. Dissemination of this new knowledge is of prime importance. A research conference is a platform which facilitates discussion on new knowledge and its dissemination. This Multi-track national conference on is one such step taken by SLIET to provide a platform to researchers to share their intellectual work and receive feedback from like-minded people. It is about time that we all sit together to seriously ponder on working out some solid framework for the coming generations and facilitate these disciplines according to our national needs.

Conferences are generally an essential part of academic discourse. This gives me a feeling of confidence that our future is bright. SLIETCON-2019 is another opportunity to move ahead in the area of future planning in terms of intellectual growth, identification of challenges and so forth. I encourage the students to participate in such activities as much as possible. The youth of today has an enormous potential thus it is essential that they be given an opportunity to express their views; conduct research and experiment to bring a positive change in the contemporary world. I hope the Conference organizers and the participants are able to achieve their goals and objectives.

PROFESSOR AJAT SHATRU ARORA,

DEAN (ACADEMICS),

**SANT LONGOWAL INSTITUTE OF
ENGINEERING AND TECHNOLOGY,
LONGOWAL(PUNJAB)**



MESSAGE FROM THE GUEST OF HONOR

It gives me immense pleasure to know that Sant Longowal Institute of Engineering and Technology, Longowal is organizing a multidisciplinary National Conference from 1st to 2nd March 2019 at National Institute of Technical Teachers Training and Research, Chandigarh. Multidisciplinary conference helps us to share resources and knowledge, enhance our understanding in emerging areas of engineering



and technology and build consensus on policy matters for meeting the current and future challenges. India faces the biggest challenges in the area of clean energy, clean drinking water, safe food, environment, climate, cyber security and healthcare. Multidisciplinary approach is essentially required to solve these issues of national importance.

I hope that this conference will provide platform to the scientists and professionals to deliberate on their subject of interest and make fruitful recommendations on the theme of the conference.

I extend my best wishes to the organizers and participants of this event and hope that the conference will be a grand success.

BHUPENDAR KHATKAR

PRESIDENT DESIGNATE AFSTI

PROFESSOR GJUST, HISAR



AcSIR

वैज्ञानिक और नवीकृत अनुसंधान अकादमी
ACADEMY OF SCIENTIFIC AND INNOVATIVE RESEARCH

(An Institution of National Importance by an Act of Parliament)

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प्रोफेसर (डॉ.) राजेन्द्र सिंह सांगवान

निदेशक

एसीएसआईआर मुख्यालय, सीएसआईआर-एचआरडीसी परिसर,
सेक्टर-19, कमला नेहरू नगर, गाजियाबाद - 201002, उ.प्र., भारत



Message

I am delighted to know that **Sant Longowal Institute of Engineering and Technology** (SLIET), Sangrur, Punjab, is organizing an important scientific conclave, named as **SLIETCON – 2019**, during March 01 to 02, 2019. It is further a matter of pleasure to learn that SLIETCON – 2019 is a unique Multi-Track National Conference platform bringing together the research students and scientist as well as industry representatives from across multiples stream/sectors of science and engineering.

I feel that SLIET – 2019, as a concomitant platform for colloquia-tracks on “**New Horizons in Food Processing Technology and Nutrition**”, “**Research and Innovation in Chemical Engineering and Technology**”, “**Recent Advances in Computing and Information Technology**”, “**Computational Techniques in Renewable Energy Systems**” and “**Electronics, Communication and Networking Technologies**”, would provide an excellent opportunity of inter-disciplinary opportunities of learning, interacting, brain-storming and ideation to all stakeholders.

I congratulate **SLIET Leadership and Organizing Teams** for conceptualizing and organizing this novel and excellent scientific event. I am sure **SLIETCON - 2019** would have rich and rewarding inter-disciplinary deliberations.

I wish SLIET – 2019 a grand success.

Rajender Singh Sangwan

February 25, 2019

(Rajender Singh Sangwan)



MESSAGE FROM THE DESK OF CHAIRPERSON

Track-I: NHFPTN-2019

It is a matter of proud privilege that Sant Longowal Institute of Engineering and Technology, Longowal (SLIET), is hosting a National conference on “New Horizons in Food Processing Technology and Nutrition (NHFPTN-2019) under SLIETCON-2019, a multi-track conference during March 1-2, 2019 at National Institute of Technical Teachers Training and Research, Chandigarh. This conference is aimed to generate a platform to present and implement the most suitable technologies in the field of food technology and nutrition as well as to encourage the academic activities in order to help students as well as teachers for continuous development of their skills.



The mandate of this conference is to bring together some of the most thoughtful, influential voices in the field of food processing sector to discuss the most recent innovations, trends, concerns as well as practical challenges and the agenda for further research in the fields of Food Technology and Nutrition. This national conference (NHFPTN-2019) is intended to give a profound impulse into the most recent insights in the field of Food technology and nutrition.

New Horizons in Food Processing Technology and Nutrition (NHFPTN-2019) aspire to provide a premium Interdisciplinary platform to build up a network from the grass root to the apical top among the people allied to food science. This conference will serve as a catalyst for the advancement in Food technology and Nutrition which will focus not only on the technologies but also on social and cultural needs. This summit will cover a wide array of themes through plenary sessions, invited lectures, paper presentations and poster sessions which includes emerging techniques for food processing, food safety and quality, innovations in the field of food product development and food process engineering, new perspectives in food biotechnology and fermentation, novel insights in composition of foods as well as value addition of food industry by-products.

This national conference will bring together the engineers, scientists and technologist from industry as well as academia to discuss current trends and future developments in the field of Food Technology and Nutrition that would improve the efficiency and quality of existing technologies.

DR. PARMJIT S. PANESAR

**PROFESSOR & HEAD (FET)
CHAIRPERSON (NHFPTN-2019)**



Track-II: RICET-2019

It is a matter of pleasure that the Department of Chemical Engineering is organizing a two days national conference on “Research and Innovation in Chemical Engineering and Technology” (RICET-2019) under Track II of SLIETCON-2019. It is heartening to note that a large number of papers have been received from across the country.

I am certain that the deliberations during the conference will help researchers from academia and industry and this conference will provide a platform for initiating collaborative research projects. I hope the conference will enhance professionalism and capabilities of all the participants which promotes towards the future advancement in the area of chemical Engineering and Technology. I am sure that RICET-2019 will contribute effectively to achieve the ultimate goal and objectives of conference. I extend my best wishes to all participants, invited delegates, speakers and hope that RICET-2019 would be a grand success.



DR. AVINASH THAKUR
HEAD, DEPT. OF CHEMICAL ENGINEERING
CHAIRPERSON (RICET-2019)



Track-III: RACIT-2019

I am delighted to welcome you all to the SLIETCON-2019 (A Multi-track National Conference) organized by Sant Longowal Institute of Engineering and Technology, Sangrur, India; being held at National Institute of Technical Teachers Training and Research, Chandigarh, India. The conference would provide a forum for exchange of ideas and its related problems to all concerns and shall provide them an opportunity to achieve a broader outlook for the challenges being faced in engineering and technology.



Recent Advances in Computing and Information Technology (RACIT-2019) under SLIETCON-2019 covers almost all the emerging research areas like Artificial Intelligence, Cloud Computing, Machine Learning, etc. in the field of Computer Science and Engineering. I hope it would be highly beneficial for the young IT professionals and researchers.

I hope that the recommendations of the conference will certainly help in accelerating the economical and industrial growth of the country.

With best wishes for the success of the conference.

DR. MAJOR SINGH GORAYA
HEAD, DEPT. OF COMPUTER SCIENCE & ENGINEERING
CHAIRPERSON (RACIT-2019)



Track-IV: CTRES-2019

Sant Longowal Institute of Technology, Sangrur, India is organizing SLIETCON-2019 (A Multi-Track National Conference) being held at National Institute of Technical Teachers Training and Research, Chandigarh, India. The main theme of the conference is to provide a platform to the Academicians, Researchers & Industry Practitioners to share their ideas and technological assets to translate innovations from basic scientific research to quality products for better returns.



Planet earth offers one of the most conducive environments for sustenance and growth of life. Consumption and production trends during the last century have posed a serious challenge to this capability and potential. Efficient use and management of energy resources is need of the hour. In this context, Computational Techniques in Renewable Energy Systems (CTRES-2019) under SLIETCON-2019 is being organized by Electrical and Instrumentation Engineering Department.

PROF. SANJAY MARWAHA
HEAD (EIE)
CHAIRMAN (CTRES-2019)



Track-V: ECNT-2019

I feel profound sense of responsibility and pleasure that the Department of Electronics and Communication Engineering is managing Track-V pertaining to National Conference of Electronics, Communication and Networking Technology (ECNT-2019) of the Multi-Track National Conference (SLIETCON-2019) organized by Sant Longowal Institute of Engineering and Technology, Longowal on March 01-02, 2019 at NITTTR, Chandigarh.



The advancement of wireless Technologies has influenced modern business practices as well as social interaction. The term ‘mobile’ has completely revolutionized the communication by opening up innovative publications that are limited to one’s imagination. As a result, the continuing study of communications and networking is important to better understand existing modes of information transfer, as well as developing and managing new methods. The fourth-generation wireless communication systems have been developed in many countries however with an explosion of wireless mobile devices and services, there are still some challenges that cannot be accommodated even by 4G, such as the spectrum crisis and high energy consumption. There is need to discuss future challenges like 5G wireless communications cognitive radio networks and visible light communications.

I am sure that the members of the research community attached to the area of Electronics and Communication Engineering are dedicated to the cause of engineering services and will make best use of the opportunity to deliberate on the topics during the conference.

I wish the event a grand success and convey my warm greetings to the participants and best wishes to the organizing team.

DR. ANUPMA MARWAHA
PROFESSOR & HEAD, ECE DEPARTMENT
CHAIRMAN (ECNT-2019)



MESSAGE FROM THE COORDINATORS

Track-I: NHFPTN-2019



Dr. Vikas Nanda



Dr. Navdeep Jindal

On behalf of the Organizing committee, it is our pleasure to welcome the delegates during **SLIETCON-2019, A Multi-track National Conference**. This two-day academic event provides a varied and rich feast of scientific information and knowledge. It is important to develop an attitude towards research and evidence building in every scientific sphere and this conference would be a major step towards this. The scientific programme includes the oration by learned speakers, presentations by scientists and researches. We have no doubt that scientific presentations and deliberations during this conference will be quite useful to all the participants and will inspire them to strive for excellence in their respective disciplines. The entire organizing team has worked hard to make it a memorable conference. We wish to extend our gratitude to those involved in making this conference a success. To our generous sponsors and contributors, supporting institutions and volunteers, for their financial support and dedication. A special word of appreciation goes to Mamta Thakur, Rishi Naik and Kirti for always having been there when needed. Last but not least, the authors and attendees, for continuing to contribute to and believe in the excellence of Conference. I again take this opportunity to acknowledge the contribution participants and the delegates.

DR. VIKAS NANDA
COORDINATOR (NHFPTN-2019)

DR. NAVDEEP JINDAL
COORDINATOR (NHFPTN-2019)



Track-II: RICET-2019



Dr. Avinash Thakur



Dr. Gulshan Kumar Jawa

With the shifting paradigm of chemical and allied industries, it has become very important to have a debate on technological innovation to meet the demand of the world in terms of materials and energy. The need of the hour is to discuss and work upon the development and sustainability for a better world. The challenges being faced by the society worldwide have to be addressed primarily through the research and innovation. Today, the world is facing a big challenge of energy and environment. The efficient and alternative methods of energy production and its use have become the matter of big concern which impacts the economy of a nation. The concept of green technology and zero effluent discharge industry has compelled the whole engineering world to collaborate with the academia for research and development for sustainability. Chemical industries play the major role in controlling the world economy and hence have to be analyzed critically.

The conference on 'Research and Innovation in Chemical Engineering and Technology (RICET-2019)' being organized by Department of Chemical Engineering, SLIET has aimed to provide a platform to researchers and the delegates from academia and industries to share their research work in various fields related to chemical engineering and technology.

We acknowledge the contributions from delegates, participants and the organizing team members for joining hands together to meet the objectives of the conference. We are committed to thrive for achieving the objectives for our nation as well as globe. Together we can make a difference.

DR. AVINASH THAKUR
COORDINATOR (RICET-2019)

DR. GULSHAN KUMAR JAWA
COORDINATOR (RICET-2019)



Track-III: RACIT-2019



Dr. Manoj Kumar Sachan



Dr. Birmohan Singh

We take this opportunity to welcome you to the prestigious SLIETCON-2019, A Multi-track National Conference. Track-III of the conference is dedicated towards “Recent Advances in Computing and Information Technology” (RACIT-2019). The general aim of RACIT-2019 to promote national collaboration in education and research in all fields and disciplines of Computer Science and Engineering is well met out.

The conference has received an overwhelming response from various academicians, researchers, and professionals across the country.

We gratefully acknowledge the support received from TEQIP-III in organizing the conference successfully. We are hopeful that this conference will be highly fruitful to all the participants.

DR. MANOJ KUMAR SACHAN
COORDINATOR (RACIT-2019)

DR. BIRMOHAN SINGH
COORDINATOR (RACIT-2019)



Track-IV: CTRES-2019



Dr. Manpreet Kaur



Dr. Raj Kumar Garg

It is a great pleasure and privilege for us to welcome you to the SLIETCON-2019, a Multi-track National Conference. Track-IV of the conference is dedicated towards “Computational Techniques in Renewable Energy Systems CTRES-2019”. This platform will assemble the leaders in the expanding fields related to the isolation, research and development of Energy Efficient Resource Management. We are all acutely aware of the growing crisis associated with resource consumption. Thus, this conference will enable us to meet and discuss critical issues in this escalating problem.

We are happy that the scientists and technologists across the country are participating in the conference. We are sure that the deliberations of the conference will bring forth ideas for developing newer technologies for the benefit of the society and nation. We wish all the participants of the conference to get the maximum benefit

DR. MANPREET KAUR
COORDINATOR (CTRES-2019)

DR. RAJ KUMAR GARG
COORDINATOR (CTRES-2019)



Track-V: ECNT-2019



Dr.A.P.Singh Pharwaha



Dr.Ajaypal Singh Chauhan

It is our pleasure for being the coordinators of the Track-V dedicated to the National Conference of Electronics, Communication and Networking Technology (ECNT-2019) under the aegis of the Multi-Track National Conference (SLIETCON-2019) organized by Sant Longowal Institute of Engineering and Technology, Longowal on March 01-02, 2019 at NITTTR, Chandigarh.

Today, Wireless Communication and Networking Technology has become gravity for human sustenance in a convenient and luxurious way. An event to make every young citizen to know the current trend in the technology is of paramount importance and this National Conference will cater the needs of the upcoming technocrats. We are glad to inform that the conference has received many technical papers from many active participants. Some papers sounded an appreciable interest in making viable attempts in presenting the future thrust area of Electronics Technology by utilizing the resources at hand and sharing the innovative ideas from the societal needs perspective point of view as well.

Brainstorm of the learning community with leading experts in the respective area will surely be helpful in creating new Ideas with the best solutions for Research and Innovation. We welcome and congratulate all the delegates and participants from different parts of the Nation for their best efforts in coming over to NITTR, Chandigarh for sharing their research contribution and innovative ideas for the benefit of the budding engineers and technocrats of our motherland.

DR.A.P. SINGH PHARWAHA
COORDINATOR (ECNT-2019)

DR. AJAYPAL SINGH CHAUHAN
COORDINATOR (ECNT-2019)



TRACK I: New Horizons in Food Processing Technology and Nutrition (NHFTN-2019)

TRACK II: Research and Innovation in Chemical Engineering and Technology (RICET-2019)

TRACK III: Recent Advances in Computing and Information Technology (RACIT-2019)

TRACK IV: Computational Techniques in Renewable Energy Systems (CTRES-2019)

TRACK V: Electronics, Communication and Networking Technologies (ECNT-2019)



Track-I: New Horizons in Food Processing Technology and Nutrition

A Multi-track National Conference

SLIETCON-2019

(March 1 - 2, 2019)

Sant Longowal Institute of Engineering and Technology, Longowal



INVITED LECTURES ABSTRACT



New Horizons in the Exploration of Ancient Grains

Dr. Savita Sharma

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Abstract

The present scenario of food processing is primarily targeting the sustainable development by the exploration of more sustainable resources. Our modern food system isn't exactly setting us up for nutritional success; therefore, various technological interventions are put forward for the growing consumer concerns over fixing all that ails us through food. Conventional grains like wheat and rice have incessant use of conventional cereals cannot fulfill the current demand of providing nutrient dense and wholesome food rich in lipids, high quality protein, micronutrients and bioactive components. The prevailing conditions of health and nutritional security are acting as propulsion for the exploration of new food sources as staple diet. Moreover the concerns like malnutrition, micronutrient deficiency and gluten sensitivity are some of the areas where major cereals deter in the development of food formulations that are suitable for particular demographics or population. Therefore, there is strong need to revive some of the crops through technological intervention so as to allow their mass use and commercialization.

Ancient grains: the gold food

Ancient grains are ancient species which are being reintroduced for a more holistic and sustainable future. Essentially, they include grains and pseudo cereals that have been relatively unchanged over the course of their cultivation and have proven their resilience by outliving their extinction. More importantly, their tiny dimensions possess abundant nutrients which are significant for cell health throughout the body. Certain nutritional benefits include higher micronutrient bioavailability to the human body, greater concentration of therapeutic components such as flavonoids, phytosterols etc., prebiotic potential and production of low-glycemic index and gluten free foods. The flour of these grains exhibits beneficial technological characteristics such as thickening, freeze-thaw stability, natural coloration and fat replacement. Due to a multitude of benefits, there is a resurgent interest in identifying and highlighting the health components of ancient grains as functional food ingredients.

Ancient grains such as quinoa, oats, sorghum, amaranth, buckwheat, barley chia and teff have been recognized by the food industry. All these inhabit a variety of nutrients and are adequate in their individual selves. For instance, quinoa is a protein rich grain with high level of essential amino acids such as lysine, arginine and tryptophan and also contains high amount of fat, fibre and minerals. But these grains also contain certain anti-nutritional factors such as phytic acid, saponins, tannins and protease inhibitors which tend to reduce the protein and mineral bioavailability. Certain processes such as thermal treatments, extrusion, fermentation and soaking have been optimally utilised to reduce their levels or remove them for food use.



Nutritional and technological aspects:

Gluten free: A significant reason for the revival of ancient grains was the inclination towards gluten-free foods. Celiac disease, more commonly known as gluten intolerance is an autoimmune disorder which is triggered on gluten consumption and damages the small intestine. It affects 1 person among 133 healthy individuals. Consumption of the gluten-free grains can eradicate this disorder for a healthy living.

Convenience: The revival of the ancient grains can also create markets for convenience foods and specialty foods. The consumer demand varies nutritionally and organoleptically with age, sex, income and lifestyle.

Wholesome: The commonly consumed high energy food products are generally linked to high carbohydrates and fats consequently leading to certain physiological disorders like diabetes and obesity. This realization has led to the exploitation of the ancient grains for their nutritional value by the food processors.

Sustainable protein: The gradual drift from animal protein to plant protein establishes new markets from the ancient grains and can be explored as a source of sustainable protein owing to good protein quality.

Processing congeniality: Texturization methods such as extrusion can help mimic animal products such as ham, steak and sausages which opens up a novel domain for the preparation of vegan food from the ancient grains such as quinoa and amaranth.

Fasting foods: Fasting foods is a unique category of specialty foods. The abstention from consumption of major cereals and unavailability of fasting foods on the shelves creates a trailblazing market for the ancient grains which is yet to be explored.

Potential and Prospects: Ancient grains are of significant importance for the food manufacturers, dieticians, nutritionists and the consumer. Exploitation of these grains to meet the consumer demand can improve the society as a whole due to their technological, nutritional, functional and monetary benefits. The trends of the health-conscious consumer further suit the requirements of end product manufacturers. A number of products manufactured from the ancient grains have commercial potential and should therefore be developed for industrialization. The different players in production and supply chain need to be engaged strategically and innovatively to work together for the common objective of expanding these grains into a vibrant industry.

Suggested Reading

Lutz, K. (2014). Ancient seeds: The complete guide to cooking with power-packed chia, quinoa, flax, hemp and amaranth. Sterling Publishing Co., New York.

Mathew, E. & Singh, M. (2016). Ancient grains and pseudocereals: Chemical compositions, nutritional benefits, and roles in 21st century diets. *Cereal Foods World* 61, 198-203.

Wrigley, C., Corke, H., Seetharaman, K. & Faubion, J. (2016). *Encyclopedia of Food Grains: The World of Food Grains*. Vol 1. Elsevier Ltd., Oxford.



Advanced Packaging Trends for Shelf Life Extension of Fresh Fruits and Vegetables

Dr Ashok Kumar and Dr Preetinder Kaur
Punjab Agricultural University, Ludhiana

Abstract

In the recent years, India has witnessed an increased consumer awareness towards the health benefits of eating fresh fruits and vegetables and convenience is the need of the hour due to the changing lifestyle. These trends towards fresh, convenient and high quality foods have led to an enormous increase in the demand for ready-to-eat and ready-to-use fruits and vegetables with fresh-like quality. Post-harvest losses in fresh produce are quite high owing to their high moisture content as well as high rates of respiration and transpiration, that lead to loss in freshness and nutritive quality. The physical, chemical and microbiological changes responsible for qualitative deterioration in fruits and vegetables need be delayed for their shelf life extension. The use of globally prevalent, advanced and innovative packaging techniques along with low temperature storage can help in meeting the consumer demand for fresh and safe fruit and vegetable products. Apart from the basic function performed by the traditional packaging methods namely containment of the produce, advanced packaging in upcoming years will be required to perform many additional functions like convenience, maintaining freshness and safety, indicating the state of freshness, and additional features like traceability and biodegradability. Many packaging technologies viz. Modified Atmosphere Packaging, Active Packaging, Anti-Microbial Packaging, Intelligent Packaging, Smart packaging, Green Packaging have evolved over the years. MAP helps in enhancing the shelf-life of fruits and vegetables through active and passive modification of in-pack atmosphere. Active Packaging involves creation of desirable gaseous atmosphere inside the package by incorporation of certain active elements either inside the package or in the package material. In Anti-Microbial Packaging, a slow release food-compatible bactericidal and fungicidal substances or anti-microbial additives are incorporated within the packaging material/package. Intelligent packaging extends the communication function of the packaging by monitoring and giving information to the consumers based on its ability to sense, detect or record external or external changes in the product's environment. Smart packaging combines active packaging and intelligent packaging and thus also maintains the desirable in-pack conditions when required. There is a growing pressure in the fresh fruits and vegetables packaging sector to replace the petrochemical based packaging films with environmentally friendly biodegradable or green packaging materials. Although biodegradable films are more expensive than the petrochemical materials, they can contribute towards effectively reducing environmental pollution as they are synthesized from organic materials and microbial polymers. These advanced technologies can help in maintaining quality and safety of fresh fruits and vegetables for a longer duration and play a major role in reducing the food losses, thereby enhancing the benefits for both the consumer and the producer.



Nano-bioengineered based commercially viable electronic sensor systems for onsite food safety and clinical applications

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Abstract

Among various global challenges, food safety and health-related concerns are major threats for mankind. The exponential bloom of population across the world have not only affected the healthcare severely but also increased the demand of food exponentially. To meet the suddenly exceeded demand of food, various technological advancements have been seen in recent past. Introduction of high yielding crops, food processing and its preservation techniques have majorly been employed to overcome the food deficit. However, the food quality and nutritional values of such processed and preserved food items became a major concern since then. The improper transportation and poor preservation at retailing outlets also introduces a few degrees of quality degradation by and spoilage through microbial invasion. On the other side, public healthcare systems have been disrupted because of the side effects of population explosion, where improper sanitation, hygiene, and sedentary lifestyle are major factors for unhealthy life. Prolong exposure in such conditions causes a number of communicable and non-communicable diseases with rapid progression rate. In the conventional practices, such conditions are diagnosed with the help of various lab-based, high end, sophisticated instrumentations, which are not only cost consuming, but also demands time to for long queue [1, 2].

To address these issues, a number of upgradations in quality control and clinical checkup systems have been seen in recent past by overcoming the conventional systems, where the examination at the point of need was given its utmost emphases. These conventional modules are either hand-held dependable devices or the lab-based extremely sophisticated workstation [3]. Another type of the modules are chip-based, small, instrument free detection kits also known as biosensors that are constantly replacing the above not only for their easy handling but also for their comparable analytical performance [4]. The talk addresses the importance of biosensors for assuring the food safety and clinical demands, where the brief introduction of such devices will be discussed with the help of illustrations. At first, the need of onsite quality control will be discussed and thereafter the case study of an instrument-free, and simplistic disposable kit for milk quality determination will be conversed. In the second phase of talk, the importance of vitamin C in neurodegenerative diseases will be discussed. Thereafter, its ultrasensitive determination in mice brain using electrochemical nanosensors will be discussed.



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 - [3] Chandra P. *Nanobiosensors for Personalized and Onsite Biomedical Diagnosis*. IET, London; 2016.
 - [4] Chandra P, Tan YN, Singh SP. *Next generation point-of-care biomedical sensors technologies for cancer diagnosis*: Springer; 2017.
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Foldscope as a frugal analytical tool for food safety and quality

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Abstract

Establishing food safety and quality by physical, chemical and microbial analysis, using elaborate methods and bulky instruments and equipment is typical and traditional. Foldscope as a lightweight, portable, economic, simple to use tool was explored for its utility to reach the masses for similar aim. A Foldscope is a microscope that can be assembled from simple components, including a sheet of water proof paper and a lens. It was invented by Dr. Manu Prakash and his team in Stanford University. It is considered a part of “frugal science” movement which aims to make cheap and easy-to-use tools for scientific purpose in the developing world. Foldscope is compatible with all smartphones, thus enabling sharing of images and videos of the samples studied.

A study was undertaken to check usage of Foldscope as an analytical tool for reigniting scientific temperament and research, with specific application in food safety and quality. Effectiveness of Foldscope to check adulteration in various food products viz., spices, flours, sugar, coffee and milk was also examined.

Sample smeared glass slides were viewed using Foldscopes, provided under a project funded by Department of Biotechnology, Ministry of Science and Technology, Government of India. The images and videos were captured using smartphones.

Hands-on training was imparted through inter-institutional and inter-departmental workshops on Foldscope assembly and application. These comprised creative microscopic exploration of a wide array of samples. Practical relevance of GMP/GHP practices were explored and disseminated among food handlers. Presence of food adulterants was detected by observing the difference in microscopic structure of food adulterants and pure food samples.

Foldscope is highly beneficial, with high data sharing efficiency. It can potentially infuse a sense of curiosity amongst various categories of users. It also creates a possible base for



future investigations as it is highly convenient for out- of-classroom studies with 3E's – Enjoyable, Encouraging, and Enlightening!

Keywords: Foldscope, food safety and quality, food adulterants.

Value chain in Food Processing

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There is a great diversity of agro-processing worldwide and in some countries, it accounts for more than 60% of the employment. Many people start agro-businesses at a small scale, often working from home and selling to neighbours and friends via a roadside stall or in a local marketplace. Characteristically, small-scale production is labour-intensive as there is rarely sufficient money to invest in specialized processing equipment. The quality of products may vary and small enterprises often do not have consistency of supply and so cannot cater for wholesalers or retailers who require guaranteed deliveries of consistent quality. Small-scale processors also may not have contracts with raw material or packaging suppliers but buy materials from local markets. There are number of these businesses in emerging economies, and with advice and assistance some of them can develop into larger scale enterprises. When small scale processors try to scale up operations a series of issues may be encountered. For example, products may be in direct competition with those of other processors when displayed on retail shelves and so the quality of the packaging becomes much more important. Retailers may negotiate lower prices than processors have experienced when making direct sales to consumers. Any scaling up of operations brings new challenges: typically these businesses employ more people and the owner must have staff management skills; more careful control is needed over business finance, especially production and distribution costs; business management and financial planning skills are required to stay ahead of competitors; investment decisions are needed for both new equipment and improved packaging. The larger production volumes require production-planning skills and may create a need for environmental protection through waste management. Other issues, such as market research, product development and the business image may also increase in importance.

The degree of processing can vary tremendously, ranging from the cleaning and grading of fruits to the milling of rice, to the cooking, mixing, and chemical alteration that create a textured vegetable food. As shown in table 1.0 agro industries can be roughly categorized according to the degree the raw material is transformed. In general, capital investment, technological complexity, and managerial requirements increase in proportion with the degree of transformation. The purposes of transforming raw food and fiber are to create an edible or usable form, to increase storability, to create a more easily transportable form, and to enhance palatability or nutritional value.

Processed foods far from being a luxury can significantly enhance an economy by freeing the work force (esp women) to more productive activities rather than preparing and



serving food in the house. In addition to preserving perishable crops, processed foods can improve health esp. of children, increase incomes, reduce sickness and improve quality of life. Food spoilage is wasteful, costly and can adversely affect trade and consumer confidence. People have the right to expect the food they eat to be safe and suitable for consumption. Everyone including farmers, growers, manufacturers and processors, food handlers and consumers has a responsibility to ensure that food is safe and suitable for consumption.

Table 1.0 Categories of Agro Industries based on degree of transformation of raw materials

PRIMARY PROCESSING	<ul style="list-style-type: none"> • Cleaning • Grading • Conditioning • Packaging • Storage 	No physical transformation of the commodity
SECONDARY PROCESSING	<ul style="list-style-type: none"> • Paddy to rice • Wheat to flour • Oilseed to Oil • Pulses to dal • Dal to basen 	Physical transformation but product is not ready to eat
TERTIARY PROCESSING	<ul style="list-style-type: none"> • Cooking rice • Baking bread & biscuit • RTE foods • Pickles • Ketchup 	RTE products Convenient

Half a century ago, green revolution provided the first big leap for Indian agriculture and food security. The country became self-sufficient in food and from a net importer of grains, it transformed into an exporter. The Government's strong interventions in creating minimum support price assured farmers of definite marketing. Institutions like FCI supported then government and farmers in this regard. Further R & D institutions like ICAR, SAU with strong extension complemented the efforts. A public distribution system created fair price shops to sell essential food items at affordable prices. However over the last 50 years, the context for food and agriculture has changed. Now tiring public infrastructure, serious water stress and growing threat of environment change necessitates new thinking towards market driven approach that will support sustainable agriculture and ensure remunerative returns to the farmers. The corporate sector can add a unique dimension, given the power of private entrepreneurship, its capacity to innovate, its wide variety of skill as well as its ability to reach markets more efficiently. Today's consumer is seeking superior nutritional and taste benefits, better hygiene and convenience. Increasing awareness of health and well being is also generating demand for wider variety of grains. This calls for a change in farming system from selling whatever is produced to producing what the consumer wants. Increasing crop production alone is not sufficient to raise farmer income if markets do not support such production. India's agri waste is estimated to be Rs 92000/- crores. A big fraction of this wastage is in



perishables. A higher level of food processing can create quality agri commodities there by reducing farm wastages. This require cold chain infrastructure as well as branded products that can win the consumer confidence. An integrated network of refrigerated buildings and vehicles to transport produce from farm to shop quickly and in good condition is must. Growing middle class in big cities is hungry for high quality fresh and processed food products. If India develops a nationwide cool cold chain, It would connect farmers with these premium markets and raise their income. As per International Institute of Refrigeration if developing countries had same level of refrigeration infrastructure as developed, they would save 200 million tonnes of food or around 14% of their food supply. In India, NCCD estimated that country has meagre (15%) control temperature transportation facility and less 1% of pack houses that pre-condition the produce for for onward transportation. This lack of infrastructure means just 4% of country's food is moved through cold chain. So main missing link is seamless control environment supply chain, comprising on farm pack houses, pre-cooling, distribution hubs, refrigerated transport and marketing vital to move the fresh produce swiftly from farm gate to consumption centers. The country needs to focus adapt the solution that worked and delivered throughout the world. Cold chain donot just reduce the post harvest losses but also allows the farmers to earn more by maintaining the quality of their produce by marketing it to distant cities. Recently Sh. Surinder Kumar of Abohar has successfully marketed his kinnows from Punjab to the city in Bangalore using the cold chain like waxing, grading, pre-cooling, packaging and transportation in reefer vans. This has not only reduced the wastage but also raised his profits tenfold. So entrepreneurial farmers or farmer cooperatives can move right up the value chain by developing its own processing activities and products that serve the society as a whole. The following few points could guide and help in this regard.

First step towards operating a successful food processing plant is to have a good idea. You also need to find out whether idea is feasible and if necessary, to convince financial backers (friends, family members, banks or shareholders) to support the idea. It is not always easy to get started but with persistence, help and determination, almost anyone can start a small processing business. However poor planning can lead to production stoppages. (Planning is thinking ahead to make sure that everything is in place to produce the required amount of product in the time available)

FEASIBILITY STUDY

Aspiring entrepreneurs may have an idea about the type of food product that they would like to make. This can come from seeing others successfully producing a food and wanting to copy them or from talking to friends and family members about products that they think they could make. However, an idea for a business is not a sufficient reason to begin production straight away, without having thought clearly about the different aspects involved in actually running the business. To reduce this risk of failure and losing money, potential producers should go through the different aspects of running their business in discussions with friends and advisers before they commit funds or try to obtain a loan. This process is known as doing a *feasibility study* and when the results are written down, the document is known as a *business plan*.



Market feasibility

Once a potential producer decides that he wishes to start a business, the first thing to do is to find out what is the likely demand for the food product that he or she wishes to make, by conducting a short *market survey*. There are two types of information that are needed:

- 1) Information about the product and its quality
- 2) Information about how much people will buy, how often and for what price. (Survey of market size and value)

The following questions needs to be answered by a feasibility study

is there a demand for the produce?	(Find out the characteristics required of the product and the size and value of the market)
who else is producing similar products?	(Determine the number and type of competitors)
what is needed to make the product?	(Find the availability and cost of staff, equipment, services, raw materials, ingredients and packaging)
what is the cost of producing a product?	(Calculate the capital costs of getting started and the operating costs of production)
what is the likely profit?	(Calculate the difference between the expected income from sales to an estimated share of the market and the costs of production)

Each of these aspects should be looked at in turn. When all the information has been gathered and analyzed, it should be possible to make a decision on whether the proposed investment in the business is worthwhile

Technical feasibility

Once an entrepreneur has found information about potential consumers, their requirements and the likely share of the market that could be obtained for a new product, it is then necessary to assess whether production at this scale is technically feasible. The series of questions below is helpful in deciding the technical requirements of the business:

- Are enough raw materials available of the correct quality when needed for year-round production?
- Is the cost of the raw materials satisfactory?
- Is the correct size and type of equipment available for the expected production level and at a reasonable cost?
- Can it be made by local workshops and are maintenance and repair costs affordable?
- Is sufficient information and expertise available to ensure that the food is consistently made at the required quality?
- Are suitable packaging materials available and affordable?
- Are distribution procedures to retailers or other sellers established?
- Is a suitable building available and what modifications are needed?
- Are services (fuel, water, electricity etc.) available and affordable?
- Are trained workers available and are their salaries affordable?



Financial feasibility:

It takes in to account the following issues

Start-up costs, Operating costs, Cash flow, Profit potential and Loans

The *start-up capital* is the amount of money that is needed to buy the facilities and equipment, to register and licence the business and get the necessary hygiene certificates.

Working Capital includes the costs of raw materials, packaging, staff training, product promotion etc. that have to be made before the business begins to generate income from sales of the product. The requirement for working capital also continues as the business develops

Operating costs

There are two types of operating (or production) costs: those expenses that have to be paid even if no production takes place and those that depend on the amount of food that is produced. The first types are known as *fixed costs* and the second type are *variable costs*

Agribusiness is a very common word and many a time it ties to cascade farming with manufacturing without realizing that the manufacturing sector is not the same as farming sector and high-tech manufacturer cannot go to the field and grow the raw material. However, farmer, the first entrant has to be supported with all that he needs in farming to get the highest production and productivity and must to be ensured profit sharing as much from the chain. Currently we have one-way movement of raw materials and one-way movement of the finished good and it must change to two way movement of commerce and money between farmer and consumer.

Issues and Challenges in Realizing the Untapped Potential of Buffalo Milk Processing

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Abstract

Buffaloes contribute a chunk (72% in Punjab and 49% in India) to the current total milk production of 11.85 million tonnes in Punjab and 176.35 million tonnes in the country. About 378 lakh and 14.30 lakh households own buffaloes (the black gold) in India and Punjab, respectively. Promoting buffaloes can also solve the menace of stray cattle, whose number is 52.88 lakhs in India and 1.01 lakh in Punjab.

The buffalo milk has higher fat, protein and minerals especially calcium content, which opens the door for greater outturn and better returns to the dairy farmers through its processing as compared to the cow milk. Additionally, higher total solids content, larger size of casein and fat globules and higher viscosity along with denser white color also make buffalo milk much more suitable for the manufacture of different dairy products such as tea/ coffee whitener, milk protein derivatives (i.e. casein, caseinates and whey protein concentrates), milk sugar and its derivatives, mozzarella cheese, concentrated



milk products, fat rich dairy products, ice-cream and frozen desserts etc. As a result, buffalo milk can play a pivotal role in the development of Indian dairy industry.

Aside from this, buffalo milk processing also have some issues and challenges, especially related to the product development (for example; some varieties of cheese, condensed and dried milk) and their storage stability, as it has a higher salt-balance ratio than cow milk resulting in low heat-stability and hence, restricting its applications.

Considerable research on the physico-chemical properties, standardization of products manufacturing techniques and value addition of buffalo milk have been carried out in India, but its full potential in enhancing the farmer's income levels is yet to be realized through technological interventions and scientific value addition. This invited talk will address all the issues, challenges and opportunities available related to the buffalo milk processing

High Fructose Syrup Production from Inulin-Rich Feedstocks

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Abstract

Inulin is a naturally occurring second largest storage polysaccharide after starch. It has wide range of applications in pharmaceutical and food industries. It is a robust polysaccharide which consists of linear chains of β -2, 1-linked-D-fructofuranose molecule terminated with α -D-glucose moiety at the reducing end. It is present in tubers, bulbs and tuberous roots of more than 36,000 plants belonging to both monocotyledonous and dicotyledonous families. Jerusalem artichoke, chicory, dahlia, asparagus, yacon, dandelion, garlic, onion, etc. are important inulin-rich plants. Inulin-rich feedstocks are used as vegetables in many countries. Various inulin-rich feedstocks can be cultivated for the production of various industrially important metabolites in bioprocessing industries at industrial level. Degree of polymerization (DP) plays an important role for the production of these metabolites. Various factors like plant species, plant age, harvesting time, soil conditions, etc. have strong influence on the DP of inulin. Inulin-rich feedstocks are a potent substrate and inducer for the production of inulinases. Inulin-rich feedstocks can be used for the production of fructooligosaccharides and high-fructose syrup. Additionally, inulin-rich feedstocks can also be exploited for the production of other industrially important products like biofuels, organic acids, single cell proteins, single cell oils, sorbitol, mannitol, pullulan, etc. Inulinase from *Kluyveromyces marxianus* was purified by ethanol precipitation, ion-exchange and gel exclusion chromatography. Hydrolysis of raw inulin from *Asparagus racemosus* was carried out by free inulinase for the production of high fructose syrup in a batch system. Inulinase was also immobilized onto duolite A568. The developed immobilized biocatalyst was used for the production of high fructose syrup from raw inulin from *Asparagus racemosus* in batch and continuous system. The developed immobilized system showed good operational stability



for the production of high fructose syrup from raw inulin in both batch and continuous systems.

New food product development for entrepreneurship and start up

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Abstract

Product development is a science and business discipline, and requires diligent focus in a suitable culture if it is to be effective. Food product development links all processes of an organization: from marketing, through production, commercial and financial activities and purchasing. The new product development processes consisted of 7 steps organized in a logical and sequential format which gives the Research and Development department a clear direction for what is required for each product development cycle. These steps include idea generation, idea screening, concept development, business analysis, product development, test marketing and market launch. The first step of new product development requires gathering ideas to be evaluated as potential product options. In Step 2, the ideas generated are critically evaluated by company personnel to isolate the most attractive options. With a few ideas in hand the marketer obtains initial feedback from customers, distributors and its own employees. In Business analysis, the marketer has reduced a potentially large number of ideas down to one or two options. Companies direct their research and development teams to construct an initial design or prototype of the idea. Products are, then, ready to be tested as real products. If market testing displays promising results the product is ready to be introduced to a wider market. Companies spend an average of 46 percent of their resources on designing, developing and launching a new food product and given that only one in every four projects never sees marketplace. Specific features associated with the product must be included during the identification of the product quality indices. Success rate for unstructured, random product development is of the order of 1 in 200 products introduced. For most sophisticated process and well run product development, success rate is 1 product in 5 launched. While some companies may not follow a deliberate step-by-step approach, the steps are useful in showing the information input and decision making that must be done in order to successfully develop new products.

Caption: It's a company's first and foremost important task to stay In Business, and it cannot do so without a steady flow of new products. - **Drucker**

Introduction

Product is a complex of tangible and intangible attributes, including packaging, colour, price, manufacturer's prestige, retailer's prestige, and manufacturer and retailer's services, which the buyer may accept as offering satisfaction of wants or needs.



Introducing new products on a consistent basis is important to the future success of many organizations, marketers in charge of product decisions often follow set procedures for bringing products to market. In the scientific area that may mean the establishment of ongoing laboratory research programs for discovering new products (e.g., medicines) while less scientific companies may pull together resources for product development on a less structured timetable.

Traditional approaches to managing the product development process often fail because they result in unbalanced milestone structures. Typically, there is no preplanned structure of milestones that identifies the deliverable for each functional group at each step of the programme. Project managers apply their often-limited experience to develop a programme plan that emphasizes their area of expertise. Often, milestones for following product performance are absent. For example, production data are not fed back to the team members who developed the product. Furthermore, management traditionally concentrates on the process only when authorization for large amounts of money is requested. Management attention, therefore, is focused typically on the purchase of equipment, not on concepts or brain work.

The future belongs to third generation R&D, emergent in leading companies. It articulates the issues that the firm must consider as it decides how to define overall technology strategy, set project goals and priorities, allocate resources among R&D efforts, balance the R&D portfolio, measure results, and evaluate progress. The crucial principle is that corporate management of business and R&D must act as one to integrate corporate, business, and R&D plans into a single action plan that optimally serves the short-, mid-, and long-term strategies of the company. A major output of third generation R&D is a vision of the company's direction; it characterizes the markets served and that competitive environment, details regulatory hurdles and identifies the company's market positioning, core competences and profitability targets.

The product development process has been described as a five to eight-step process including idea or concept generation and screening, research, development and product testing and marketing launch activities. Early models of product development implied that those companies who employed a stepwise new product process were more successful. However, it is now generally accepted that a stepwise model of food product development is over simplistic and that a concurrent or overlapping, flexible team oriented product development process is more advantageous than a sequential process. In this section, 7-step process comprising the key elements of new product development are discussed. While some companies may not follow a deliberate step-by-step approach, the steps are useful in showing the information input and decision making that must be done in order to successfully develop new products. The process also shows the importance market research plays in developing products.

While the 7-step process works for most industries, it is less effective in developing radically new products. The main reason lies in the inability of the target market to provide sufficient feedback on advanced product concepts since they often find it difficult to understand radically different ideas. So, while many of these steps are used to research breakthrough ideas, the marketer should exercise caution when interpreting the results.

Step 1. Idea Generation

The first step of new product development requires gathering ideas to be evaluated as potential product options. For many companies idea generation is an ongoing process



with contributions from inside and outside the organization. Many market research techniques are used to encourage ideas including: running focus groups with consumers, channel members, and the company's sales force; encouraging customer comments and suggestions via toll-free telephone numbers and website forms; and gaining insight on competitive product developments through secondary data sources. One important research technique used to generate ideas is brainstorming where open-minded, creative thinkers from inside and outside the company gather and share ideas. The dynamic nature of group members floating ideas, where one idea often sparks another idea, can yield a wide range of possible products that can be further pursued.

Step 2. Screening

In Step 2 the ideas generated in Step 1 are critically evaluated by company personnel to isolate the most attractive options. Depending on the number of ideas, screening may be done in rounds with the first round involving company executives judging the feasibility of ideas while successive rounds may utilize more advanced research techniques. As the ideas are whittled down to a few attractive options, rough estimates are made of an idea's potential in terms of sales, production costs, profit potential, and competitors' response if the product is introduced.

Table 1: Calculation of Product Idea.

Criterion	Weight W_i	Very good (5)	Good (4)	Average (3)	Poor (2)	Very poor (1)	$W_i S_i$
Newness	0.15			X			0.45
Feasibility	0.13		X				0.52
<u>Saleability</u>	0.12	X					0.60
Profit	0.11	X					0.55
Life	0.10			X			0.30
<u>Perishability</u>	0.10					X	0.10
<u>Labour</u>	0.09		X				0.36
Logistics	0.09		X				0.36
Compatibility	0.08			X			0.24
Aesthetics	0.03	X					0.15
Total	$\sum W_i = 1.00$						$\sum W_i S_i = 3.53$

CALCULATION FOR A PRODUCT IDEA

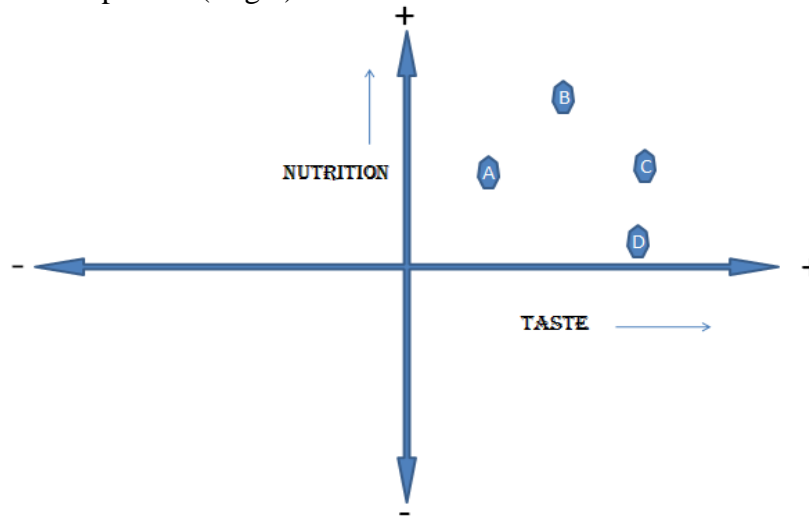
Every criterion is given some weightage and ideas are calculated on the basis of these criterion. Ideas are scored from 'very good' to 'very poor'. And the products which get maximum marks are selected. Acceptable ideas move on to the next step (Table 1)

Step 3. Concept Development And Testing

With a few ideas in hand the marketer now attempts to obtain initial feedback from customers, distributors and its own employees. Generally, focus groups are convened where the ideas are presented to a group, often in the form of concept board presentations



(i.e., storyboards) and not in actual working form. For instance, customers may be shown a concept board displaying drawings of a product idea or even an advertisement featuring the product. In some cases focus groups are exposed to a mock-up of the ideas, which is a physical but generally non-functional version of product idea. During focus groups with customers the marketer seeks information that may include: likes and dislike of the concept; level of interest in purchasing the product; frequency of purchase (used to help forecast demand); and price points to determine how much customers are willing to spend to acquire the product(Fig 1).



PERCEPTUAL MAP FOR CONCEPT TESTING

Fig. 1 Concept Testing

Concept testing is done either on a perceptual map or on the basis of the desired quality attributes. A food product is required to have a good taste as well as good in nutrition. Hence, a product having average of both these requirements is selected.

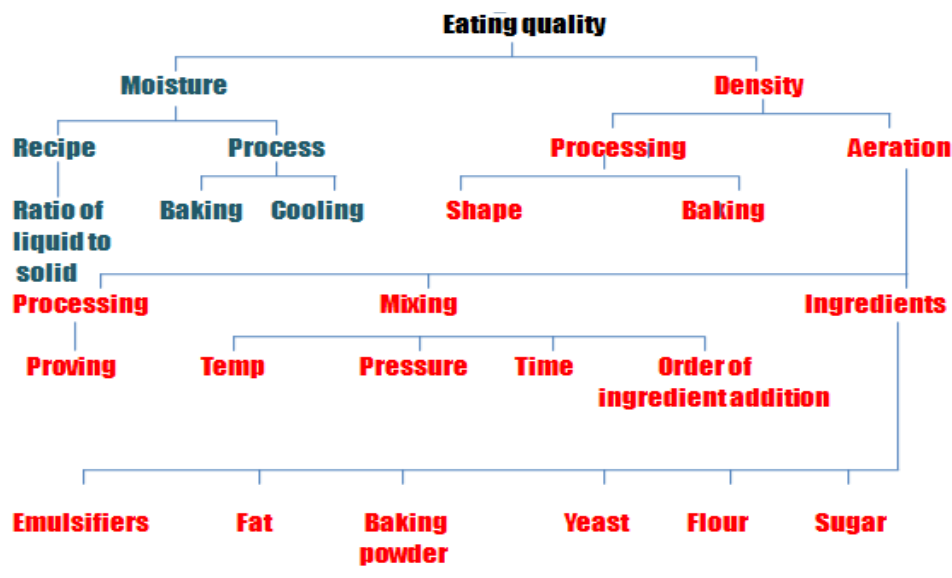


Fig. 2 Quality Attributes of Raw material.



The tree (Fig.2) which can be read from quality attribute to the raw material or from raw materials to the desired attribute. Eg. , eating quality of cake depends on the raw materials like emulsifiers, fat, baking powder, yeast, flour and sugar. The type and level of these ingredients and processing conditions decide the eating quality or the desired quality is dependent on these raw materials. The method is described and a concept is developed

Package

Packaging is so abundant in the solid waste system because it impacts so many aspects of life, commercially as well as privately. In fact, modern society could not exist without a mature and advanced packaging system, and packaging coincides with society's wants and needs. We choose what packaging is used by what we purchase. Three-quarters of all finished goods require a package and ninety percent of that packaging market is within the food and drink industry. Additional areas requiring packaging are auto/hardware, housewares, and tobacco products. The cost of the packaging as a percentage of total selling price varies greatly. Although this cost ranges from 1.4 percent to 40 percent. Nine percent of the amount you spend on any product is probably the cost of its packaging. The package designs are planned to reflect the many changing social and economic trends in the world. Several of those trends and resulting examples include:

- Health consciousness (nutrient and additive contents)
- Family size/singles (different portions)
- Economy (various sizes, quality levels)
- Mobility (convenience items)
- Novelty
- Labeling requirements (contents and directions)
- Available equipment (products for the freezer or microwave)
- Time and convenience to purchase and use (various available sizes, complete meals in a package)

Guidelines for minimum labeling requirements are established. The laws that govern package labeling, however, are complex, confusing, and subject to change; it is always best to have labels reviewed by a professional before incurring expenses for labels.

1. The label must have the common and usual name of the food. If there is no common or usual name, the food must be appropriately described (for example Knorr tomato soup).
2. Ingredients must be listed by common and usual name in descending order of predominance by weight. Standardized ingredients must be listed. For example, if catsup were used in the formulation, it would be listed in the appropriate order in the ingredient statement, followed by its ingredients in parenthesis.
3. The label must state the name and place of business of the manufacturer, packer, or distributor. If the firm's name and address are listed in a current city or telephone directory, the place of business does not have to include a street address or box number but must include the ZIP code).

The quantity of the contents must be conspicuously stated in the lower third of the primary display panel of the label. Type size must be easy to read and established in relation to the size of the principal display panel. The line of type must be generally parallel to the package base and should be no less than 1/16 of an inch high.



5. If the product is filled into the container by weight, net weight is stated and must also be declared in metric measure, for example, ml /g
6. If the product is filled into the container by fluid ounces, fluid ml/l must be stated and must also be declared in metric measure.
7. Nutritional labelling requirements “Nutrition Facts” must now be printed on most food products. Some food manufacturers are exempt under the small business exemption amendment.
8. Health claims need to be mentioned.
9. Instruction to use is mentioned
10. Shelf life of the product.

At this point in the new product development process the marketer has reduced a potentially

large number of ideas down to one or two options. Now in Step 4 the process becomes very dependent on market research as efforts are made to analyze the viability of the product ideas. (Note, in many cases the product has not been produced and still remains only an idea.) The key objective at this stage is to obtain useful forecasts of market size (e.g., overall demand), operational costs (e.g., production costs) and financial projections (e.g., sales and profits). Additionally, the organization must determine if the product will fit within the company’s overall mission and strategy. Much effort is directed at both internal research, such as discussions with production and purchasing personnel, and external marketing research, such as customer and distributor surveys, secondary research, and competitor analysis.

The output of consumer real-time knowledge elicitation is the identification of new consumer needs and product concepts that can be incorporated in a product business plan; a document that describes a market opportunity and the programme required to realize the opportunity. The business plan, usually written for a 12-month period, does the following:

- ⊗ defines the business situation – past, present, and future;
- ⊗ defines the opportunities and problems facing the business;
- ⊗ establishes specific business objectives;
- ⊗ defines marketing strategy and programmes needed to accomplish the objectives;
- ⊗ designates responsibility for programme execution;
- ⊗ establishes timetables and tracking mechanisms for programme execution;
- ⊗ translates objectives and programmes into forecasts and budgets for planning by other functional areas within the company

We use a product definition process based on quality functional deployment (QFD) to help us combine and translate consumer requirements into product specifications. QFD [7] was developed in Japan as a tool to provide designers with an opportunity to consider the qualities of a product early in the design process. QFD is a method that allows us to consider the qualities of a product, process, or service. It helps us to focus our activities on meeting the needs of the customer:

- ⊗ Who are the customers?
- ⊗ What is it they want?
- ⊗ How will our product address those wants?



Using QFD leads to a better understanding of customer needs that the product must meet to exceed competition. QFD methodology evolves around the “house of quality” (see Figure 4), a graphical representation of the interrelationships between customer wants and associated product characteristics. It maps product requirements, helps to identify and understand requirement trade-offs, and predicts the impact of specific product features. Additionally, it provides a team-building tool for interdisciplinary product planning and communication. It is a method that is an important part of the process to develop successful products that fit the strategic and tactical needs of the business

Product and Marketing Mix Development

Ideas passing through business analysis are given serious consideration for development. Companies direct their research and development teams to construct an initial design or prototype of the idea. Marketers also begin to construct a marketing plan for the product. Once the prototype is ready the marketer seeks customer input. However, unlike the concept testing stage where customers were only exposed to the idea, in this step the customer gets to experience the real product as well as other aspects of the marketing mix, such as advertising

g, pricing, and distribution options (e.g., retail store, direct from company, etc.). Favorable customer reaction helps solidify the marketer’s decision to introduce the product and also provides other valuable information such as estimated purchase rates and understanding how the product will be used by the customer. Reaction that is less favorable may suggest the need for adjustments to elements of the marketing mix. Once these are made the marketer may again have the customer test the product. In addition to gaining customer feedback, this step is used to gauge the feasibility of large-scale, cost effective production for manufactured products.

Step 5: Product Development

Once the food product is defined, a “works like, looks like, tastes like” product prototype is constructed or formulated. To demonstrate that the product prototype in its conceptualized final form will meet the technical and business objectives established, Arthur D. Little staff use their profile attribute analysis (PAA) method.

PAA is an objective method of sensory analysis that uses an experienced and extensively trained panel to describe numerically the attributes of the complete sensory experience of a product. These attributes are a limited set of characteristics which provide a complete description of the sensory characteristics of a sample. When properly selected and defined, little descriptive information is lost. PAA is a cost-effective tool for product development that takes advantage of the use of powerful statistical techniques, such as Analysis of Variance.

PAA is used in product prototype development in two ways: competitive product evaluations (benchmarking); and product optimization.

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PAA is used in product prototype development in two ways: competitive product evaluations (benchmarking); and product optimization.



Benchmarking: Competitive product evaluations provide formulators with objective information regarding the flavour quality of competitive products and the areas of flavor opportunity. The following example demonstrates a competitive product evaluation of several nationally branded oatmeal cookies. The products sampled (four full-fat oatmeal cookies, two reduced fat cookies, and a no-fat oatmeal cookie) are identified in Table I.

The evaluation was conducted to determine whether reduced fat and/or no fat products provide sensory characteristics similar to those of their full-fat counterparts.

A panel of trained sensory analysts evaluated two replications of each of three lots of each type of cookie. The samples were presented in a random order with no visible identification of the brand.

The panel used PAA to evaluate the products against the 13 sensory attributes. Summary indices for texture and flavour were developed using principal components analysis to summarize the attribute data.

Product optimization- Response surface methodology (RSM) can be used to achieve product optimization. In experimental food product formulations with multicomponent mixtures, the measured response surface, usually a flavour attribute, can reveal the “best” formulation(s) that will maximize (or minimize) the attribute.

Professional panelists characterized the initial market samples from five plants with six code dates and the subsequent reformulated experimental products. The three most important variables were identified as percentages of salt, acid, and high fructose corn syrup. The experimental design called for the manufacture and sensory analysis of 15 ketchup formulations and a control. Each formulation was evaluated three ways: with unsalted french fries; with salted french fries; and neat. The RSM results revealed that our client’s original evaluation design (without including different “carriers”) was misleading:

- ⊘ Ketchup evaluated neat has different flavour characteristics from ketchup evaluated with french fries
- ⊘ The original “optimized” formulation was acceptable in limited use situations.
- ⊘ The resultant optimized formulations were acceptable in all ketchup uses when a standard manufacturing process was followed. When RSM is utilized, product optimization time is greatly reduced from traditional “cook and look” optimization techniques that depend on subjective formulation and evaluation procedures and often stop short of fully realized product improvements.

Market strategy and testing- At this point in the product development process, the organization has invested time and money in developing a new product from the initial concept to product optimization. If marketing forecasts look good, the temptation is to prepare for a full-scale launch. But the product definition phase is based on models that are reasonably accurate representations of market response, but not of reality. Things can still go wrong, as witnessed by the failed national introductions of “New Coke”, Milky Way II candy bars and ConAgra’s Life Choice Entrees (low-fat diet regimen).

Long-run sales are based on two types of consumer behaviour, product trial and repeat purchase. Forecasts of long-run sales can be made if market test analysis can predict the percentage of consumers who become repeat users as well as those who will try the product. Numerous models have been developed that present the new



product to consumers in a reasonably realistic setting and take direct consumer measures leading to the forecasting of cumulative trial and repeat purchases. Although they will not be discussed in detail here, some of these models are based on previous purchasing experience, the so-called stochastic, or random models, attitude-based pre-test market analysis models, and a combination of trial/repeat and attitude models. New services are constantly being developed commercially, and it is clear that technically strong models and measurement systems will be widely available to forecast sales of new packaged food products.

Scale-up and trial production- Ultimately, the new food product has to be manufactured to meet the needs of the consumer. Early involvement of the manufacturing function in the product development process helps to avoid problems that invariably surface when consumer expectations conflict with engineering constraints. The product's success is often linked to the level of compromise that is reached between the R&D and manufacturing functions. Implicit in the scale-up and trial production of the new food product is a total quality programme that continuously identifies, analyses and controls risk. The risk controlling process begins with the identification of all potential hazards and proceeds through the screening, analysis, ranking, quantification and evaluation stages, ultimately to the controlling of the risks. A hazard analysis/critical control point (HA/CCP) matrix is a useful tool for identifying and prioritizing hazards which may affect food product quality. Such a matrix has the following elements:

- ∅ identification of critical control point;
- ∅ evaluation hazard potential;
- ∅ assignment of a degree of concern (low, medium,high);
- ∅ development of criteria for hazard control;
- ∅ preparation of monitoring/verification procedures;
- ∅ designation of corrective action alternatives that may be required.

Since food safety is always of paramount concern, new products often linger or die at this point in the process if the issues cannot be resolved satisfactorily.

All operations in the receiving, inspecting, transporting, segregating, preparing, manufacturing, packaging, and storing of food shall be conducted in accordance with adequate sanitation principles. Appropriate quality control operations shall be employed to ensure that food is suitable for human consumption and that food-packaging materials are safe and suitable. Overall sanitation of the plant shall be under the supervision of one or more competent individuals assigned responsibility for this function. All reasonable precautions shall be taken to ensure that production procedures do not contribute contamination from any source. Chemical, microbial, or extraneous-material testing procedures shall be used where necessary to identify sanitation failures or possible food contamination. All food that has become contaminated to the extent that it is adulterated within the meaning of the act shall be rejected or, if permissible, treated or processed to eliminate the contamination.

Step 6. Test Marketing

Products surviving the earlier step are ready to be tested as real products. In some cases the marketer accepts what was learned from concept testing and skips over market testing to launch the idea as a fully marketed product. But other companies may seek more input from a larger group before moving to commercialization. The most common type of

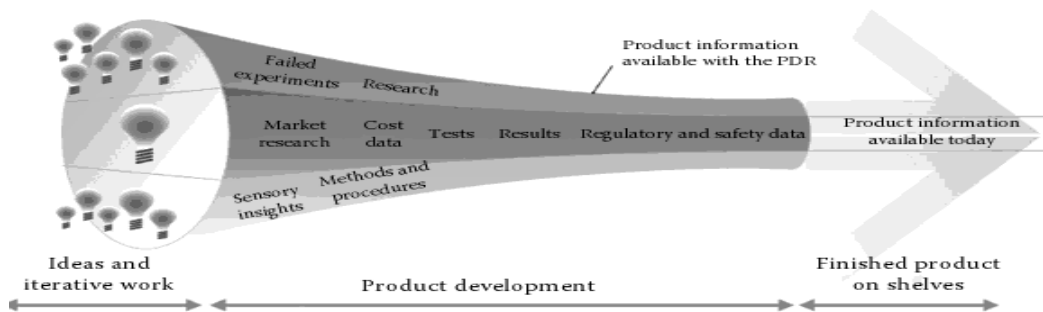


market testing makes the product available to a selective small segment of the target market (e.g., one city), which is exposed to the full marketing effort as they would be to any product they could purchase. In some cases, especially with consumer products sold at retail stores, the marketer must work hard to get the product into the test market by convincing distributors to agree to purchase and place the product on their store shelves. In more controlled test markets distributors may be paid a fee if they agree to place the product on their shelves to allow for testing. Another form of market testing found with consumer products is even more controlled with customers recruited to a “laboratory” store where they are given shopping instructions. Product interest can then be measured based on customer’s shopping response. Finally, there are several high-tech approaches to market testing including virtual reality and computer simulations. With virtual reality testing customers are exposed to a computer-projected environment, such as a store, and are asked to locate and select products. With computer simulations customers may not be directly involved at all. Instead certain variables are entered into a sophisticated computer program and estimates of a target market’s response are calculated.

Product Introduction:

The product introduction milestone is led by sales but supported through all other functional areas, especially marketing and distribution. Field trials have been completed and the product is designed to meet the needs of the consumer. The product has been packaged and priced appropriately to convey the correct messages of quality and value. Packaging for transport has been tested and the product has been distributed in a timely and correct fashion so that it flows through the distribution system without impediments. This phase is perhaps the most exciting and anxious, where customers see the product for what it is. Their initial response generally reveals the potential for success or failure of the product.

Product support Product support is a complementary milestone that builds product success and repeat business because it feeds back valuable information to other functional areas that can lead the process for line extensions, product upgrades, and the creation of all new opportunities. Product support is the “infantry” for the battle at the retail shelf; the first line of communication from the point- of-sale back to the organization.



Step 7. Commercialization

If Market testing displays promising results the product is ready to be introduced to a wider market. Some firms introduce or roll-out the product in waves with parts of the market receiving the product on different schedules. This allows the company to ramp up production in a more controlled way and to fine tune the marketing mix as the product is distributed to new areas.



The role of advertisement is clear. The industry spends millions of its money in advertisement, to educate the customer about its product and increase the sale volume by increasing and maintaining the brand value eg. 'Aerated Soft Drinks', Noodles, Cadbury and Pitanjali etc

Registration of the product: As per Indian FSSAI law product need to be registered with the authority. Brand name /logo have to be registered or be having some copy right. All these things need to be considered for getting into food business so that the product is in compliance with national and international food safety standards.

Encapsulation of Bioactive Components for their use in Health Promoting Foods

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Abstract

Nearly 61% of deaths in India are now attributed to non-communicable diseases (NCDs), including heart disorders, cancer and diabetes, according to new data released by the World Health Organisation in 2017. Unhealthy diet is among the four risk factors responsible along with tobacco, physical inactivity and harmful use of alcohol. Two thousand years ago, when Hippocrates said "Let food be thy medicine and medicine be thy food," he was on the right path. However, we may now revise this to "Let functional food be thy medicine." Functional food science arose out of public need, and is made possible through the collaboration of different sciences. This field of research incorporates food science, nutrition, and medicine to produce food products that are combinations of food and pharmaceuticals. Specifically, researchers study food components and their potentially-beneficial health effects. During last one decade researchers in the food science have been focusing on the design of new delivery system for incorporation of bioactive and nutrient into functional foods. There are number of key issues associated with incorporation of these molecules in the foods such as their physical and chemical stability in food system, interaction with other food components, solubility and dispersability which in turn affect their bioavailability and bioactivity. Encapsulation in the food industry are being used to protect bioactive components against degradation on various environments (e.g., high temperature, oxygen, extreme pH), avoid their undesirable interactions with other food components, mask undesirable flavors, and control their release at the desired time and site, and increase bioavailability. Formulating encapsulated food ingredients is challenging as the food industry is limited to the use of food grade and generally regarded as safe (GRAS) materials as encapsulants.



Vitamin D activation by magnesium and their role in human health

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Abstract

Magnesium (Mg) is the forgotten mineral, an "orphan," as Professor Robert Heaney of Creighton University says. It is the fourth most abundant mineral in the body, and it is involved in more than 300 biochemical reactions. All the enzymes that metabolize Vitamin D require Mg. It is also required in each of the steps concerned with replication, transcription, and translation of genetic information, and thus it is also needed for the genetic mechanism of action of Vitamin D

Mg content in vegetables has seen declines from 25-80% between 1940 and 1991. Mg intake of humans has declined very sharply during the past few decades. This may be due to the refining and preparing of food and use of pesticides, insecticides and fertilizers with no Mg. Modern farming practices, especially since World War II, emphasize the use of chemical fertilizers, pesticides and herbicides to maximize yield, ignoring the impact on the quality of the soil and the Nutrient Density of the food produced. A strong correlation exists between Mg & vitamin D deficiency. Study showed that Mg supplementation, taken along with vitamin D supplementation, was more effective at correcting a vitamin D deficiency than vitamin D supplementation alone. Consider Mg Gluconate 550 mg supplement with each meal. Get your blood Vitamin D level checked 2 X a year. If the level is low, consider monitored use of D3 (blind is not wise). Stress Management, and adequate sleep are also very important as well! Mg intake and interaction with vitamin D may contribute to vitamin D status and may be effective to control the vitamin D resistant deficiency. Mg homeostasis is maintained by the delicate interactions of the intestine, bone, and kidney. Magnesium is an essential cofactor for vitamin D synthesis and activation and, in turn, can increase intestinal absorption of magnesium and establish a feed-forward loop to maintain its homeostasis. Dysregulation in either of these nutrients can be associated with various disorders, including skeletal deformities, cardiovascular disorders, and metabolic syndrome.

Enzymatic bioprocessing of plant biomass transforming the caloric sugars into functional biomolecules

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Abstract

India is the second largest producer of fruit and vegetables in the world. The fruit and vegetable processing activities generate residual biomass in huge quantity. Our group intends to transform the *in situ* caloric sugars in plant biomass into value added biomolecules. The enzymatic bioprocessing of fruit juices and the processing residual biomass can replace the sugars with functional biomolecules. Consumption of processed food of reduced calorie and enhanced functional potential can be effective in controlling the non-communicable disease such as diabetes, cardiac complications, obesity etc. We work on discovery of novel enzymes, improvement in enzymes and enzyme immobilization to treat the plant biomass for the conversion of sugars like fructose, glucose, and sucrose into value-added functional molecules. We have developed a modified D-allulose 3-epimerase enzyme with improved stability to convert D-fructose into D-allulose in its free and immobilized forms. We have also recently discovered a novel biocatalyst for D-allulose synthesis. D-allulose is a C-3 epimer of D-fructose with significantly reduced calorie and several additional health benefits. We also work on glycosyltransferases which can transform sucrose into prebiotic oligosaccharides and isomeric sugars of reduced calorie and functional potential.

Innovative processing of fruits and beverages for improvement in their nutritional quality and shelf-life

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Abstract

Considering the overproduction of tomato during a specific period of the year, the processing effect of tomato was investigated on physicochemical characteristics and shelf-life of the developed tomato-based bakery products. Tomato based bakery products were observed for softer texture, better nutritional quality, enhanced shelf-life with lesser microbial counts. We have optimized an innovative non-thermal processing technology in the form of atmospheric cold plasma. Comparative investigation on the effect of thermal and non-thermal atmospheric cold plasma as well as ultrasonication and ultra-violet was assessed on the quality of a tomato-based beverage. Optimized atmospheric cold plasma was found to be a potential processing mechanism for retaining better quality of beverage for longer duration. Atmospheric cold plasma processing has also been observed to improve the bioavailability of bioactives and polyphenols. To improve shelf life of fruits, functional composite edible coatings have been realized as potential proposition. In view of this, functional coatings using pectin, corn flour, beetroot powder, orange peel powder, muesli root powder and rice flour have been developed. Variation in their starch quality and bonding behaviour with pectin could be



responsible for their structural integrity, functionality, solubility, permeability and stability. Some of the functional and structurally stable coatings could make a better alternative for synthetic packaging and hence for improving shelf life of agricultural produce.

Integrated Approach to Convert Corn Fiber into Maltose, Hemicellulose and Insoluble Fiber

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Abstract

Corn fiber hemicellulose with antioxidant property attracts significant commercial interest nowadays. Corn fiber (CF) is a low-value processing waste of corn wet-milling industry that is formed in large amount. It is mainly composed of starch, cellulose, hemicellulose, lignin, protein, and a few other extractives. Corn fiber is a remarkable resource for arabinoxylans (AX) also known as the hemicellulose or corn fiber gum with exceptional carbohydrate components. AX has remarkable uses such as stabilizer, thickener, adhesive, emulsifier and film forming property. Furthermore, AX is soluble dietary fiber which is prebiotic in nature, so it is important for health benefits, for example, normalize the disorders of cardiovascular, diabetes and boosted the colon function. In the present work, the corn fiber was initially treated enzymatically to destarch by using amylase to make a product like 34% (w/w) maltose and 1.5% (w/w) glucose. The de-starched corn fiber was thermochemically treated in small autoclave reactors at a temperature in a range of about 120° C- 150° C for 3 hrs time period. The thermochemical treatment was able to extract 47 % (w/w) of solubles from whole corn fiber biomass, which includes the arabinoxylan, monosaccharides, ferulic acid and oligosaccharides that are prebiotic in nature. The other fraction 51.6 % (w/w) remains as which is majorly cellulose and unhydrolyzed part of the hemicellulose. In previous studies the color and aroma of extracted hemicellulose are major constraints limit the usage of corn fiber for industrial utilization. Corn fiber may be converted to valuable products like maltose, glucose and arabinoxylans (AX) and this technology may be capable of producing efficiently at pilot scale without affecting color and aroma of product.

Keyword: corn fiber, destarched, hemicellulose, thermochemical treatment, soluble fiber



Digestibility of starches: its various fractions and importance to human health

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Abstract

Starch is the most abundant polysaccharide available and very important for human health as it is the main source of energy. Apart from providing energy, it has other beneficial effects on human health too. Based on digestion when we ingest food, we have three types of starch fraction's i.e. readily digestible starch, slowly digestible starch, and resistant starch. Among these fractions, resistant starch (RS) fraction is very important to us as it acts like dietary fiber in our body. RS may be classified into four major types: RS1, RS2, RS3 and RS4. In foods, the resistant starch varies between negligible to very high (>15%). *in vitro* digestibility of different starches can be measured and the glycemic index can be calculated. Glycemic index has become a potentially useful tool in planning diets for the patients suffering from diabetes, dyslipidemia, cardiovascular disease, and even certain cancers. Understanding glycemic index is very important as we have a ready reference regarding the rate of release of glucose in the blood. In case of diabetic persons the fast rate of release of glucose in the blood may be detrimental so foods having high RS content may prove beneficial for them. We can also increase RS content of the foods by allowing the foods to retrograde i.e. cooking and cooling. In this way the RS content of the foods can be increased as the crystallinity is increased as this makes the food less digestible by human enzymes. We have huge diabetic population in our country i.e. about 65 million people suffering from this disease. Wheat and rice are the staple food crops that our population eats, so, knowledge of reducing the calories of these can prove beneficial. Other beneficial effect of RS is in relation to our large intestine health. Resistant starch is acted upon by various bacterial genera in the large intestine of human body producing various short chain fatty acids (SCFA). Major SCFA's produced are acetate, butyrate and propionate. These SCFA's have been reported to inhibit certain types of large intestine cancers. In many researches RS has been compared with dietary fibers and some reports says they are better than other dietary fibers in terms of amount of SCFA's.



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ORAL PRESENTATION ABSTRACTS



FETO 1

Standardization and nutritional evaluation of ginger supplemented confectionery and bakery products

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Abstract

Ginger is widely used around the world in food as a spice both in fresh and dried form which adds flavour to the meal by creating spicy pungent taste. The characteristic flavour of ginger is due to the presence of polyphenol compounds such as gingerol and its derivatives like zingiberone, bisabolene, paradols, shogaols and gingerones¹ which possess therapeutic properties too. Ginger is found effective in stimulating digestion, absorption; relieve constipation and flatulence by increasing muscular activity in the digestive tract. It is also found effective in treating nausea caused by sea sickness, morning sickness, diarrhea, asthma, respiratory disorders and treat migraine headache without side effects². Thus, utilizing ginger into product development enhances the functional properties of the novel products and also reduces losses caused due to rhizome rotting. The investigation aims at standardization and nutritional evaluation of ginger fortified confectionery and bakery products viz., cookies, bar and jelly candy. Out of varying concentrations of ginger powder, the standardized formulation of cookies contains 12% ginger powder in flour which enhanced the total phenolic content to 32.17mg/100g as against 13.35 mg/100g in conventionally prepared cookies apart from crude fibre which was observed as 1.69 percent in ginger powder supplemented cookies as compared to 0.81 percent in control cookies. Further, the combination of ginger: plum in the ratio of 50:50 for the preparation of bars was standardized on the basis of drying and organoleptic characteristics³. The ginger enriched fruit bar possessed 13.16 percent ascorbic acid, 55.89 percent total phenols and 72.94 percent antioxidant activity. The formulation of jelly candy standardized with 3.0 percent ginger powder showed 16.72 percent total phenols and 62.40 percent antioxidant activity as against 7.75 percent and 23.40 percent respectively in jelly candy without ginger powder.

The present investigations have therefore shown that ginger powder possessing appreciable nutritional properties can successfully be utilized for the preparation of ginger powder supplemented cookies (12% ginger powder), jelly candy (3% ginger powder) and plum: ginger (50:50) bar⁴. The ginger powder supplementation not only enhanced the nutritional value of the bakery and confectionary products but also created novel products for the market. Thus, the commercial adoption of incorporation of ginger in confectionery and bakery products showed seems to be a profitable proportion for efficient utilization of fresh ginger rhizome thereby enhancing the income of growers.



Keywords: ginger, supplementation, functional characteristics, confectionery, bakery products

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FETO 2

Rehydration modelling and characterization of dehydrated sweet corn

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Abstract

Rehydration of pre-treated (hot water blanching, steam blanching, microwave blanching) sweet corn kernel and dried at 55, 60, 65 and 70°C was performed using boiling water. Peleg, Weibull and newly proposed Lewis based models were considered to describe the change in moisture content during rehydration. The proposed model performed better with higher value of R^2 and lowest value of χ^2 and RMSE. The empirical models show that the equilibrium moisture content increased with the increase in dehydration temperature. The rehydrated sweet corn with microwave blanching and dehydration at 70°C possessed relatively less changes in total sugar, ascorbic acid, geometric mean diameter and difference in total colour with the fresh samples, indicating suitability for the use of rehydrated sweet corn.

Keywords: Sweet corn, pre-treatment, rehydration characteristics, mathematical modelling



FETO 3

Changes in falling number and pasting properties during storage

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Abstract

Two cultivars of whole wheat flour PBW343 and HS490 were studied for changes in their falling number values and pasting properties. Whole wheat flour samples were stored at 30, 20 and 4°C for storage period of 80 days. Storage time and temperature resulted in significant increase in falling number values and modified pasting properties. Maximum increase was noticed in flour samples stored at 30°C. Variety PBW343 resulted in more drastic changes than HS490. Pearson correlation provides positive correlation among falling number values and peak and final viscosities of flour samples determined using Rapid Viscoanalyzer instrument.

Keywords: Storage, whole wheat flour, Falling number, temperature, pasting properties.

FETO 4

Shelf life extension of yellow bell pepper fruits using active modified atmosphere packaging

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Abstract

Food packaging has been used to enable marketing of products and to provide passive protection against environmental contaminations or influences that affect the shelf life of the products. Due to limitations in passive modified atmosphere packaging, active modified atmosphere packaging is being explored. Active packaging is defined as packaging in which subsidiary constituents have been deliberately included in or on either the packaging material or the package headspace to enhance the performance of the



package system. As oxygen is considered the chief cause of the food spoilage so the most commonly used active packaging systems remove oxygen from the food package.

Keywords: Active packaging, yellow bell pepper, shelf life, quality

Methodology Proposed

Fresh bell pepper (*Capsicum annum* L. var. *Oribelli*) was procured from farms of Punjab Agricultural University, Ludhiana grown under poly-house. Samples were cleaned, surface dried and then kept at desired temperature for 2 hours for equilibration. Yellow bell pepper fruits were packaged in different LDPE packages i.e. 100, 150 and 200 gauge and stored in cold chambers at temperature of 5°C and 10°C. For active modified atmosphere packaging oxygen absorbers O-busters 20cc were used. This active component was placed inside the packages before sealing. Samples stored without oxygen absorber were taken as control. Quality analysis of stored samples were done at regular interval in terms of physiological loss in weight (PLW), ascorbic acid, total flavonoids and overall acceptability.

Results and Discussion

Statistical analysis revealed that effect of storage temperature and film thickness was significant. The active packaging using oxygen absorbers helped in better retention of quality attributes and extended the shelf life up to 28 days as compared to samples stored without oxygen absorber which had shelf life of 12 days only.

Conclusions

Active modified atmosphere packaging of yellow bell pepper fruits in LDPE 150 gauge packages using oxygen absorber can be used for extending the shelf life up to 28 days.

FETO 5

Effect of Supplementation of Foxtail Millet Flour (*Setaria italica*) on Rice Fryms Quality

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Abstract

Foxtail is thought to be native to Southern Asia and is considered one of the oldest cultivated millets. Apart from their low glycemic index, millets are also good source of energy, protein, vitamins, and minerals. The objective of the present study was focused on preparation and physico-chemical assessment of fryms from blends of rice flour and foxtail millet flour. Chemical properties of rice flour and foxtail millet flour were analyzed in terms of ash content, fat, protein, carbohydrates and moisture content while



physical parameters like weight, size, density, and bulk density were also evaluated. Foxtail millet flour was incorporated into rice based fryms at concentration of 10 to 30% and final product was evaluated in terms of hydratability, frying time, Diameter, thickness and sensory analysis. Rice flour showed ash content (0.33%) lower than that of foxtail millet flour (3.66%). Foxtail millet flour depicted higher protein content (10.29%) in comparison to rice flour (6.19%). Frying time for fryms decreased with elevation in the foxtail millet flour. Maximum diameter for fryms was observed for rice flour and foxtail millet flour (90:10). Thickness was highest was seen at 15% level of foxtail millet flour level. Sensory evaluation in terms of appearance, flavor, texture, color, crispiness, and overall acceptability which presented 8.6 on 9-point hedonic scale for 15% foxtail millet flour. Color of sample became dark as the concentration of millets increased.

Keywords: Foxtail, Fryms, Rice, Sensory evaluation

FETO 6

Rheological, morphological and in vitro digestibility properties of heat moisture treated starches from pearl millet cultivars

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Abstract

The effect of heat moisture treatment (HMT) on physicochemical, pasting, rheological, morphological, and *in vitro* digestibility properties of starches from pearl millet cultivars were studied. Amylose content, swelling power and solubility of HMT starches were decreased as compared to their native counterpart starches. Peak, trough, breakdown, setback and final viscosity were reduced as compared to native starch whereas breakdown and setback viscosity was not observed for cv.GHB-732. Results showed that after HMT treatment starches heat stability of starches increased. G' and G'' values varied from 2999 to 6054 Pa and 223 to 447 Pa., the highest value was observed for cv.W-445 and cv.GHB-732, respectively during heating. Drastic decreased was observed for G' and G'' values during frequency sweep test. Herschel Bulkey model was used to explain the steady shear properties. Yield stress and consistency index value ranged from 3.34 to 16.10 Pa and 5.5 to 21.2 Pa.s, the lowest value was observed for cv.HHB-67 and cv.W-732, respectively. The decrease in rheological properties may due to decrease of swelling power of starches. After HMT modification thermal stability and nutritional value of starches improved which enhance food applications of starches.



FETO 7

Impact of high intensity-ultrasound (HIUS) and wet milling on extraction of amaranth starch and its utilization in preparation of edible coatings

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Abstract

Impact of high intensity ultrasound and wet milling on isolation; yield and characterization of amaranth starch was seen. Amaranth starch was utilized in development of edible Coatings for panner cubes. Edible coatings were prepared from isolated amaranth starch and carboxymethyl cellulose (CMC) as an additive was added to the amaranth starch solution. Paneer cubes were immersed in the amaranth starch filmogenic solutions and coating was created on the surface of paneer. Amaranth starch blended with glycerol and carboxymethyl cellulose at 6.0%, 2.0%, and 0.25% concentrations respectively. CMC as gum hydrocolloid was added to filmogenic solutions of amaranth starch - glycerol to develop transparent gel. Paneer cubed were then dried in hot air drier and coated paneer cubes were evaluated for color and sensory attributes.

FETO 8

Quantification of phenolic acids and antioxidant potential of wheat rusks as influenced by partial replacement with barley flour

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Abstract

This study was investigated to evaluate the phenolic acid composition, antioxidant potential and acceptance of rusk prepared from barley flour (BF) by the progressive replacement of wheat flour (WF). The wheat-barley blends rusks were also evaluated for their pasting and sensorial properties. The pasting characteristics of WF was influenced by BF incorporation with a increase in peak and final viscosity values with increasing amount of BF. The results revealed that incorporation of BF into WF improved the



nutritional and bioactive compounds profile. The free radical scavenging activities towards DPPH and ABTS⁺ was found to be higher for wheat-barley blends rusk in comparison with wheat rusk. As evident from total phenolic content, total flavonoids contents and antioxidant activities, BF was found to be rich in bioactive compounds in comparison with WF. Supplementation of rusks with 30% BF were suggested to be nutritionally superior with an acceptable sensory score and is a successful approach to enrich rusks with nutrients.

FETO 9

Effect of processing on colour and total carotenoids of carrot pomace

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Abstract

Carrot; a vitaminized food, is a rich source of bioactive compounds like carotenoids and dietary fibre with appreciable levels of other functional components having significant health-promoting properties. In recent years the consumption of carrot juice has been increased due to the demands for healthy and natural drinks. Carrot pomace; a by-product obtained during carrot processing, contains a considerable amount of vitamins including carotene, mineral, and dietary fibre. Carrot pomace; highly perishable leftover, is either dumped or fed to animals. The present study was aimed to process the carrot pomace into the shelf-stable product that can be utilized as a source of supplement for value addition in food formulation (dairy or bakery products). Carrot pomace was processed into frozen, dried, sweetened and candied form. Frozen and dried carrot pomace was treated with 0.05% sodium benzoate while sweetened and candied carrot pomace with 0.02% sodium benzoate. Steam blanched fresh carrot pomace kept as control. Frozen carrot pomace packed into polyethylene and stored at -18°C. Dried carrot pomace was prepared in hot air oven (60°C for 16 hrs.) followed by polyethylene packaging. Sweetened pomace concentrated into sugar syrup up to 70°B with 0.3% citric acid and stored in glass jars while candied carrot pomace prepared from dried (60°C in hot air oven for 5-6 hrs.) sweetened carrot pomace and packed into polyethylene pouches. In contrast, to control samples, maximum retention of total carotenoids and lycopene was observed into frozen carrot pomace. Maximum total solids and fibre content were observed in dried carrot pomace. In colour analysis (*L, a, b values) maximum 'a' value (positive= redness, negative= greenness) was observed in frozen (+11.21) followed by candied (+7.43) carrot pomace



FETO 10

Bioflavonoids from kinnow peels fabricated into edible hydrogels using nanotechnology interventions

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Abstract

Biomass generated after processing kinnows comprise chiefly of peels and seeds, which are significant source of nutraceuticals, particularly flavonoids that are antioxidant in nature. It is, therefore, favourable to utilize the biomass by extracting nutraceuticals from it and designing functional foods from them. However, a limitation in the use of these bioflavonoids is the poor aqueous solubility and hence low bioavailability. This work includes supercritical fluid extraction and identification of bioflavonoids from kinnow peels. Furthermore, food grade polylactide-co-glycolic acid (PLGA) was used a matrix for nanoencapsulation of flavonoids and additionally, their impregnation into edible hydrogels. Total flavonoids in the supercritical fluid extract were estimated to be 48.1 ±0.65 mg/ml rutin equivalents. Mass spectral analysis revealed the abundance of polymethoxyflavones (PMFs), nobiletin and tangeretin as the major flavonoids in the extract. The extract exhibited free radical scavenging of 62.0%, 60.0% and 71.0% for hydroxyl, superoxide and DPPH radicals, respectively. The flavonoid-PLGA nanoencapsulates furnished a particle size of 252.2± 2.19 nm and PDI 0.187 ±0.039 with smooth and spherical shape as revealed by FE-SEM. Casein and casein-alginate composite hydrogels impregnating flavonoid-PLGA nanoencapsulates were fabricated. The hydrogels exhibited a porosity of 66.0% and 59.0% for casein and casein-alginate composite hydrogels, respectively. Confocal microscopic images revealed composite hydrogel as an efficient matrix in comparison to casein hydrogel for entrapment of nanoencapsulates. Therefore, focusing on retrieving nutraceuticals from the biomass and further implementing nanotechnological interventions for designing functional foods lays the foundation for developing innovative value-added products, thereby contributing towards sustainable use of biomass.

Keywords: kinnow, flavonoids, antioxidant, nanotechnology, hydrogels



Methodology

Procurement and Preparation of kinnow peel powder

Kinnow biomass was procured from juice processing unit, Punjab Agro juices limited, Abohar. Further, biomass was sundried and ground to form a fine powder and stored under dark conditions at 4 °C.

Supercritical Fluid Extraction and Estimation of total flavonoids

For supercritical fluid extraction, the different parameters for maximum extraction of flavonoids were optimized. Then, flavonoids were quantified spectrophotometrically at 500 nm [1].

Antioxidant activity

Radical scavenging activity of flavonoids was estimated by hydroxyl, superoxide and DPPH radicals assay and for identification of nutraceuticals responsible for imparting antioxidative character mass spectral studies were done [2].

Preparation and Characterization of flavonoid-PLGA nanoencapsulates

Nanoparticles were prepared by solvent displacement method and characterized in terms of its particle size, polydispersity index and FE-SEM [3].

Fabrication and Characterization of nanoencapsulates loaded hydrogels

Casein hydrogels were fabricated using food grade enzyme transglutaminase as a cross linker. Also, composite hydrogels using casein and alginate were prepared through electrostatic complexation [4,5]. The hydrogels were characterized for their porosity. Confocal laser scanning microscopy was done to confirm the entrapment of nanoencapsulates in the hydrogels.

Results and Discussion

Extraction and Estimation of total flavonoids

The optimum extraction conditions were found to be pressure: 330 bar, temperature: 40°C and co-solvent: 10% ethanol. Total flavonoids in supercritical fluid extract were estimated to be 48.1 ± 0.65 mg/ml rutin equivalents.

Antioxidant activity

It was found that the extract exhibited free radical scavenging of 62.0%, 60.0% and 71.0% for hydroxyl, superoxide and DPPH radicals. Mass spectral analysis revealed the abundance of polymethoxyflavones (nobiletin and tangeretin) as the major flavonoids in the extract as shown in figure 1. So, on basis of these results it is evident that supercritical fluid extract is rich in bioflavonoids that are potent antioxidants.

Characterization of flavonoid-PLGA nanoencapsulates

Particle size of nanoencapsulates was measured and found to be 252 ± 2.19 nm with particle distribution of 0.187 ± 0.03 . This PDI is suggestive of negligible polydispersity in the particles population. These nanoencapsulates were found to be stable for more than 16 months based on the particle size values which suggested that nanoencapsulates holds a potential for use in value addition of foods. FE-SEM of nanoencapsulates revealed smooth and spherical morphology of the nanoencapsulates

Characterization of flavonoid-PLGA nanoencapsulates loaded hydrogels

The fabricated gels exhibited a porosity of 66.0% and 59.0% for casein and composite hydrogels, respectively. Confocal microscopic images revealed that upon same loading of



nanoencapsulates in hydrogels, composite hydrogels were proven to be efficient matrix for encapsulation of nanoencapsulates shown in figure .

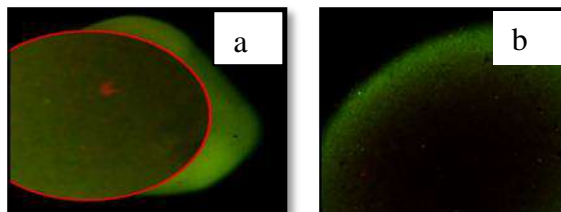


Fig. Casein hydrogel Composite hydrogel

Conclusions

The bioflavonoids retrieved from kinnow peels and further augmentation of nanotechnological interventions in fabrication of edible hydrogels enabled biomass as an efficient source of natural antioxidants and therefore, lays the foundation for developing innovative value added products, thereby contributing towards sustainable use of biomass.

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FETO 11

Quality evaluation and shelf life enhancement of pectin coated fresh cut pineapples

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Abstract

Experiments were conducted to assess the effect of pectin based edible coatings on shelf-life and quality of fresh-cut pineapples (*Ananas comosus*) under refrigerated conditions (4 °C and 90% RH). Three different concentrations of pectin (1, 2 and 3 %) and oil (0, 0.25 and 0.50 %) were tried on fresh-cut pineapples to extend the marketing period. Coating was applied by immersion method. Coated and uncoated samples were stored in plastic containers under refrigerated conditions. The quality of stored pineapples was evaluated on the basis of retention of sensory (appearance, firmness, taste, texture, flavor), physiochemical (pH, TSS, weight loss, L*, a*, b, whiteness index, browning index), microbiological (yeast and mold count) and storage characteristics at regular intervals up to 12 days of storage. It was observed that the coating with 1% pectin and 0.25% oil recorded minimum changes in quality parameters as compared to other pectin coated as well as uncoated samples. It was possible to extend the shelf life of fresh-cut pineapples up to 7 days, with acceptable quality attributes while the shelf-life of uncoated sample was only 3 days.

Keywords: Fresh-cut, pineapples, pectin, edible coating.

Methodology Proposed

Nine combinations of coating solutions were prepared using three different concentrations of pectin (1 %, 2 %, and 3 %), with incorporation of olive oil at 0 %, 0.25 % and 0.5 %. Pineapples, obtained from local market were peeled and cut into equal sized pieces of approximately 2 cm after removing the core. The fresh cut pineapple slices were treated with 2% calcium chloride solution and 2 % ascorbic acid solutions for 2minutes each. The cut slices were dipped in the coating solution for about 3 minutes and after removing, were placed on a tray for another 3 minutes. About 130 g fresh cut pineapple pieces were packed in each sterile plastic container and were analyzed up to 12 storage days (0, 4, 8, and 12), with three replications of each. All the containers were stored in a refrigerator (BOD incubator) maintained at 4°C.

Determination of physical and quality parameters:

After the application of pectin coating, different physical and quality parameters were studied such as:

Moisture content: Moisture content of pineapple slices was determined by hot air oven method as recommended by Ranganna (1994).

TSS: Total soluble solids content was measured by the method described by Ranganna (1994).

pH: pH was determined by the method followed by Albanese et al. (2007) using a digital pH meter.



Physiological Loss in weight (PLW): The percent loss in weight was calculated by subtracting final weight of the samples from initial and then converted into percentage value.

$$\text{PLW (\%)} = (\text{Initial weight} - \text{Final weight}) / \text{Initial weight} * 100.$$

Ascorbic acid: Ascorbic acid of fresh-cut pineapple was estimated using a 2, 6-dichlorophenol-indophenol visual titration method as recommended by Ranganna (1986).

Titrateable acidity: Titrateable acidity was determined by the method as recommended by Ranganna (1986).

Color: Hunter Lab, Mini Scan XE Plus, (45/0-L model) manufactured by Hunter Associates Laboratory Inc., U.S.A. was used to measure the color value (L^* , a^* , b^*) of pineapples.

Sensory evaluation: Sensory evaluations were done by trained and semi-trained panelists on a 9 point hedonic rating test for appearance, texture, aroma, taste, juiciness and overall acceptability as recommended by Ranganna (1994).

Microbial analysis: The total yeast and molds colony count were determined on plate count agar (PCA) by spread plate method.

Results and Discussion

Moisture content: Moisture content of the samples ranged between 84 % and 91 % throughout the study. A higher retention of water was observed in coated samples with 0.25 % oil and 3 % pectin solution, and the weight loss was negligible. At the end of storage (12 days), the moisture loss ranged between 1.21 % and 5.06 % with the control samples having higher values. With the decrease in moisture content, shrinkage was observed in control samples. So, it can be concluded that the coating was efficient in maintaining the texture, checking moisture loss and thereby reducing weight loss.

TSS: During the study, TSS showed a slight increase in most of the samples, ranging between 13° Brix and 14.7° Brix. Most stable values were obtained in the samples treated with 2 % pectin solution and 0.5 % oil. Maximum increase of TSS was observed in the control samples followed by the ones coated with 0.5% oil and 1% pectin solution. The increase in TSS of the control samples may be due to the loss of moisture itself.

pH: Only a little variation was observed in the pH values of the samples during storage. By Day 12, the pH values of all coated samples were found to be less than that of the control and varied between 3.4 and 3.6. The slight increase in pH may be related to the decrease in titrateable acidity.

PLW: Weight loss was more evident in control samples as compared to coated ones. The least weight loss was observed in the sample coated with 0.5% oil and 3% pectin. In many cases, an increase in oil concentration was associated with weight loss, which may be attributed to physiological weight loss accompanied with water loss. Pectin, being a



polysaccharide, offers better oxygen resistance and lowers respiration which eventually leads to lesser weight loss, while that of oil is poor.

Titrateable acidity: Titrateable acidity reduced as a function of storage time for all the treatments. By Day 12, all coated samples showed higher values compared to the uncoated controls. TTA values of coated samples were reduced up to 0.54 while that of control was up to 0.51. Minimum decrease was observed in the samples coated with 0.5% oil. Higher TTA values correlate with low pH values, thereby preventing the early growth of microorganisms in fresh-cut fruits. Thus the pectin coating with oil provides a good barrier to control the metabolic reactions and delay the respiration process.

Ascorbic acid: Severe loss of vitamin C was noted in all the samples, with the maximum marked in the uncoated controls. The loss extended up to 61.40% for controls whereas in the coated samples it was in between the range of 36.8% to 49.1%. Since ascorbic acid is soluble in water, it is readily lost via leaching from cut or bruised surfaces of raw material (Tannenbaum, 1985). The loss of vitamin C can be attributed to the stress caused by the operations involved in processing, resulting in greater weight loss and juice leakage.

Color: In the study, the L^* values showed a continuous decrease with storage time for all the samples. In the control samples, L^* value reduced to 57.09 from 71.08, while it was up to a maximum of 63.92 among the coated samples. The samples showed only a little variation in a^* values ranging between 1.71 and 8.05. There was clear variation in the b^* values in both the coated and control pineapple slices. The average reduction in the values ranged from 44 to 31 in all the samples. These changes can be attributed to browning reactions and can be related to polyphenol oxidase activity. So in compliance with these results, the pectin coating was effective in reducing the browning effects in fresh-cut pineapples.

Sensory analysis: All edible coating treatments resulted in higher sensory scores than uncoated fruits for taste, texture, juiciness and overall acceptability. But in case of aroma and color, there were some coated samples over which the control samples were preferred. Overall preference was given to the coating containing lower percentage of pectin (1%) without oil. It might be because the sample lacked the off-flavor of lecithin which was only used in the samples containing oil for emulsification. It can be concluded that the emulsifier added also had a significant effect, which reduced the acceptability of some samples.

Microbial Analysis: Microbial analysis showed that there were no colonies detected till the end of Day 7, except in controls. Maximum colonies were detected in the uncoated control samples i.e., 6.83 cfu/g followed by the sample with least amount of pectin and oil. This indicates that both the pectin concentration as well as the amount of olive oil used was influential in checking the microbial growth on fresh-cut pineapple slices.



Conclusions: The pectin coatings were found to increase the shelf-life of fresh-cut pineapples in storage studies. However, 1% concentration of pectin coating showed better results in comparison to higher concentrations (2 and 3 %), while all the characteristics were found acceptable for the oil concentration at 0.25 %. So, it can be concluded that the combination of 1 % pectin and 0.25 % oil could be translated as the best coated sample for extending shelf-life of fresh-cut pineapples up to 7 days without adversely affecting the quality.

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FETO 12

Comparison of different storage methods for bulk packaging of Cucumber (*Cucumis sativus* L)

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Abstract

Cucumber also known as *Cucumis sativus* L. belongs to the cucurbitaceous family. Cucumber is a highly perishable crop and the environmental conditions under which cucumber is produced, transported and displayed have a noteworthy effect on its keeping quality and loss. Post-harvest losses of fresh cucumber are caused due to continued respiration and transpiration after harvest. An extension in shelf life of cucumber can be achieved by reducing the respiration and transpiration rate of cucumber as soon as it is harvested. This is possible to some extent by Modified Atmosphere Packaging (MAP) and subsequent storage at low temperature. Evaporative cooling system (ECS) The system has shown the effectiveness in many aspects since its temperature is decreased lower than the ambient at least 8 to 10°C while its RH is higher than ambient from 20 to 40%.

Keywords: Cucumber, evaporative cooling, shelf life, quality



Methodology Proposed

Cucumbers grown under poly-house conditions were taken and washed with plain water in order to remove any dirt and surface dried. Bulk packaging was done in LDPE bags having thickness of 150 gauge and the cucumbers kept open in crates were taken as control. In order to seek for appropriate and low-cost methods to maintain the quality and enhance shelf-life of cucumbers, cucumbers packaged in low density polyethylene (LDPE) or in the open crate were stored under different storage conditions (evaporative cooling system (ECS), designed in the department of processing and food engineering, Punjab Agricultural University, low temperature (10°C) and ambient condition. Analysis of the quality of the cucumbers was done at regular interval of four days in terms of weight loss, firmness, colour, ascorbic acid, Titrable acidity and total soluble solids.

Results and Discussion

Statistical analysis of the recorded observations revealed that the effect of storage temperature was significant ($p \leq 0.05$) on shelf life of cucumber. Shelf life of cucumber stored in evaporative cool chambers was reported upto 8 days whereas cucumber stored under low temperature had shown maximum shelf life of 24 days with acceptable quality.

Conclusions

Cucumbers packaged in 150-gauge LDPE packages and stored under low temperature can retain better quality with shelf life of 24 days.

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FETO 13

Terpenoid nanoformulations derived from Citrus pomace

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Abstract

Punjab is the leading producer of kinnow and contributes for more than 65.0 % of the total citrus fruit production in India, with Abohar and Hoshiarpur regions the main contributors of it [1]. Population generally consumes this fruit as fresh or in the form of juice. After the processing of kinnow into juice more than 50% of waste is generated in the form of peels, seeds and internal tissues, which is generally referred as mandarin pomace [2]. This pomace encloses the quantum of bioactive compounds such as terpenoids (limonoids and



carotenoids), polyphenols, essential oils, and coumarins which have found to have various significant health promoting properties such as anticancer, antiviral, antimicrobial, antioxidant, hepatoprotective and anti-inflammatory [3]. Pomace encloses more bioactives than the juices, which makes them favourable candidates for extraction of the valuable bioactives from them. Terpenoids are derived from isoprene units and citrus agrowaste generally contains two types of terpenoids- limonoids and carotenoids. Limonoids are tetracyclic, densely oxygenated triterpenoids and carotenoids are classified as tetraterpenoid pigmented compounds, both found abundant in mandarin pomace. Despite numerous health benefits, terpenoids are found to be less bioavailable in humans due to their hydrophobic nature [4], lack of specific receptors on intestinal cells leading to their efflux, and enzyme mediated premature metabolism [5]. So, to overcome these limitations various strategies have been taken up by researchers such as structural changes, use of the p-glycoprotein efflux inhibitor and inhibitors of metabolic enzymes. Structural changes of the terpenoids may lead to loss of their functionality, whereas use of the p-glycoprotein inhibitors and inhibitors of the metabolic enzymes cannot be used in food formulations. So, it is imperative to use technological interventions for realizing their potential, nanotechnology in this work. Therefore, we prepared terpenoid nanoemulsions to overcome the limitations as listed above.

Keywords: Kinnow, limonoids, carotenoids, Nanotechnology, nanoemulsion

Methodology

This work entails supercritical fluid extraction of terpenoids (limonoids and carotenoids) from kinnow pomace. Pressure 350 bar and temperature 55°C was used for limonoids extraction [6] and 330 bar pressure, 40°C temperature and 8% ethanol (cosolvent) was used for carotenoid extraction. After extraction the concentration of limonoids and carotenoids in the extract was estimated for limonoids and carotenoids, respectively [7,8]. Further, this extract was used for loading into nanoemulsions which were prepared by high energy emulsification (ultrasonication), in accordance with FSSAI specifications using food grade materials to ensure development into functional foods [9]. After the formation of terpenoid nanoemulsion its characterization in terms of particle size, PI, zeta potential was carried out. The shape of the nanoparticles was determined by TEM and confocal microscopic images. Stability of the prepared nanoemulsion was carried out for months in terms of particle size and zeta potential of the nanoparticles.

Results and Discussion

The concentration of limonoids and carotenoids in the supercritical fluid extract was estimated to be 54.32±0.23 mg/ml and 0.996±0.084 mg/ml, respectively. The nanodroplets in the emulsion had a particle size, PI and zeta potential of 184.43±6.25 nm, 0.072±0.023 and, -68.3±2.97 mV, respectively. Further, TEM and confocal microscopic images as shown in **figure 1** revealed smooth and spherical shape of the nanodroplets. The nanoemulsion stored at 4°C was found to be stable for 15 months and was also found to be aqueous dispersible. This aqueous dispersible nanoformulation has been tested at a GLP certified National laboratory and cleared the acute oral (study no. Acute Oral Toxicity Study No.: AOT-01/18) and repeated dosage (study no. ORT-02/18) toxicity. After its clearance from toxicity testing it is now undergoing human trials (study no.



DMCH/R&D/2017/526) for treatment of liver malfunctions and the results are promising.

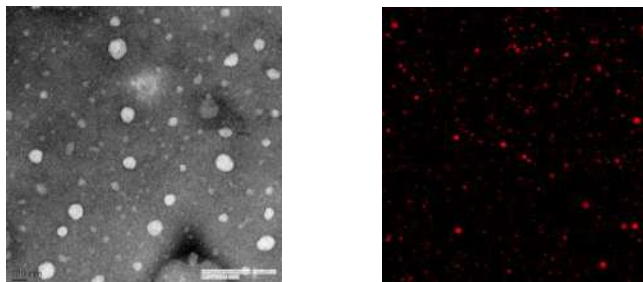


Figure 1. (a) TEM image and (b) Confocal microscopic image

Conclusions

- 1) This work presents the extraction and estimation of terpenoids from the kinnow processing waste (pomace). The limitation of terpenoids (low aqueous solubility) was overcome by forming oil in water terpenoid nanoemulsion.
- 2) Total limonoids and carotenoids content in extract was found to be 54.32 ± 0.23 mg/ml and 0.996 ± 0.084 mg/ml, respectively.
- 3) Nanoparticles had a particle size, PI and zeta potential of 184.43 ± 6.25 nm, 0.072 \pm 0.023 and, -68.3 ± 2.97 mV, respectively.
- 4) Nanoemulsion was found to be stable for the period of 15 months.
- 5) TEM and confocal microscopic images revealed the smooth and spherical shape of the nanoparticles.
- 6) Nanoemulsion has cleared the toxicity (acute oral and repeated dose) testing conducted at GLP certified National Laboratory.
- 7) Clinical studies have shown the prominent results as it helped in curing the liver malfunctioning.

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FETO 14

Storage behavior and pectin yield of kinnow peel powder

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Abstract

Kinnow Mandarins (*Citrus reticulata*) is grown very extensively in north Indian states of Punjab and Rajasthan. The present work explores the storage behavior and pectin yield of kinnow peel powder dried in a tray drier at 55 °C for 47.25 hrs upto a moisture content of 5.5% (db). The dried powder was stored in different packaging materials at 22.5 °C and 33.4% RH for 60 days. The quality parameters studied indicated that PET open containers showed maximum physiological loss in weight (0.76%) followed by aluminum (0.64%), LDPE (0.44) and HDPE (0.42%). Highest acceptability sensory score of 77% was obtained for powder packed in HDPE as compared to other packaging materials. Furthermore, a ΔE value of 5.5 was observed for powder packed in HDPE, which was the lowest among all the materials. HNO₃ was used to extract pectin from fresh and dried peel powder at 60 °C and 2 pH. It was found from observations that fresh kinnow peel yielded 12.02% pectin content. While extracting pectin from dried powders, a reduction of only 0.02% pectin yield was reported in powders packed in HDPE which was the lowest among all the packaging materials studied.

Keywords: Kinnow, citrus, peel, pectin, HDPE.

Methodology Proposed

Kinnow peels, which is considered a waste, was collected from a number of vendors around PAU, Ludhiana. These peels were cut into even pieces with knife and were dried in a tray drier at a temperature of 55 °C. Dried peels were grounded in grinder. Powder obtained after grinding was analyzed for storage behavior and pectin was extracted from the powder after 60 days of storage.



Determination of physical and quality parameters:

After preparation of sample, different physical and quality parameters were studied such as

Moisture Content: The moisture content in the peel was determined by the hot air Oven Single Stage Method [1].

Energy Consumption: Total energy consumed for drying of kinnow peel to its safe moisture content was determined by using three phase energy meter.

Drying time: In order to dry the kinnow peel to its equilibrium moisture content, the drying time was noted for 50 kg of peels. Drying of peel was done on two different batches. The time was noted in minutes.

Storage: Grounded kinnow peels were packaged in four different packaging material i.e. Aluminium foil, Low Density Polyethylene (LDPE), High Density Polythene (HDPE) and PET open container covered with muslin cloth. The packed samples were stored under ambient condition (temperature 22.3 ± 2.3 oC and relative humidity $30.4 \pm 1.5\%$) and were evaluated for its quality attributes at regular intervals.

Physical Parameters: Kinnow peel powder was stored in different packaging materials in order to study its physical parameters such as

Physiological Loss in weight (PLW): The percent loss in weight was calculated by subtracting final weight of the samples and then converted into percentage value.

$$\text{PLW (\%)} = (\text{Initial weight} - \text{Final weight}) / \text{Initial weight} * 100$$

Color: The samples were evaluated for its change in surface color and internal color using Konica Minolta Color Reader CR-10.

The color change was calculated from L, 'a' and 'b' readings as suggested by [2].

Sensory score card: The samples stored kinnow peel powder was examined for its physio-organoleptic quality attributes using 9-point hedonic scale using standard procedure.

Pectin extraction: Pectin was extracted at optimum conditions keeping pH 2 and temperature 60 °C. Ten kilograms of kinnow peel powder was mixed with 100 L of distilled water in two different batches. One batch was of 5 kg mixed with 50 L of distilled water. The distilled water was acidified using HNO₃ and pH was adjusted by using pH meter (Elico model no. L-614). This mixture was shaken at temperature 60 °C for time of 90 minutes in orbital shaker cum boiler at 150 rpm. After these treatments samples were filtered by using two fold muslin cloth. This was done to remove the solid impurities and to collect the filtrate in container. 96% ethanol was added to the filtrate for precipitation of pectin. After addition of ethanol, sample was kept overnight to allow complete precipitation. Sample was centrifuged at 2500 rpm for 20 minutes to separate the pectin from supernatant. Obtained pectin was washed thrice with the ethanol to remove the moisture content from the pectin. Pectin was dried at 45-50 oC in tray dried until it had become completely free from moisture. Dried pectin was grounded to convert it into powder. Yield of pectin was calculated by the following formula:

$$\text{Percentage yield of pectin} = \text{Pectin obtained (g)} * 100 / \text{Total amount of peel (g)}$$

Results and Discussion

Moisture Content: The initial moisture content found in fresh kinnow peel was 80% on dry basis. The samples were dried to a final m.c of 5.5% on dry basis.



Energy consumption: Energy consumed by first batch was 23.1 kW h and consumption of energy by second batch was noted as 16.1 kW h. The average energy consumption was 19.6 kW h.

Drying time: The average time taken for drying kinnow peels from 80% moisture content to equilibrium moisture content was 2,835 minutes.

Physiological loss in weight (PLW): Maximum PLW was observed for kinnow peel powder packed in PET open container (0.76%) followed by aluminium (0.64%), LDPE (0.44%) and HDPE (0.42%). PLW was minimum for samples packed in HDPE because it has lower water permeability in comparison to other packaging materials.

Color: Minimum change was witnessed for kinnow peel powder packed in HDPE followed by aluminium, PET open container and LDPE respectively. Difference in color change in peel powder was 5.5 only. The packaging material LDPE had the maximum decrease in value from 39.0 to 33.6 followed by HDPE, aluminium and PET open container. Maximum increase in hue angle values was observed in HDPE from 81.3 to 86.3 followed by PET container, aluminium and LDPE.

Sensory score card: It was found that HDPE preserves kinnow peel powder better than other packaging materials. Flavour and taste was preserved well in HDPE packaging material rather than other packaging materials. After storage for 30 days, kinnow peel powder packed in HDPE material was still moderately desirable.

Pectin yield: It was found that percentage yield of pectin from fresh kinnow peel powder was more than stored kinnow peel powder. Among the selected packaging materials, the HDPE packed samples gave closer yield (12%) to the fresh kinnow peel powder.

Conclusions: Overall, HDPE packed kinnow peel powder adjudged to be the best with regard to its quality attributes and pectin yield.

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FETO 15

Optimization of multilayer drying process variable of bitter gourd for increased energy efficiency and dryer capacity

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Abstract

Analysis were carried out on bitter gourd to study the effect of multilayer drying process parameters viz. loading density (31 kg/m² to 60 kg/m²) and air velocity (2.6 m/s – 5.41 m/s) at constant 60°C drying temperature on energy aspects as well as mathematical modeling and quality characteristics. Increasing the air velocity from 2.6 to 5.41 m/s, decreased the drying time from 480 to 180 min. The drying process took place in falling rate period. The Page model showed best fit to the experimental drying data. The average values of Deff varied between 3.00 - 7.22 × 10⁻⁷ (m²/s). The energy parameters on multilayer drying process were analyzed for calculating the maximum heat utilization factor. The high value of HUF indicates higher utilization of heat during drying or conversely less wastage of heat. The specific energy consumption increased with increase in loading density but it reduced with increase in air velocity. Quality characteristics like rehydration ratio, shrinkage ratio, ascorbic acid and color of dried bittergourd were analyzed. The process parameters were optimized using response surface methodology for responses with significant model and non-significant lack of fit. The optimum operating conditions for loading density and air velocity were 55 kg/m² and 5 m/s at 60°C drying air temperature. Corresponding to these values of process variables viz. maximum rehydration ratio, ascorbic acid, overall acceptability and minimum shrinkage ratio and color change. The overall desirability was 0.77. By using this technique multilayer drying resulted in increased capacity of dryer, increased energy utilization and resulting into a better-quality product.

Keywords: Bittergourd, Energy efficiency, Multilayer Drying, Optimization, Quality.

Methodology Proposed

The multi-layer drying of bittergourd comprised of an experimental dryer (Make-SATAKE) with electrically heated hot air system capable of supplying air upto a temperature of 70°C. A centrifugal blower capable of delivering air velocity upto 5.41 m/s was fitted in the dryer. The blower was powered with 0.75 kW, 1410 rpm, 3 phase, 230-Volt electric motor with a direct online starter. The hot air was sucked by the blower through the heaters and was thrown into the drying chamber. The heaters were vertically fitted in an aluminum chamber having rectangular cross section. Drying chamber for multi layer drying of bittergourd consisted of cubical boxes made of GI sheets with dimensions 20 cm X 11 cm X 6 cm. There were 24 chambers provided on the dryer but in order to maintain multi layer drying conditions and to meet the requirements for multi layer drying, the boxes were stacked one over the other. These boxes had a mesh at the bottom with approximate 1 mm hole diameter. The hot air enters the chamber from the bottom, passes through the product and leaves the chamber at the top. Blanched rings of bittergourd were kept for surface drying. The multilayer dryer was started half hour before actual drying experiment so that it can achieve desired temperature 60°C steady state conditions. Sample was put into three drying boxes of equal weight according to the desired loading density to get the required bed depth. Three boxes make multilayer through which the hot air passed. The temperature and relative humidity of the ambient, incoming and exhaust air were determined with the help of thermo-hygrometer placed on the surface of the sample. Temperature of product at each different layer was determined



with infrared thermometer. Weight of boxes was measured after each 30 min until moisture content reached at 6-7%. All other parameters were recorded at regular intervals. After drying, the sample was taken out, brought to room temperature, packed and stored. Three replications were taken for each experiment to get an average value.

Results:

Analysis of quality of bittergourd was done with response surface methodology in terms of rehydration ratio, shrinkage ratio, ascorbic acid, color change and overall acceptability. The specific energy consumption increased with increase in loading density due to increased drying time. Statistical analysis of the recorded observations revealed that the effect of loading density and air velocity significant ($p \leq 0.05$) on quadratic terms. The optimum operating conditions for loading density and air velocity were 55 kg/m² and 5 m/s; corresponding to these process variables with maximum rehydration ratio, ascorbic acid retention, overall acceptability and minimum shrinkage ratio, hardness and color change. The overall desirability was 0.77.

Conclusions

Multilayer drying dried approx 67% more material in 5-8 hr which took nearly 17 hr in single layer drying to dry same material which means it reduces the energy cost of drying. Page model best describe the drying behavior of multilayer dried bittergourd slices. The air velocity has a pronounced influence on the drying rate and consequently, markedly affected the value of the diffusion coefficient.

FETO 16

Development of Fruit Bars Utilizing Kinnow Juice Waste

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Abstract

Punjab has an annual production of 11.08 lakh tonnes of kinnow and is the major fruit of the state. Juice recovery is about 40- 45 per cent and the processing residue goes waste. The present study was conducted to prepare a high fibre and antioxidant rich fruit by utilizing kinnow juice waste. Acceptable fruit bars can be made from kinnow juice waste by adding 20 per cent sugar and 0.2 per cent citric acid. The fruit bars had a storage stability of more than six months and had good nutritional profile with health promoting benefits.

Keywords: kinnow juice waste, fruit bars, value addition, byproduct utilization



Methodology Proposed

The following objectives were undertaken:

1. to study the physico-chemical and phytochemical profile of kinnow juice waste
2. to develop fruit bars utilizing kinnow juice waste
3. to assess the shelf life stability and nutritional profile of developed product

The bars were prepared by the addition of 0.2 per cent citric acid and 20 per cent sugar to kinnow juice wastes, with open pan concentration to reach a TSS of 40°B followed by sheeting (4-5 mm), drying at 50°C for 6-18 hours and cutting and packing in polythene pouches of 100 gauge thickness. The prepared bars were stored at ambient temperature for further studies. The phytochemical and nutritional status and sensorial studies were done following standard protocols.

Results and Discussion

The kinnow juice waste is a rich source of phytonutrients like ascorbic acid (37.95 mg/ 100 g), total phenolics (70 mg/ 100 g), total carotenoid (2.57 mg/ 100 g), anthocyanins (0.79 mg/ 100 g) and had a TSS of 11.50°B and 0.65 per cent acidity. The kinnow fruits show the juice waste of 17.86 per cent with the peel content of 27.81per cent and juice recovery of 52.33per cent. The fruit bars prepared by utilizing kinnow juice waste obtained high scores during its sensorial evaluation with the overall acceptability of 8.0 on a 9- point hedonic scale. The storage study of the fruit bars at ambient temperature for 6 months show the loss of moisture content from 17. 16 to 15.63 per cent and a successive increase in the total soluble solids and acidity from 68.30 to 69.23°B and 3.43 per cent to 4.0 per cent respectively. The total sugars and crude fibre increased during the storage period while the ascorbic acid content, total phenolics, total anthocyanins showed a decrease in their content as shown in the table1.

Table 1: Effect of storage on different parameters of kinnow juice waste-based fruit bar

Parameters	Storage period(months)			
	0	2	4	6
TSS (°B)	68.3	68.5	68.9	69.2
Acidity (%)	3.43	3.60	3.90	4.00
pH	4.92	4.92	4.91	4.91
Total sugars (%)	60.8	61.6	62.5	63.2
Crude fiber (%)	10.8	10.8	10.8	10.8
Ascorbic acid (mg/100g)	140.8	138.94	133.03	124.31
Total phenolics(mg/100g)	890	886	881	878
Total anthocyanins (mg/100g)	0.7	0.65	0.57	0.50



Total carotenoids (mg/100g)	2.27	2.20	2.11	2.08
Antioxidant activity/ 100g	114.28	103.21	94.38	82.37

Conclusions

The kinnow fruit juice waste can be used for the preparation of fruit bars with good sensorial acceptability. The physico-chemical and phyto-chemical analysis show an increase in total solids, total soluble solids, total sugars, acidity, and crude fiber. During storage of fruit bars, all the bioactive compounds decreased significantly but were still acceptable nutritionally.

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FETO 17

Millet based functional beverage for geriatric population

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Abstract

Appetite and food intake often decline with ageing although their nutrient requirements do not decrease. Under-nutrition due to inadequate consumption is a common problem among elderly people. Elderly people often find it difficult to chew and swallow. Inclusion of liquid foods can ensure that they get adequate nutrients in their diet. In addition to the nutrients they provide, beverages contribute to hydration as well which is essential for good health. It is often seen that age-related changes make older adults more vulnerable to shifts in water balance that can result in over-hydration or, more frequently, dehydration. Nutritional drinks can be used between meals, as a snack or supplement to provide the nutrition essential for their health.

Coarse cereals and millets had been traditionally an important component of Indian food basket and a variety of coarse cereals are grown throughout the country in different agro-climatic conditions. Their popularity and importance has declined in the past particularly



in urban areas which is largely attributable to the fact that as incomes increase, fine cereals are substituted for coarse cereals. However, their importance is revived due to the nutritional and phytochemical superiority over fine cereal grains. These nutria cereals “gluten-free” and suitable for persons suffering from coeliac disease and wheat-induced enteropathy, sensitivities and allergies. Their consumption has many potential health benefits such as high antioxidant levels, improved cholesterol profiles of the consumer. Sorghum and ragi grain have high fibrecontent, moderate digestibility, rich mineral content compared to other cereals such as rice and wheat. Sorghum wax has sterols like policosanols which regulates cholesterol absorption and endogenous cholesterol synthesis. Ragi or finger millet, has exceptionally high Calcium content (344mg) compared to other cereals and millets. They are rich in compounds that help against several chronic diseases like ischemic strokes, cardiovascular diseases, cancers, obesity and type II diabetes. Coarse cereals such as sorghum, pearl and finger millets and maize are common substrates usually for producing a wide variety of beverages. However, in India, the use of coarse cereals in beverages is limited. Understanding the nutritional importance and potential of use of coarse cereals and millets in beverage, this study was planned with the objectives to develop a novel nutritious beverage for old and convalescent patients.

Three differently flavoured beverages were prepared with the use of sorghum and ragi as the base material. Coconut, carrot and cocoa were used for colour and flavor. Beverage formulations was optimized using laboratory scale trials and bench top sensory evaluation by the research group. Soaked grains were wet milled, passed through muslin cloth and thermally treated followed by homogenization. Physical and nutritional analysis were carried out. TSS (°Brix) of beverages ranged from 43.8 to 44.4. The textural properties of beverages expressed as firmness, consistency, cohesiveness and index of viscosity relate to the sensory properties of beverages. Firmness, consistency, cohesiveness and index of viscosity of coconut flavored nutritious beverage (C1NB) were 0.016, 0.324, 0.009 and 0.124; carrot flavored nutritious beverage (C2NB) were 0.025, 0.296, 0.009 and 0.002; cocoa based nutritious beverage (C3NB) were 0.018, 0.387, 0.09 and 0.141 respectively. All the three beverages were acceptable to the consumers as indicated by the overall acceptability score above 7 in a 9 point hedonic scale. 100 ml of the beverages provides- energy ranged from 103- 130 Kcal; 0.6 g protein; 0.5-0.9 g fat; 0.9-1.4 mg iron; 14-19 mg calcium and 12-14 mg phosphorus. Beverages formulated in this study can be consumed between meals, as a snack or supplement to add calories and other essential nutrients to the diet of geriatric population for nutrition security.

Keywords: millet, beverage, geriatric

FETO 18

Hemp plant: Characterization and utilization as a food ingredient

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Abstract

The world's most extraordinary plant is considered to be *Cannabis sativa* which is the most recognised species of *Cannabis* (Hemp plant). It was earlier cultivated as a source of fibre. In the early 20th century, the cultivation of its drug biotypes was a major concern due to the presence of high amounts of Δ 9-tetrahydrocannabinol (THC), the principle psychoactive cannabinoid. This led to the banning of the cultivation of all forms of *C. sativa*. Recently, many countries have legalised its use after realising its nutritional importance.

Cannabinoids are a unique class of terpenophenolic compounds that occur only in hemp plant. Glandular trichomes are present in the leaves, seeds and roots. The content of cannabinoids correlates with their quantity. The hempseed is of major importance in the food industry because all plant parts with the exception of seeds contain cannabinoids. The Lowest-Observed-Adverse-Effect Level (LOAEL) of THC is 10mg/day. The regulations for hemp, in different countries which have legalised the use, are based on the threshold concentration of THC (<0.3%). The different macro- and micronutrients are present in adequate amounts in the hempseed. Hemp oil contains the highest amount of chlorophyll (75mg/g) and PUFA (80%) and sufficient amount of antioxidant compounds (tocopherols, flavonoids, phenolic compounds). The ratio of linoleic acid to linolenic acid is 3:1 which is considered optimum for human nutrition. The presence of terpenes gives it a pleasant nutty flavour similar to pine nut. The hempseed meal can be defatted to obtain hempseed protein which contains all the essential amino acids. Various studies have been carried out to use hemp for preparation of gluten free products, enhancement of nutritional quality, hemp protein isolate for its functionality and antioxidant properties, preparation of edible films and the essential oil for antimicrobial activity. For instance, the hemp flour improves the sensory acceptability of gluten-free bread and limits its ageing. The presence of high amount of PUFA in the hemp oil makes it highly susceptible to oxidation thus requiring optimum packaging to prevent the same. Labeling of these products must be done carefully with warning statements regarding presence of THC even to the slightest amounts taking into account its LOAEL.

The regulatory framework for legalized cannabis still remains unclear, which opens up an opportunity for the industry with unattended risks. Clinical studies are required to confirm the various benefits and adverse health effects. Hemp based food can provide a complete source of dietary nutrition. In the present scenario, its potentiality needs to be explored further as a nutritive ingredient for functional food products.

Keywords: hemp, cannabis, THC, PUFA, nutrition

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FETO 19

Approaches to the Food and Medicinal Uses of Plant Based Genotoxic Carcinogens

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Abstract

For centuries, plants have been used for their food as well as medicinal properties. These traditional remedies are tried and tested by our ancestors and transferred from one generation to other generation. People have been using these plants as food and medicine, because they have knowledge, which is limited to the beneficial effects only. Over the time, many of these plants have been grown on large scale and processed into different types of products and commercialized in the market as green herbal products and generally regarded as safe. But with the advancement of new sophisticated analytical techniques and systems, it has been found that, these traditionally used plants may contain certain chemical compounds which are carcinogenic to the human body. These chemical compounds are termed as genotoxic carcinogens. However, contradictory results have been reported in various studies regarding the positive and negative effects of these chemical compounds on the human body. Therefore, detailed analysis is required on the genotoxic carcinogens to provide a clear image about the risks associated with their consumption. These genotoxic carcinogens should also be tested for randomized human clinical trials, which will be helpful for establishing the relationship between food components, health and disease risks. Using these tools, the safe limits for the consumption of plants containing genotoxic carcinogen can also be established.

Keywords: Genotoxic, Carcinogenic, Food, Medicinal, Clinical trials

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FETO 20

Development of biodegradable fruit coating materials from agricultural byproducts

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Abstract

Arabinoxylans (AX) was isolated from wheat straw, whereas β -glucan (BG) was extracted from oat bran. The BG was further conjugated with lauric, myristic, palmitic, stearic and oleic acid to prepare the corresponding β -glucan-fatty acid esters (BGFAs). The effect of BGFAs to AX films on the water barrier, optical and mechanical properties were investigated. The addition of BGFAs to AX films improved the functional properties of the films. The composite films based on arabinoxylan and β -glucan stearic acid ester (SABG) exhibited the improved functional properties and found to be the best candidate as a biodegradable coating material.

Further, the effect of wheat straw arabinoxylan (AX) and β -glucan stearic acid ester (SABG) composite coating on the quality and storage life of apple (Royal Delicious) was studied at 22 °C (± 2) with relative humidity of 65% and 85% for 60 days. Fresh fruits were coated with surface coatings of AX-SABG and shellac in the concentration range of 1–4%. Application of both AX-SABG (1–4%) and shellac (1–4%) coatings was found to be effective in significantly reducing the weight loss, respiration rate, fruit softening process, ripening index, color degradation and polyphenol oxidase activity compared to control during the storage period of more than 30 days. However, an AX-SABG coating was more effective in reducing fruit decay and loss of aroma volatiles followed by shellac coated apples; the uncoated apples being showing maximum quality deterioration. These findings confirmed the potential benefits of applying AX-SABG coating to extend the shelf life and quality of apples especially during transportation and storage.

FETO 21

Comparative study of functional properties of soybean Varieties grown in Punjab and Madhya Pradesh

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Abstract

The present study was conducted to study the functional properties such as water absorption capacity, oil absorption capacity, water solubility index, swelling power, foaming capacity, foaming stability bulk density and least gelation concentration of different soybean varieties SL 744, SL 958, SL 525, JS 335, JS 93-05, JS 97-52 grown in Punjab and Madhya Pradesh. It was observed that the water absorption capacity ranged from 2.44 to 2.94 g/g and SL 744 showed the higher water absorption and oil absorption capacity i.e 2.82 g/g and 2.25g/g respectively among Punjab varieties and among Madhya Pradesh varieties JS 93-05 showed the higher water absorption capacity 2.94g/g whereas higher oil absorption capacity was observed in JS 335 with a value of 2.30 g/g. Least gelation concentration varied for all the varieties from 12 to 16%.

Keywords: Soybean varieties, functional properties, water absorption capacity, least gelation concentration, foaming capacity

Methodology Proposed

Objectives

- To prepare whole soybean seed flour
- To evaluate the functional properties of prepared soybean seed flour

Methodology

1. Procurement of soybean seed varieties
2. Preparation of whole soybean seed flour
3. Evaluation of functional properties of prepared flour

Results and Discussion

The Water Absorption Capacity (WAC) of the whole soybean flours ranged between 2.44 and 2.94 g/g. Among them, JS 93-05 showed higher WAC (2.94 g/g) than other varieties which could be due to the polar amino acid residues present in the proteins have high affinity for water molecules. Similarly the high oil absorption capacity (OAC) of JS 335 could be due to the hydrophobic amino acids present in the proteins shows greater binding towards lipids. Foaming Capacity (FC) of SL-744 was greater than SL-958 and FC and Foaming Stability (FS) are inversely related to each other. The greater FC is due to the large air bubbles surrounded by thinner protein film, these air bubbles collapse easily and therefore lowers FS. This property of flour is required and finds application in baking industry where foams provide enhanced texture. Among Punjab varieties SL-958 formed a firm gel at the concentration of 12% whereas SL-744 gave a firm gel at 14% and SL 525 at 16% whereas among Madhya Pradesh varieties JS 335 formed a firm gel at 14% & JS 93-05 and JS 97-52 at 16%. High protein as well as starch present in legume flours influence the gel capacity as protein gelation and starch gelatinization both compete for water.



Conclusions

The analysis of various functional properties of different soybean varieties revealed that the Madhya Pradesh varieties of soybean found to be better in almost all the functional properties such as WAC, OAC and FC which makes it a better choice for application in baking and other food preparations as a functional ingredient. SL 744 and SL 958 varieties of Punjab are comparable with the Madhya Pradesh varieties which will be further evaluated for the preparation of commercial soy products.

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FETO 22

Characterization and functionality of microalgae in food system

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Abstract

Microalgae is nutrient dense sustainable biological resource constituting numerous functional ingredients. Characterization and functionality evaluation of any food ingredient is important to evaluate its potential for the valorisation of food products as nutritional and functional ingredient. Characterization and functionality assessment involve evaluation of physico-chemical, functional and pasting properties and the overall effect microalgae will confer to the food system in which it has been incorporated. Present investigation was carried out to evaluate the potential of microalgae for the valorisation in various food systems. *Chlorella* and *Spirulina* were evaluated for their potential for utilization in the food products. *Chlorella sp.* was cultivated by optimizing the conditions for the maximum production of the pigment, followed by the extraction of pigment and its utilization in the food products as natural colorant. The meal left after the pigment extraction was characterized for the utilization in the cookies. *Spirulina platensis* powder was used for the formulation of functional pasta and evaluated for its quality attributes; phytochemical, nutritional and morphological characterization. Microalgae



exhibited variability in its characteristics based on cultivation conditions optimized as per the intended use. Chlorophyll extracted from the *Chlorella* was used as stable natural colorant by making its metallo-complex in dairy based food formulations. Results revealed that meal left after pigment extraction and whole microalgae exhibits disparity in the pasting characteristics, where whole microalgae improved the pasting behaviour. Valorisation with microalgae and meal resulted in improving the ash content of the food products, whereas *Spirulina* significantly improved the amino acid profile of the pasta. Microalgae improved colour characteristics to the food products and also strengthen the matrix, conferring it better textural attributes. Characterization of microalgae revealed versatility in its functionality in the various food systems.

FETO 23

Essential Oil Based Nanoemulsions: Preparation And Characterization

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Abstract

The purpose of this study is to formulate and characterize stable nanoemulsions which are formed by using clove essential oil. Essential oils have always been used as natural and efficient antimicrobials to check food borne pathogens and increase food safety. Incorporation of essential oils directly in food system to achieve high functional solubility is difficult due to their poor water solubility. This results in development of different emulsion oil delivery system. In this study, high energy approach ultrasonication was used to formulate nanoemulsions using oil phase and surfactant (Tween 80) at different concentrations (1:1, 1:2, 1:3 and 1:4). Prepared nanoemulsions were characterized for different parameters like morphology, zeta potential, poly dispersity index (PDI), droplet size, viscosity, pH, optical transparency and stability. It was concluded that with increase in concentration of surfactant more stabilized nanoemulsions were formed.

Keywords: Nanoemulsions, Essential oil, Ultrasonication, Tween 80

Methodology

Nanoemulsions were prepared spontaneously using clove essential oil, tween 80 and water by high energy method of probe ultrasonication. The mixtures of oil phase (essential oil), surfactant and water were subjected to process of ultrasonication for 40 minutes with 1 min on and off cycle. The concentration of essential oil and water were kept constant whereas variable concentrations of surfactant were used to determine the



effect of surfactant on the stability of nanoemulsion. This resulted in the formulation of nanoemulsions with variable concentrations i.e. 1:1, 1:2, 1:3, 1:4.

Result and discussion

Colorimeter: Colorimeter analysis showed that with increase in concentration of surfactant lightness of the nanoemulsion is also increased with 'l' value decreasing with increase in concentration tween 80. 'l' value of NE (1:1) is 54.40 while that of NE (1:2) is 47.46. pH meter Minute increase in the ph was observed as the concentration of the surfactant was increased with each nanoemulsion. pH was around 7 for all the sample, proving nanoemulsions can be incorporated easily with food products.

Zeta potential: Zeta potential of clove oil nanoemulsion with 1:3 concentration was found to be -0.3418 eV, and that of 1:4 was found to be -0.0687 eV. Zeta potential value less than -25 eV and more than +25 Ev shows good stability of the prepared nanoemulsion. PDI Pdi of clove oil nanoemulsion with 1:3 was found to be 0.205nm and that of 1:4 was found to be 0.240nm. The closer the pdi of the obtained nanoemulsion is to 0.1, the better the stability and shelf life

with aggregation of oil droplets. Stability Nanoemulsions with high surfactant concentration showed high stability when centrifuged at 3000rpm for 30min.

Viscosity: Viscosity of the nanoemulsions increased with increase in the concentration of surfactant.

Conclusion

Nanoemulsions with high surfactant concentration in the mixture are highly stable and transparent for utilization than low surfactant concentration nanoemulsions. Ultrasonication came out to be efficient method for formulating spontaneous nanoemulsion with high stability for long use.

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FETO 24

Effect of Gums, Vital Gluten and Pregelatinized Flour On The Cooking And Sensory Quality Of Glutinous Rice Pasta

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Abstract

A variation in the level of xanthan gum (0.5-2.5 %), vital gluten (2-10 %) and pre-gelatinized flour (10-50 %) was used to study the effect of these different binding agents on the quality characteristics of glutinous rice based pasta. The pasta samples were evaluated for their cooking quality which includes minimum cooking time, water absorption, swelling volume and gruel solid loss. Increasing the level of xanthan gum resulted in increased water absorption and swelling volume while decreasing the gruel solid loss. Increasing the content of vital gluten resulted in pasta with lower water absorption, swelling volume and gruel solid loss. With increase in level of pre-gelatinized flour, the water absorption and swelling volume decreases while it has a non-linear effect on the gruel solid loss. However, different binders don't seem to have any significant effect on the minimum cooking time. Evaluation of cooking quality suggests that the use of different binders improved the cooking quality of the glutinous rice-based pasta due to better texture and decrease in cooking loss due to their binding properties. Sensory evaluation suggested the use of 2 % of xanthan gum, 8 % of vital gluten and 30 % of pre-gelatinized flour for optimized preparation of glutinous rice-based pasta.

Keywords: Pasta, xanthan gum, pregelatinized flour, gluten.

Objectives

The current work was proposed with the aim to study the effect of different binders on the quality of pasta and to optimize the level of binders required by studying its cooking quality and sensory characteristics. To fulfill this objective, the following studies were made: i) the relationship between rice flour and different binders and quality features of cooked pasta was analyzed; ii) the accurate amount of binders required to obtain a high quality gluten free pasta from glutinous rice was predicted based on the response of cooking quality and sensory analysis.

Methodology Proposed

Preparation of Pre-gelatinized Flour (PGF)

Rice grains were soaked in water to moisture content of about 40%. The soaked grains were kept on a cheese cloth and steamed at 85 °C for 45 min to achieve 70–80% degree of gelatinization (Cai and Diosady 1993) followed by drying at 50 °C in a hot air oven. The dried pre-gelatinized rice grains were ground to uniform particle size.

Preparation of pasta

Glutinous rice flour was mixed with various levels of binding agents viz. xanthan gum, vital gluten and pre-gelatinized flour as shown in table 1. Extrusion was performed using a cold extruder (Model: Dolly, La Monferina, Asti, Italy). Weighed and mixed glutinous rice flour and binding agents were placed into the pasta mixer and approximately 35 ml water was slowly added. Mixing was done in the mixer for about 10 minutes to properly distribute the water in the flour particles. The mixed dough was then extruded through the die in shell shape and cut to an uniform size using a cutter attached to the die. The pasta produced were dried in a hot air oven at 50+ 2°C for 3 hours. The dried pasta were cooled and packed in high density polythene bags until analysis.



Table 1: Different levels of binding agents used.

Binding agent	Level%
Xanthan gum	0.5, 1, 1.5, 2, 2.5
Vital gluten	2, 4, 6, 8, 10
Pre-gelatinized flour	10, 20, 30, 40, 50

Determination of product responses

Cooking quality

Minimum cooking time, water absorption, swelling volume and gruel solid losses were determined by using methods given by AACC(2000).

Sensory evaluation

The cooked pasta was evaluated for sensory analysis by semi trained panel of 10 judges using 9 point hedonic scale (Larmond 1970).

Statistical analysis

Data related to the cooking quality of the pasta samples prepared with various levels of binding agents were statistically evaluated by analysis of variance using Statistical Package for social Sciences (SPSS Inc. ,Chicago) software version 20. Tukey's tests were used to determine the difference among means at the level of 0.05.

Results and Discussion

Determination of cooking quality is a basic test in checking the quality of pasta. During cooking, various changes occurs in pasta due to effect of the heat and water uptake which results in starch gelatinization, formation of protein network, increase in pasta weight and volume and loss of soluble organic matters in the cooking water. Different binders significantly affect the cooking quality of the glutinous rice based pasta.

Conclusions

The addition of different binders viz. xanthan gum, vital gluten and pre-gelatinized flour improved the cooking and sensory quality of the glutinous rice pasta. With increase in the level of binders there is decrease in cooking loss which is an important cooking quality. Xanthan gum and pre-gelatinized can be used for preparation of gluten free pasta.

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FETO 25

Characterization of bioactive peptides in sodium substituted cheddar cheese during storage

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Abstract

The present study investigated the effect of salt replacement with KCl in combination with flavor enhancer (HVP) and bitter blockers (AMP) on the generation of bioactive peptides during storage. Cheddar cheeses (3 trials) of different salt content were prepared by substituting the sodium chloride (NaCl) with potassium chloride (KCl) @50% (1NaCl:1KCl) and 75% (1NaCl:3KCl) in combination with flavor enhancer (HVP) and bitter blocker (AMP). Prior to characterization of bioactive peptides, all the cheddar cheeses were assessed for the sensory and biological attributes. Overall sensory scores of control cheddar cheese (2.5%, NaCl only) were slightly higher during the 4 to 6th month of ripening than the low sodium cheddar cheeses (1NaCl:1NaCl and 1NaCl:3KCl) and thereafter the sensory scores decline. Changes in the antioxidant activity observed to be related to the rate of formation of soluble peptides and also on the ripening period. Antioxidant activity of whole water-soluble extract of 1NaCl:3KCl cheddar was observed to be higher than the control and 1NaCl:1KCl cheddar cheese. ACE inhibitory activity of UF permeates of 1NaCl:3KCl cheddar cheese was observed to be increased significantly ($p < 0.05$) than the control and 1NaCl:1KCl cheddar cheese. Caseinophosphopeptide content showed the decreasing trend with the increase in the KCl throughout ripening period. The peptides in water soluble extract of 5th and 6th month ripened cheddar cheeses were purified using C₁₈ RP-HPLC column. All the eluted three major fractions in all the cheddar cheeses of 5th and 6th month were assessed for the antioxidant and ACE inhibitory activity. All the three fractions in all the cheese extracts showed the better antioxidant and ACE inhibitory activity. Hence the pooled samples of all the three major fractions were subjected to the LC-MS/MS for sequencing. Among these identified peptides 74 peptides observed to be originated from β -casein in control, 1NaCl:1KCl and 1NaCl:3KCl cheddar cheeses during the 5th and 6th month of ripening. 2 peptides found to be originated from α_{s2} -casein during the 5th month of ripening only in 1NaCl:3KCl cheddar cheese and four peptides observed to derived from α_{s1} -casein during the 6th month of ripening only in 1NaCl:3KCl cheddar cheese. Identified peptides showed the sequence homology with the antioxidant, ACE inhibitory and antimicrobial peptides as reported earlier. Peptide profile indicated that the presence of KCl might affect the type of proteolysis which further influences the biological properties as well as proteolytic enzymes susceptibility towards cleavage site.

Keywords: Cheddar cheese, bioactive peptides, substitution, flavor enhancer, bitter blocker



FETO 26

Flaxseed mucilage: a heteropolysaccharide with desirable functional and rheological properties

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Abstract

Flaxseed has been emerging as one of the key sources of bioactive ingredients in the functional food arena. Flaxseed mucilage represents 3 to 9% of the total seed and is composed of 50–80% carbohydrates, 4–20% proteins and 3–9% ash. Flaxseed mucilage consumption has been reported to be beneficial in diabetes and cardiovascular disease management, colon cancer prevention and reduction in the incidence of obesity. Flaxseed mucilage has a considerable potential for use as a food gum. It possesses excellent rheological properties including thickening, emulsification and gelling and finds applications as an additive in food industry. It is a hydrocolloid with good water holding capacity similar to guar gum, forms viscous aqueous solutions, can act as a foaming agent in solutions and also stabilizes oil-in-water emulsions. In the present study mucilages were extracted from six Indian flaxseed cultivars and their chemical, functional, and rheological properties were investigated. A systematic study of these characteristics would be useful in exploring the full potential of flaxseed mucilage and also help in selection of a cultivar that will give best characteristics for different industrial applications. The extracted mucilages differed significantly in their yield (5.56–6.54%), ash (4.80–7.23%), protein (7.68–12.33%), pentose (0.48–0.80 mg/ml) and total sugar (1.58–3.06 mg/ml) contents. Copper (18.87–148.08 mg/kg) and zinc (15.43–53.43mg/kg) were found to be the most abundant minerals in mucilages. All mucilages exhibited endothermic as well exothermic transitions with high decomposition onset temperatures. Rheological data revealed shear rate dependent behaviour of aqueous mucilage solutions irrespective of cultivar type and concentration used. The availability of mucilage fully characterized endowed with different physicochemical and functional properties could significantly broaden the range of flaxseed mucilage application and will provide a tool-set for practical applications in food, pharmaceutical and cosmetic industries.



FETO 27

Effect of Exogenous Enzymes on the Extraction of Polyphenolic Compounds from Different Fractions of Pulses

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Abstract

In this study, the effect of carbohydrase's (α amylase and β glucosidase), proteases (protease and pepsin) and viscozyme on extraction of polyphenolic compounds were evaluated with the goal of their maximum extraction from different fractions of black gram (BG), mung bean (MB) and cowpea (CP). Overall, a significant variation in individual polyphenol extraction was observed with exogenous enzymes treatment. Among the enzyme treated extract, carbohydrase's extracts showed the higher extraction of polyphenolic compounds from different fractions of pulses followed by viscozyme, whereas, proteases showed the least effect. Hydroxybenzoic phenolic acids, flavonoids and stilbenes were found more in bound form than free, whereas, hydroxycinnamic acids showed the reverse trend. protocatechuic acid (PCA), gallic acid (GA), sinapic acid (SA), ferulic acid (FA), *p*-coumaric acid (*p*-CoA), caffeic acid (CA), luteolin (LU), vanillic acid (VA), catechin (CAT), quercetin (QE), resveratrol (RS) and trans-stilbene (TSB) were major polyphenols found in different *Vigna* species. Hydroxybenzoic acids were the highest followed by hydroxycinnamic acids and flavonoids amongst pulses studied, whereas, stilbenes were the least. It is concluded that overall extraction of polyphenolic compounds increased with the exogenous enzyme's treatment.

Keywords: Exogenous enzymes, Black gram, Green gram, Cowpea, Polyphenols

Methodology Proposed

Sequence extraction using different solvents (acetone, methanol, ethanol and water) and enzymes (α amylase and β glucosidase, protease and pepsin and viscozyme) were employed for evaluated the variation of different polyphenols among fraction. Different crude extracts obtained after sequential enzymes extraction (SEE) and sequential solvent extraction (SSE) were further used to quantify the free and esterified/soluble bound phenolic acids in pulses. The residue obtained after sequential exogenous enzymes and solvent extraction of different fractions were hydrolysed with alkali and acid to get base hydrolysable insoluble bound phenolic acids (BHIPA) and acid hydrolysable insoluble bound phenolic acids (AHIPA).



Results and Discussion

A significant variation in individual polyphenol extraction was observed with carbohydrase's, proteases and viscozyme treatment. Among different hydroxybenzoic acids, PCA was most predominant among fractions of pulses, whereas, VA was the least. Among different fractions, cotyledon of the pulses contained higher hydroxybenzoic acids than hull. Hydroxybenzoic phenolic acids were present more in bound than free form. Among the hydroxycinnamic phenolic acids, SA was most predominant among fractions of pulses, whereas, CA was the least. Among different fractions, cotyledon of the MB and CP had higher hydroxycinnamic acids than hull, whereas, BG showed the reverse trend. Hydroxycinnamic acids were present more in free form than bound. Among the flavonoids, LU was most predominant in different fractions of pulses, whereas, QE was the least. Among different fractions, hull of the MB and CP had higher flavonoids than cotyledon, whereas, BG showed the reverse trend. Flavonoids were present more in bound than free form. Among different stilbene, TSB was most predominant in different fractions of pulses, whereas, RS was the least. Among different fractions, hull of the MB had higher stilbene than cotyledon, whereas, CP showed the reverse trend. However, fractions from BG showed negligible difference. Like flavonoids, stilbenes were also found more in bound form than free. It is concluded that hydroxybenzoic acids was the highest followed by hydroxycinnamic acids and flavonoids amongst pulses studied, whereas, stilbenes were the least. Results also revealed that SEE extract higher amount of overall polyphenolic compounds except QE and TSB. The soluble polyphenolic compounds increased with increase in the permeability of the cell wall due to enzymatic treatment via hydrolytic degradation of the lignin and polysaccharides linkage and ether and/or ester linkage of polyphenolic compounds with cell wall matrix (Stalikas, 2007; Acosta-Estrada *et al.*, 2014; Zheng *et al.*, 2009; Hong *et al.*, 2013; Pinelo *et al.*, 2008).

Conclusions

Carbohydrases and viscozyme showed greater extraction of polyphenolic compounds from pulses. Majority of polyphenolic compounds were present in bound form than free, therefore, SEE treatment can be used to obtain maximum yield of these compounds. Overall, SEE treatment was more efficient to extract maximum individual's polyphenolic compounds (except QE & TSB) from the pulses than SSE.

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FETO 28

Extraction of dietary fibre from Kinnow juice industry by-products using hydrothermal treatment method

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Abstract

With the increase in altered food habits and stressful life styles, healthy digestive system becomes essential to improve overall quality of life. People now-a-days become more and more conscious towards healthy food. Dietary fiber helps to combat with problem of intestinal constipation, diabetes, cardiovascular disease, diverticulosis and obesity. Dietary fibers including both soluble and insoluble fibers consisted of cellulose, pectin, non cellulosic polysaccharides, and non-carbohydrate lignin. Citrus fruit by products have considerable amount of dietary fibre including high amount of soluble dietary fibre. Soluble part consisted of phenolics and varied amount of cello-oligosachharides that are considered as prebiotic and amount of soluble fibres and insoluble fibres produced has been optimized using hydrothermal reaction. Soluble and insoluble fibres produced using hydrothermal reactions have antioxidant activity and high dietary fibre content. The optimum conditions for the production of dietary fibre from kinnow juice byproducts using hydrothermal reactions are temperature 130⁰C, pH 4.5, time duration 3 hrs. These can be incorporated to various food products such as biscuits, breads, muffins, pasta, vermicelli, nutri-bars and wafers.

Keywords: Kinnow pulp residue, Kinnow pomace, Hydrothermal reactions, dietary fibre, soluble fibre, insoluble fibre



FETO 29

Antioxidant activities and nutritional assessment of pomegranate (*Punicagrannatum*) peel supplemented cookies

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Abstract

Fats imparts texture and taste to product but it is being susceptible to oxidation it leads to off-flavor and rancidity development. Use of antioxidants has been used in foods since very long. Use of synthetic antioxidants in bakery products were reviewed and was effective to enhance the shelf life of the products. Experimental studies on animals showed that synthetic antioxidants had carcinogenic, toxigenic and mutagenic effects. This study aimed to explore the pomegranate peel its potential as an ingredient of choice in baked products. Pomegranate peel was supplemented to wheat flour cookies at 5%, 10% and 15% respectively. Cookies supplemented with 10% pomegranate peel significantly reduced the caloric content and enhanced the dietary fiber. Positive correlation was observed for phenolics contents of cookies with 2,2-diphenyl-1-picrylhydrazyl (DPPH). Pomegranate peel supplemented cookies holding significant antioxidant properties. Sensory evaluation of pomegranate peel supplemented cookies acceptability was maximum at 10% and was ranked acceptable at 9-point hedonic scale for all sensory parameters but it slightly decreased when the level of incorporation was increased to 15 percent as peel powder imparts dark color in cookies.

Keywords: Antioxidants, Pomegranate peel, cookies.

Methodology Proposed

This study was undertaken to utilize the benefits and potentials of the pomegranate peels which go waste and develop products for variety and health benefits.

- 1) To develop “cookies” by incorporating pomegranate peel powder.
- 2) To assess organoleptic quality of the prepared cookies.
- 3) To determine the antioxidant activity and nutritive value of the cookies.

Details of treatments:

The treatments were based upon pre-trials.

Cookies:

Control (T₀): 100 percent refined wheat flour.

Treatment (T₁): 95 percent refined wheat flour + 5 percent pomegranate peel powder.

Treatment (T₂): 90 percent refined wheat flour + 10 percent pomegranate peel powder.

Treatment (T₃): 85 percent refined wheat flour + 15 percent pomegranate peel powder.



Incorporation level of pomegranate peel powder in cookies			
Treatment			
T₀	T₁	T₂	T₃
-	5%	10%	15%

Treatments and replication of the food products:
Organoleptic analysis of prepared product:

Organoleptic test	3	3	3
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Sensory evaluation of pomegranate peel powder namely *Cookies* was done by panel of five judges selected from the faculty members of the Department of Foods and Nutrition, Ethelind School of Home Science. The judges were requested to score the products with the help of “Nine point hedonic scale” score card especially prepared for the purpose. (Srilakshmi 2006).

Determination of nutritive value of the developed food products:

The nutrient estimation of Developed Cookies was done by using the food composition tables by (Gopalan 2011).

Treatments	Color & appearance	Body & texture	Taste & flavour	Overall acceptability
T₀	6.6	7.8	8.1	7.3
T₁	6.6	8.2	8.4	8.2
T₂	7.6	8.8	8.7	8.7
T₃	6.3	6.3	7.2	6.3
F-test	NS	S	S	S
CD	-	0.26	0.22	0.24

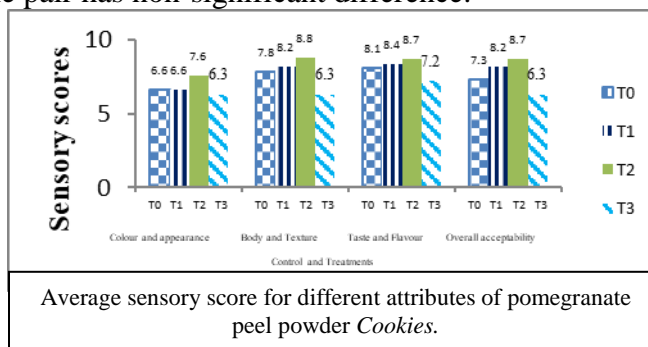
Comparison between Treatments for overall acceptability of Pomegranate peel powder *Cookies* against CD.

Treatment & mean value	T₂	T₁	T₀	T₃
T₂ (8.7)				
T₁ (8.2)	0.5*			
T₀ (7.3)	1.4*	0.9*		
T₃ (6.3)	2.4*	1.9*	1*	

CD=0.24 *- Significant



Difference between two treatment means has been compared against the CD value. There was significant difference between T₂, T₁ i.e. 0.5; T₂, T₀ i.e. 1.4; T₂, T₃ i.e. 2.4; T₁, T₀ i.e. 0.9 T₁, T₃ i.e. 1.9; T₀, T₃ i.e. 1 as their mean values were greater than of critical difference whereas none of the pair has non-significant difference.



Antioxidant composition in control & treated sample of Pomegranate peel powder cookies.

	T ₀	T ₁	T ₂	T ₃
Polyphenols (mg/100g)	62.1	75.08	88.0	98.5
%radicalscave nging activity	45%	48.25	51.5	55.5

Conclusions

On the basis of findings it is concluded that pomegranate peel powder can be suitably incorporated in cookies. On the basis of sensory evaluation 10% of pomegranate peel powder was most acceptable for cookies. Fat content of cookies decreases with the increase in amount of pomegranate peel powder. Fiber content increases as the level of incorporation of pomegranate peel powder increased. Iron content was highest in T₃ followed by T₂ and T₁. Calcium content was also found highest in T₃ (76.31) followed by T₂, T₁. Phosphorus content was also found highest in T₃ (121.34) in which the percentage of pomegranate peel powder was maximum.

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FETO 30

Quality Assessment of Whey protein-based health supplements

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Abstract

In recent years whey protein has been recognized for its applicability in muscle building and sports nutrition. These supplements are essentially manufactured by blending whey protein concentrates (WPC) and whey protein isolates (WPI) with other non-dairy ingredients like: caffeine, artificial flavour, etc. However, Indian market is flooded with whey protein-based supplements of various brands at premium rates but quality of these products are seldom checked and hence, they are available in unregulated environment. As per FSSAI, there are no specific quality parameters outlined which has further encouraged adulteration of these whey supplements with melamine, maltodextrin, plant proteins and other nitrogenous compounds with low biological value. Therefore, the present study has been undertaken to analyze composition and develop analytical tools to assess the quality of whey protein-based health supplements available in Indian markets; as WPI and WPC. In the study, the protein content was found to be less than the label value in majority of samples. Further, to confirm the type of protein, HPLC-DAD protocol was developed. The fat and lactose contents were found to be higher than those claimed. Whereas, three types of minerals were also present in all the ash samples, viz. Calcium, Sodium and Iron in appreciable amount. Also, nearly all samples were tested positive for urea but the content was below 0.5% (w/w). Lastly, analytical detection of potential adulterants like: melamine, caffeine, etc. is still in progress. Nevertheless, the existing unstructured scenario of whey protein-based health supplements market in India calls for an immediate framing of licit standards and specifications.

FETO 31

Antimicrobial and immunomodulatory activity of colostrum derived bioactive proteins and peptides against diarrheogenic pathogens

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Abstract:

Buffalo colostrum, the first mammary secretion after calving, is a complex fluid rich in nutrients. It is characterized by high level of bioactive proteins such as immunoglobulins,



lactoferrin, lactoperoxidase, lysozyme, growth factors and growth hormones. Proteins and bioactive peptides from colostrum are considered as important source of antimicrobial peptides that show antimicrobial property against diarrheogenic organism such as *E. coli* MTCC 723, *E. coli* MTCC 724, *E. coli* MTCC 725 and *E. coli* ATCC 25922. Colostrum derived proteins are precursor for many potential biologically active peptides, which are inactive within intact protein and released from their protein precursor by enzymatic hydrolysis or by fermentation process involving proteolytic starter culture. In laboratory conditions, proteolytic culture *Lactobacillus rhamnosus* C25 (lab isolate), *Lactobacillus rhamnosus* C6 and *Lactobacillus casei* NCDC 17 were selected for fermentation. First, colostrum whey was separated by rennet treatment followed by separation through 0.45 μ m membrane filter and for separation of bioactive proteins and peptides and it was passed through 100kDa and 50kDa (without fermentate) 10kDa and 5kDa Mol. cut off membrane (with fermentate) for separation of bioactive peptides. Antimicrobial activity of both permeate and retentate (10 fold concentrate) of 100 kDa, 50 kDa and fermentate of 10 kDa, 5 kDa and 3 kDa was checked by agar well assay method against diarrheogenic pathogens. The zone of inhibition of fermented 10 kDa with *Lactobacillus rhamnosus* C25 culture, was higher in permeate as well as retentate against *E. coli* MTCC 723. Further, immunomodulatory activity was also checked by phagocytosis assay in which macrophage from mice peritoneal fluid was extracted and incubated with yeast stain of *Kluyveromyces marxianus* MTCC 140 which shows engulfing potency against yeast. This inhibitory activity may be due to enhanced phagocytic activity of macrophages against yeast cells. Therefore, with this study it was concluded that colostrum derived bioactive proteins and peptides can inhibit the growth of diarrheogenic pathogens as compared to others and further scientific data is required to justify these studies.

FETO 32

Effect of Life Skills on health and nutrition among adolescents: Qualitative Research

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Abstract

Over the past twenty-five years, life skills have become the part of educating the adolescents with respect to improve their nutritional habits and the prevention of



malnutrition amongst adolescents. The term “Life Skills” refers to programs targeted primarily at young people and based on the need to promote healthy lifestyles through health education. Life skills education emerge from a growing concern about certain health problems with particular impact on young people including mal-nutrition, instant food habits and peer influence. The emphasis of this approach is on basic, personnel and social skills, attitudes and knowledge, which are significant in making positive decisions and healthy lifestyle choices. The present paper highlights some aspects of dietary pattern and cooking habits of adolescents of Government high schools of Chandigarh.

Keywords: Life skills, adolescents, malnutrition, food habits

Methodology Proposed

The research was designed to examine the nutritional habits of adolescents amongst students in Government High Schools of Chandigarh and to see the role of systematic learning among them. The multistage sampling procedure was used and total twenty adolescents participated in the study. Case study method was used for the study and the tool was developed in Hindi, in the light of objectives for easy understanding.

Objectives

To study the dietary pattern of adolescents, for instance, preference of vegetables, cereals, instant food etc.

Results and Discussion

Results depict that over the period of one year, the learner’s knowledge of nutrition helped them to amend their personnel hygiene, food habits and attitudes towards nutritional value of the food product was improved. This was indicated by improvement of height-weight measurements of the adolescents. Their norms and values towards life have been found to be positive and productive over the period of one year. It sets a direction that if programmed learning can be started at an early stage, it can play a major role in combating with nutritional issues and schools provides this kind of opportunity amongst adolescents so that the problems like malnutrition, instant food habits could be changed well in advance.

Conclusions

There is a need to inculcate healthy dietary pattern among adolescent by training them like skills on food habits. The qualitative research experiences the need to control the instant food dietary pattern amongst adolescents. Sensitization of adolescents for dietary amendment and safe guarding their health hazards is required. This is because of peer influence and advertisements and role of media in their day-today life.

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FETO 33

Comparison of Quality Attributes of Potato Puree Dried in Developed Refraction Based Dryer & Conventional Dryer

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Abstract

Potato also known as *Solanum tuberosum* belongs to the Solanaceae family. Potatoes are generally harvested in February/ March in Indo-Gangetic region where 80% of India's production is accounted. The sudden increase in temperature causes heavy injuries to the produce. The farmers are in hurry to dispose of their stocks. This leads to a glut in the market. Processing can be a possible solution to reduce the problem of potato waste. Drying is an important processing operation extending the shelf life of perishable products. So, the present study was conducted to develop a refraction-based dryer and compare the quality attributes of potato flakes dried in a developed and convective tray dryer. It was observed that the physicochemical parameters of potato flakes were significantly affected by TSS, blanching time and drying temperature ($p < 0.05$).

Keywords: Refraction based dryer, convective tray dryer, physicochemical parameters

Methodology Proposed

Refraction based dryer was developed in Pilot plant, Department of Processing and Food Engineering, Punjab Agricultural University. The fresh potatoes were peeled, cut into quarters, hot water blanched and immersed in 0.2% KMS solution for 15 min. After pretreatment, the potatoes were processed into puree and a known amount of distilled water was added to the puree to achieve desired total soluble solids (TSS) levels. The samples thus prepared were dried in the refraction-based dryer and convective tray dryer and kept for further analysis.

Results and Discussion

The statistical analysis revealed that the physicochemical parameters i.e. color, protein content, starch content, total sugars and reducing sugar of potato flakes were significantly



affected by TSS, blanching time and drying temperature ($p < 0.05$). Overall, it was found that refraction-based dryer was quite efficient for the dehydration of potato puree.

Conclusions

The best quality retention was found when potato was blanched for 5min and blended to form puree of TSS 12°Brix dried in refraction-based dryer at drying temperature 70°C.

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FETO 34

Multilayer drying kinetics of white button mushroom

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Abstract

An intensive study on multilayer mechanical drying of white button mushroom was carried out to evaluate the effect of input parameters viz temperature, air velocity and loading density on drying kinetics. The multilayer drying of mushroom was carried out at 3 levels of temperature, air velocity and loading densities ranging between 45-65°C, 1-5.4m/s and 26- 52 kg/m² respectively. The various observations were recorded To study the drying behavior of white button mushroom the observations viz, moisture content, drying rate, temperature of outgoing air, relative humidity, temperature of product, heat utilization factor and effective diffusivity was observed. The high value of HUF indicates higher utilization of heat during drying or conversely less wastage of heat. In order to evaluate the treatment of convective models, the values of statistical parameters for all the experimental runs were compared and model coefficients were calculated by using non-linear regression techniques. The best model chosen was logarithmic model, having the highest R² and the least (χ^2), mean bias error (MBE), root mean square error (RMSE). The drying rates were determined from drying model. The visualization of result showed that the drying constant (k) decreased with increase in the loading density and air velocity. By using the technique of multilayer drying resulted in increased capacity of dryer, increased heat utilization factor and resulting into a better-quality product.



Keywords: white button mushroom, Multilayer Drying, Drying models, Capacity enhancement, Quality.

Methodology Proposed

The multilayer drying of Mushroom comprised of an experimental dryer (Make-SATAKE) with electrically heated hot air system capable of supplying air upto a temperature of 70°C. A centrifugal blower capable of delivering air velocity upto 5.41 m/s was fitted in the dryer. The blower was powered with 0.75 kW, 1410 rpm, 3 phase, 230-Volt electric motor with a direct online starter. The hot air was sucked by the blower through the heaters and was thrown into the drying chamber. The heaters were vertically fitted in an aluminum chamber having rectangular cross section. Drying chamber for multilayer drying of mushroom consisted of cubical boxes made of GI sheets with dimensions 20 cm X 11 cm X 6 cm. There were 24 chambers provided on the dryer but in order to maintain multilayer drying conditions and to meet the requirements for multilayer drying, the boxes were stacked one over the other. These boxes had a mesh at the bottom with approximate 1 mm hole diameter. The hot air enters the chamber from the bottom, passes through the product and leaves the chamber at the top. Blanched rings of mushroom were kept for surface drying. The multilayer dryer was started half hour before actual drying experiment so that it can achieve desired temperature at steady state conditions. Sample was put into three drying boxes of equal weight according to the desired loading density to get the required bed depth. Three boxes make multilayer through which the hot air passed. The temperature and relative humidity of the ambient, incoming and exhaust air were determined with the help of thermo-hygrometer placed on the surface of the sample. Temperature of product at each different layer was determined with infrared thermometer. Weight of boxes was measured after each 30 min until moisture content reached at 6-7%. All other parameters were recorded at regular intervals. After drying, the sample was taken out, brought to room temperature, packed and stored. Three replications were taken for each experiment to get an average value.

Conclusions

Multilayer drying dried 2.5 times more product then the in single layer drying for the same period of drying, which also means that it reduces the energy cost of drying. Logarithmic model best describe the drying behavior of multilayer dried mushroom. The temperature and air velocity have a pronounced influence on the drying rate and consequently, markedly affected the value of the diffusion coefficient.

FETO 35

Development of oil extraction method from kinnow peel

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Abstract

Citrus peel essential oils have an impressive range of food and medicinal uses. During citrus juice processing waste such as peels, seeds and pulps produced corresponds to about 50% of the raw processed fruit, which can be used as a potential source of valuable by products. The drying kinetics and physico-chemical characteristics of dried (mechanical and solar dried) kinnow peel was studied. Also, different extraction methods: physical method (II), physical and hydro-distillation combined (I), and hydro-distillation of fresh (III), mechanical dried (IV) and solar dried peel (V) were used to obtain oil from kinnow peel and compared on basis of yield, extraction time and color characteristics of isolated the essential oils. Final moisture content of mechanical and solar dried kinnow peel was 7.06 and 7.4 %, respectively. L, a and b values of fresh, mechanical and solar dried peel ranged from 45.44–57.24, 29.4–33.9 and 44.10–55.27 respectively. It was observed that water retention capacity, total phenols, flavanoids content and antioxidant capacity significantly ($p < 0.01$) decreased whereas oil retention capacity increased significantly ($p < 0.01$) on drying treatments. Essential oil yield from physical method and physical combined with distillation method was 0.177g/100g and 0.291g/100g, respectively. The hydro-distilled essential oil content from fresh, mechanical and solar dried peels of kinnow was 0.365g/100g, 0.910g/100g and 0.617g/100g. L, b and C value vary significantly ($p < 0.01$) with respect to drying treatments and yield and extraction time vary significantly ($p < 0.01$) with respect to extraction methods. Physical method oil showed highest color difference (ΔE) and lowest Lightness difference (ΔL).

Keywords: Hydrodistillation; Kinnow mandarin; Mechanical and Solar dried; physical method.

FETO 36

Characterization of Vacuum and Spray-dried bee pollen-rich milk powder: A comparative study

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Abstract

Bee pollen - a potent source of essential amino acids, fatty acids, dietary fiber and polyphenols is an under-utilized but nourishing food, hence its incorporation in food products not only increases its utilization but also improves the nutritional status of end product. The present study employed the bee pollen as a functional component in milk powder preparation using vacuum as well as spray drying and the developed bee pollen-rich milk powder was evaluated for microstructural, physico-chemical, functional and thermal properties. SEM analysis showed the highly-textured, larger and irregular surface of vacuum-dried milk powder while spray dried powder contained the smooth, regular, smaller and almost spherical particles. The results of FTIR analysis revealed the presence of polyphenolic compounds as well as amide I and amide II whereas the X-ray diffraction pattern exhibited the slight crystalline and amorphous nature of vacuum and spray-dried powder, respectively. Spray-dried powder had highest porosity (65.59%), angle of repose (42.49°), solubility (96.83%), dispersibility (89.74%), and oil holding capacity (2.62%) while bulk (510.20 kg m⁻³) and true (655.25 kg m⁻³) density, lipids (5.41%), protein (34.72%) and ash content (4.69%) were maximum in vacuum dried milk powder. Further, the thermogravimetric analysis indicated the similar pattern of thermal degradation, characterized by three stages on heating from 40-700°C.

Keywords: Bee Pollen, Milk powder, Vacuum and Spray-drying, Fourier Transform Infra-Red spectroscopy, X-ray diffraction, Thermogravimetric analysis

FETO 37

Brewing Beer with Fruits

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Abstract

Beer, the complex brewed beverage made from malt (processed barely), hops, water, and yeast, is widely consumed all over the world. Other cereals can also be added as adjuncts. Beer contains minerals, vitamins, fibre and polyphenols that can positively contribute to a person's diet. Also, the alcohol in beer can have positive health effects when consumed in moderation. Demand for variety of beers is pushing the boundaries of conventional brewing, crafting unique beverages that incorporate unique flavors and ingredients. In doing so, brewing is coming up with the addition of unique and exotic ingredients. Various adjuncts, including fruits, are added for flavoring beer, one of the most famous beverages in the world. Fermented fruits are promising products due to the tendency of high consumer acceptance. Traditionally, grapes and apples are used for fermented beverages. The fruits used in beer preparation are not essentially fermented; they might be rather added only for imparting the fruit flavor to the finished beer. Also, it influences the antioxidant activities and quality characteristics of beer. Fresh fruits as well as



concentrates, purées or juices of some fruits are used for this purpose. The amount of fruit to add to a beer depends on many variables- the type of fruit, the amount of fruit flavor desired, the beer style etc.

Keywords: Beer, Brewing, Fruits.

FETO 38

Characterization of pigment extracted from *Rhodotorula mucilaginosa* and its application in confectionary products

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Abstract

The objective of the present investigation was to identify and characterize the pigment produced by yeast strain *Rhodotorula mucilaginosa* (MTCC-1403) using food industry residues. A lot of synthetic colors such as Brilliant Blue, Indigo Carmine, Citrus Red, Fast Green, Orange B, Erthrosine B, Allura Red, and Tartrazine cause severe harmful effects as carcinogenicity, genotoxicity, and neurotoxicity. Present day, consumers demand their food to be as 'natural' as possible. Under the bio-colorants, microbial pigments are preferred over plant pigments because of their availability, higher yield, cost efficiency and convenient down streaming. The extracted pigment was characterized in terms of various Spectroscopic and Chromatographic techniques. After cytotoxic assay, application was assessed in confectionary products.

Keywords: *Rhodotorula mucilaginosa*, agro-industrial waste, carotenoids, antioxidant activity

Methodology Proposed

In this study, the target organism was procured from Institute of Microbial Technology, Chandigarh and was cultivated on food industry residues in a 3-L bioreactor. The pigment extracted from yeast strain after the fermentation was characterized in terms of UV-Visible spectrophotometer, Fourier Transform Infrared (FTIR) spectroscopy, High Performance Liquid Chromatography (HPLC), Mass Spectrometry Liquid Chromatography (LCMS), and Fluorescence Spectroscopy. Before application of extracted pigment in food products, the cytotoxicity of the pigment was analyzed. Furthermore, the pigment was used in the development of confectionary products (hard boiled candy and jelly) at different concentrations to appraise its effect in food products.



Results and Discussion

The reports revealed that the major carotenoid compounds found in the extracted pigment were torularhodin, β -carotene, and torulene. Mass spectrum of extracted pigment confirmed the presence of some other carotenoids along with β -carotene. The peak present at 546.52 m/z was in resemblance to phytoene, a carotenoid under the category of carotenes. Another peak at 379 m/z illustrated the presence of 10'-apo-beta-caroten-10'-ol. In case of cytotoxicity, cell inhibition of 21.21% was observed with 40 μ g of the extracted pigment after 72 hours of incubation. The effect of application in confectionary products was analyzed in terms of antioxidant activity, carotenoid content, color analysis and sensory evaluation. It was noted that with elevation in the concentration of the extracted pigment, total carotenoids concentration, and radical scavenging activity also increased. Effect on L*, a*, and b* was also found to be significant at p<0.05.

Conclusions

Rhodotorula mucilaginosa (MTCC-1403) when cultivated in onion peel and mung bean husk synthesized more than one carotenoids in pigment i.e. β -carotene, phytoene, torulene and torularhodin. Pigment extracted from *Rhodotorula mucilaginosa* (MTCC-1403) when used in confectionery products improved the sensory and bioactive composition of the products.

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FETO 39

Development of Iron Fortified Coating for Roasted Cicer Areitinum

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Abstract

Roasted *Cicer areitinum* (chana) is a popular traditional snack in India. This product is filled with goodness of MUFA, PUFA, Proteins and Minerals like calcium, iron, magnesium, potassium etc. To increase its acceptability, preservative and nutritional value, edible coating is one of the reliable methods. This method helps in extending the shelf life of food commodity by reducing bacterial and fungal growth as well as enhances chemical, physical and sensory properties. Our topic discusses the fortification of iron in the coating of roasted Chickpea (*Cicer areitinum*) that underlines the new trend for an innovative food product development. Different compositions and combinations of raw materials for coating were carried out to increase the sensory attributes as well as its functionality. The sweet confectionary based product with iron rich coating increase the consumption of these roasted chana among various age groups as the product is healthy and tasty. The product developed was liked by sensory panelists and common person due to its improved sensory and quality attributes. Keywords: Edible Coating, Iron Fortification, Roasted *Cicer Areitinum*.

FETO 40

Influence of storage conditions on the quality characteristics of amaranth based cookies and pasta

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Abstract

Amaranth (*Amaranthus spp.*) is a unique nutrient grain which supplies both grains and leaves for human as well as animal feed. Raw and germinated amaranth flour used to prepare gluten free cookies and pasta. Cookies and pasta prepared from amaranth flour (raw and germinated) were stored for 90 and 180 days at ambient storage conditions (27±2°C and 58±2% R.H.). During the storage period cookies were evaluated for different characteristics (moisture content, water activity, free fatty acid value, peroxide value, hardness, and overall acceptability) at a time interval of 0, 15, 30, 45, 60, 75, and 90 days. Likewise, pasta was analyzed for different characteristics viz. moisture content, water activity, cooking loss, and overall acceptability at a time interval of 0, 30, 60, 90, 120, 150, and 180 days. It was found that moisture content of the raw and germinated amaranth flour cookies stored for 90 days were in the permissible limits. However, more increase in the moisture content was observed in germinated amaranth flour cookies (2.72 to 3.20%) as compared with raw amaranth flour cookies (2.20 to 2.61%). The values of water activity for germinated amaranth flour cookies were slightly higher (0.33 to 0.44) than raw amaranth flour cookies (0.21 to 0.33). Results indicate that the water activity of



the raw and germinated amaranth flour cookies was in the microbiologically safe limits up to 90 day. Germinated amaranth flour cookies presents slightly higher values of peroxide value (5.22 to 6.35 meq.peroxide/Kg) than raw amaranth flour cookies (4.13 to 4.67 meq.peroxide/Kg).

Similarly, the values of FFA for germinated amaranth flour cookies were slightly higher (0.60 to 0.77 mg KOH/g) than raw amaranth flour cookies (0.33 to 0.51 mg KOH/g). But the FFA value of both cookies were according to ISI specification (IS: 7487) in which the acidity of fat as 1.5% (maximum) for high protein biscuits. Furthermore, there was a significant decrease in hardness values of raw and germinated amaranth flour cookies stored up to 90 days. Germinated amaranth flour cookies showed lower hardness (42.44 to 34.10 N) than raw amaranth flour cookies (50.37 to 45.11 N). Sensory analysis shows that there was no significant change in overall acceptability of stored cookies (raw and germinated amaranth flour) up to 90 days. Data showed that all the quality parameters are within the permissible limits up to 90 days storage period.

The results of storage study of pasta revealed that the moisture content of raw and germinated amaranth flour pasta increased from 6.10 to 6.52% and 6.20 to 6.74% up to 180 day of storage. Similarly, a significant change was noticed in water activity of raw and germinated amaranth flour pasta stored up to 180 days. Germinated amaranth flour pasta showed higher water activity increase from 0.37 to 0.42 than raw amaranth flour pasta ranging from 0.33 to 0.38. Further, there was no significant change in cooking loss and overall acceptability of raw and germinated amaranth flour pasta up to 180 days of storage. Data shows that both raw and germinated amaranth flour pasta could be stored up to 180 days at ambient condition without changing their quality characteristics.



POSTER PRESENTATION ABSTRACTS



FETP 1

Lactose Intolerance and Management

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Abstract

Lactose intolerance occurs when our intestine doesn't produce enough of an enzyme to digest milk sugar ie Lactose. The management of lactose intolerance comprise two parts: The basic principles of treatment in persons intolerant to a dietary dose of lactose. Main maneuveres to reduce the lactose content in food, and consumption of special products of milk or exogeneous lactase enzyme. The tactics of management depend on the type of Hypolactasia, the severity of intolerance, and on the age the patient. Dietary adjustment is the primary form of therapy for patients with lactose intolerance. Advice patients to reduce or restrict products containing lactose. Prehydrolysed milk is available and is effective Yoghurt and fermented products, such as cheeses, are better tolerated than regular milk. Soy -based milk or food products are well tolerated. Commercially available lacatase enzyme preparations ie. LACTAID, Lactrase are effective in reducing symptoms, however they may not be effective in some patients, partially due to insufficient dosing.

Keywords: Lactose intolerance, Lactase, Lactaid, Hypolactasia.

FETP 2

Influence of different pretreatments on drying rate, rehydration and antioxidant retention of raisins prepared from Red Globe grapes.

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Abstract

The drying of Red Globe grapes is a more complex process compared to the dehydration of other agricultural materials due to the necessity of a pretreatment operation prior to drying. Grape drying to produce raisins is a very slow process, due to the peculiar structure of grape peel, that is covered by a waxy layer. Its removal has been so far carried out by using several chemical pre-treatments. However, they cause heterogeneity in the waxes removal and create microscopic cracks. In this work the effect of chemical treatments like olive oil(v/v) (1%,2%,3%,9.48%) and K₂CO₃(w/v) (2%,4%,4.74%,6%) with different concentration at 60°C are used against the control sample. The treated raisins preserved more anthocyanins than non-treated raisins. Moreover, the total



dehydration time accelerated by approximately 40% in the pretreated raisins. The greatest rehydration was obtained in fruit pretreated with olive oil (9.48%) and K_2CO_3 (4.74%). Therefore, olive oil, used in red globe grapes raisins, act as a natural surfactant constitutes an interesting process from both the industrial and health points of view as it results in remarkable reduction in the processing time and also aids the preservation of high concentrations of anthocyanin, which have important claims to health benefits from biological activities.

Keywords: Red grapes, K_2CO_3 , Olive Oil, anthocyanins, rehydration capacity.

FETP 3

Study of nutritional, pharmacological properties and utilization of *Citrullus colocynthis*

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Abstract

Citrullus colocynthis belongs to family Cucurbitaceae and commonly known by the various names like bitter apple, egusi, Tumba etc. The plant produces oils, different amino acids such as arginine, methionine and tryptophan. This fruit is rich in minerals like potassium and calcium. The plant is also reported to possess numerous nutritional and pharmacological properties. The roots of this plant are used to treat inflammation of breasts, asthma, ulcers, joint pain, urinary diseases and rheumatism. Its fruit is used to treat constipation, bacterial infections, diabetes and even cancer. *Citrullus colocynthis* contains carbohydrate, protein, separated amino acids, tannins, saponins, phenolics, flavanoids, flavones, glucosides and trace elements. The kernels of the fruit contain approximately 28.4% protein, 52.0% oil, 3.6% ash, 2.7% fiber and 8.2% carbohydrates. Its oil contains 63% linoleic acid, 16% oleic acid and small amounts of linolenic acid and composition of oil resembles that of safflower oil which is very beneficial for human nutrition. Minerals are the essential nutrients required by the body for carrying out normal functions. Fruit and seeds of this plant possess several micronutrients (vitamins and minerals) that could contribute to the diet. It is also good for low milk-consuming regions because its seeds are a rich source of calcium and niacin. *Citrullus colocynthis* possess wide range of biological activities which include antioxidants, cytotoxicity, antidiabetic, antilipidemic, insecticide, antimicrobial and anti-inflammatory. Aqueous extracts of *Citrullus colocynthis* possess antibacterial properties against *E. coli* and *Staphylococcus aureus*, whereas methanol extracts of the plant possess antibacterial properties against *Bacillus subtilis*, *Streptococcus pyrogenes*, *Salmonella typhi*. Free radical scavenging activity of *Citrullus colocynthis* made it effective in curing cancer.



FETP 4

Ficus geniculata (putkal): bioactive compounds, health benefits and utilization in food industry

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Abstract

With the increase in consumer awareness about health and diet, fruits and vegetables emerge out as suitable food material for processing industry. The health effect of Ficus Geniculata is accounted by its antioxidant and antimicrobial property. Ficus Geniculata is an underutilized plant, commonly known putkal, belongs to the family Moraceae. The crop Ficus geniculata is not available throughout the year and the people are not aware about its health benefits. Moreover, young leaves and buds are cooked, and are consumed by the tribal people (as vegetable and pickle). Different parts of the plant having numerous components including phytochemicals {protein, total fat, total carbohydrates, dietary fiber, Vitamin A (β -carotene), Vitamin C and Ascorbic acid} due to which it possesses different health benefits (antibacterial activity, antioxidant property, curing colic diseases). An innovative research on Ficus geniculata is necessary to explore all the unknown facts so that making it from underutilised to maximum utilised is easy. However, different value-added product can be prepared for curing different diseases and making people aware about its consumption. Still a kind concern of the researchers and the industrialist are required for its effective delivery.

Keywords: Ficus Geniculata, antimicrobial, gastro-intestinal properties, antioxidant

FETP 5

Utilization of Jackfruit (Artocarpus heterophyllus)- A Review

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Abstract

Jackfruit grown in tropical and subtropical regions all through the world. Jackfruit is a dicotyledonous compound product of the jack tree (Artocarpus heterophyllus) which belongs to the family Moraceae grow in many of the tropical countries of Southeast Asia but is particularly abundant in India and Bangladesh. Jackfruit is perceived as the National Fruit of Bangladesh & Sri Lanka. People consumed it mostly as a fruit when ripe but also as vegetable in the unripe stage. The Jackfruit is a great degree flexible and



sweet tasting natural product that has high health benefit. From the time immemorial, the entire jackfruit tree is utilized as a traditional medicine. Jackfruit has multifaceted medicinal properties. The medicinal properties of Jackfruit include anti-carcinogenic, anti-inflammatory, hypoglycemic, antifungal, antibacterial, antioxidant etc. The jackfruit altogether adds to the sustenance of the general population of this nation as a source of vitamins, minerals and calories. Both tender and ripe fruits as well as the seeds are rich in minerals and vitamins. It is grown and sold in the market almost everywhere in the country. The primary economic product of jackfruit is the fruit, used both when immature and when mature. The fruit pulp is sweet and tasty and used as dessert or preserved in syrup. The seeds contained in the ripe fruits are also cooked. The fruits and seeds are also processed in a variety of ways for food and other products. The present paper deals with reviewing the nutritional and utilization of Jackfruit into the various food products

FETP 6

Influence of different steeping solution and concentration on the shelf life of osmo-dried kiwifruit candy

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Abstract

The study was conducted to evaluate the effect of different soaking treatments. Kiwifruit slices were dipped in honey solution, jaggery solution, brown sugar solution and sucrose solution with varied sugar syrup concentration i.e. 30, 45 and 60° B for the preparation of osmo-dehydrated kiwifruit candy. Results obtained after three months storage study revealed that the osmo-dried kiwifruit prepared with 45° B honey steeping was considered best with respect to organoleptic characteristics colour (7.0), texture (7.0), flavour (7.0), overall acceptability (8.0) and its physio-chemical attributes were TSS (14.45 %), titrable acidity (0.83%), brix:acid ratio (17.40), moisture (75.35%), yield (25.13%), solid gain (7.57%), water loss (30.54%), reducing sugar (5.10%), total sugar (11.22%), ascorbic acid (33.56 mg/100gm), total phenols (211.45 mg/100gm) showed minute alteration during three months storage interval.

Keywords: Candy, Kiwifruit, Honey, Osmo-dried, steeping solution

FETP 7

Biosensors as an emerging technique for identification of food borne pathogens

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Abstract

Food poisoning microorganisms that contaminate food are major threat and has led food safety as a growing concern all over the world. The conventional methods for detection of food contamination based on culturing, colony counting, chromatography and immunoassay are tedious and time consuming. With the surge of innovative developments, new techniques for food analysis have emerged. Biosensors are used nowadays in food industry. They are self-contained integrated devices capable of providing means of transduction of biological events into an electronic signal. These are based on the principle of signal transduction and have the potential to enable fast analyses, that is cost and time-effective for the detection of heavy metals, residual agrochemicals, toxic metals, food borne pathogen, unpermitted chemicals, sensory analysis, smart packaging thus assuring food safety. The principle concepts of different biosensors used for the rapid detection of food borne pathogens, their characteristics, recent developments and applications have been studied. Commercially, there are various SPR systems available which includes BIACORE, SPR spectroscope, Optrel GbR and Reichert SR7000, which are used for the identification of different food borne pathogens such as *L. monocytogenes*, *Staphylococcus*, and *E. coli* O157:H7. There is a foreseeable future trend in biosensor research activities, which pave the way for fresh and healthy food proposal.

FETP 8

Morphological and Physico-Chemical Analysis of Organic Wheat Cultivars

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Abstract

In this study, three organic wheat cultivars viz Navrattan, Bansi, Lekatta were selected for the morphological and physicochemical analysis. Single Kernel Characterization System and Vernier caliper were used to analyze hardness index, thousand kernel weight, moisture content, diameter, length, breadth for morphological parameters. Insignificant variation was observed in the grain quality parameters of organic wheat cultivars. The flour quality was evaluated by subjecting samples for gluten quality parameters such as SDSV, wet gluten, dry gluten, gluten index and R/E ratio using Glutomatic instrument and Texture Analyzer.



Methodology Proposed

Morphological parameters and physic chemical parameters were analyzed using approved methods of AOAC.

Results and Discussion

Hardness index and Hectoliter weight of Navrattan variety was highest with 91.9 N and 831 respectively, whereas diameter of grain was least with 3.1 mm. Lekatta variety was found to be the longest grain (99.83 mm) among three cultivars. Lekatta variety was found to with highest gluten index (11.59) and dry gluten content 11.59%. SDSV value demonstrated the high protein quality of Navrattan (53ml) and low for Banshi (40ml). R/E ratios of gluten extracted from different wheat cultivars ranged from 0.53 to 4.63 which indicated the resistance to extension to extensibility of gluten proteins.

Conclusions

It was concluded on the basis of analysis that Banshi variety was good for chappati whereas Lekatta variety for pasta and Navrattan variety for noodle making.

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FETP 9

Edible food packaging: A novel packaging technology

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Abstract

Edible coating is a thin continuous layer of edible material which is applied to food and food components. The package is an integral part of food, which can be eaten as a part of whole food product. Edible packaging materials for replacing conventional polymers should be both renewable and biodegradable. Polysaccharides and polypeptides address those requirements and have good film-forming properties. Most proteins and carbohydrates are also edible, and can be used as matrices for edible films and coatings, which are supposed to be ingested with the food. To increase active packaging functions, emulsifiers, antioxidants and antimicrobial agents can also be incorporated into film-forming solutions which protect food products from oxidation and microbial spoilage, resulting in quality improvement and enhanced safety. Stearic acid can be incorporated



into the hydroxy-propyl-methyl-cellulose matrix to improve its moisture barrier properties. Incorporation of nisin can be effective against gram positive strains. Garlic oil can be incorporated into alginate-based edible films to prevent bacterial contamination. Incorporation of cassava starch and composite films of wheat gluten and lipids improves moisture barrier properties. Nanotechnology-based smart edible packaging is widely used to improve barrier properties of edible films. Edible films and coatings must be chosen for food packaging purpose according to the types of food products, specific applications and the major mechanisms of quality deterioration.

Keywords: Edible films and coatings, biopolymers, moisture barrier properties, quality

FETP 10

A study on sweet corn storage practices

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Abstract

Sweet corn is one of the most perishable, high moisture content and respiration rate grain. Its behaviour resembles with vegetables, which are difficult to store. Generally sweet corn can be stored for 4 days only under natural condition. Temperature also has direct effect on respiration rate and moisture losses during storage. Pre-cooling shows significant effect to storage quality of sweet corn using any method like air cooling, and hydro cooling along with direction of flow of air and water. Sweet corn harvesting should be done on 15th day after silking for maximum storability. The sweet corn cob may be wrapped with shrink PVC film after removal of cob and stored at low temperature for maximum shelf-life and minimum quality loss. Storage time is also dependent on O₂ and CO₂ concentrations and storage temperature. The study attempts to outline some of the important findings, especially on blanching, pre-cooling, storage temperature, packaging, modified atmospheric packaging of sweet corn storage.

Keywords: Sweet corn, blanching, Pre-cooling, storage temperature, packaging, modified atmospheric packaging

FETP 11

Thermo-fluids and phase changing material based thermal reservoir for probable processing application in dairy and food sector

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Abstract

During the study, different energy storage materials likewise thermal fluids and phase changing salts (PCM) were investigated to check their thermal profile (capacity to store the thermal energy) and engineering characteristics (phase change, viscosity, smoke point etc.). Sensible heat energy storage based thermal fluids namely; paraffin oil and silicon oil were analyzed for their heat absorption during heat charging process of oils. In addition to this, two phase changing salts namely; acetamide and magnesium chloride hexahydrate were examined to check their thermo-physical properties. Among these four materials, paraffin was found as highest thermal energy absorbing material. However, phase changing salts has more energy storage density as they absorb the heat in the form of latent heat. This leads to the storage of thermal energy for a longer period, once the salts are charged by heating. Among these, maximum heat energy was absorbed by paraffin oil (257°C) surging ahead of silicon oil (242°C). Peak temperature achieved by these oils is more than sufficient to cover the entire range of heating operations required in dairy and food processing industries.

Keywords: Thermal fluids, PCM, thermal energy, dairy, food.

FETP 12

Microbial Inactivation by Cold Plasma

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Abstract

Depending on the condition in which plasma is created, it is energetically fourth state of matter from solid, liquid and gas state. Cold plasma technology is effective as a tool for food decontamination and extension of shelf-life. Plasma is a source of different antimicrobial substances. Cold plasma treatment effectively inactivates a wide range of microorganisms including spores and viruses. This review explained about microbial inactivation in food and decontamination of packaging material. It is the eco-friendly process which used in preservation of food. It is now extended to food industries as a novel technology.

FETP 13

Preparation and evaluation of apple wine blended with ginger and different sweetening agents

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Abstract

Preparation of wine from surplus apple fruits can reduce post-harvest losses besides source of income. Apple wine using different sources of sugars i.e honey, sugar to raise the TSS of must to 20°B is prepared as per routine procedure. To impart medicinal and herb value ginger and stevia @ 5% each is added to the must. The apparent effect of addition of extract is to delay the fermentation, not to stop it. Different blending patterns of Apple juice (*Malus domestica*), ginger juice (*Zingiber officinale*), honey, sugar, and stevia are used for the preparation of wine using *Saccharomyces cerevisiae* G to obtain 12 wine versions. In the proximate analysis of fruit must, pH value ranged from 3.27 to 3.50, titrable acidity from 0.020 to 0.061, percent volatile acidity from 0.045 to 0.15 and specific gravity values from 1.010 to 1.100. Percent alcohol (%v/v) values ranged from 12.6%(v/v) to 14.6%(v/v). The prepared wine is allowed to sediment for 7 days at 4°C siphoned and filtered and then matured for 6 months in amber colored bottles. A significant decrease in ethanol, total phenols and yeast count is observed in wine prepared from both fresh and recycled inoculum during storage.

Keywords: Apple wine, different sugar sources, herbs and medicinal extract, Yeast (*Saccharomyces cerevisiae*).

FETP 14

Physico-chemical composition and Processing of apricot into bar, juice and jam grown in temperate region, Kashmir.

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Abstract

Introduction: Fresh apricot were analyzed for physicochemical weight, length, diameter, thickness, moisture content, total soluble solids, firmness using penetrometer and other properties. Measurement of color using Hunterlab Colorimeter was done. Properties of apricot kernels were also analysed.

Methods: The physical parameter readings length, diameter and thickness were measured using vernier calliper and weight was measured using a weight meter. Measurement of total soluble solids using Refractometer was done. The color values were determined using hunter lab colorimeter. The moisture content of different apricot processed foods like Jam, Jelly, Fruit bar was determined. Difference in the antioxidant properties



between the fresh apricot pulp and its processed products was observed by performing DPPH antioxidant assay.

Result: The maximum values of length, thickness, diameter, and weight were 31.92mm, 34.65mm, 34.37mm and 69.3g respectively. On measurement of The total soluble solids of apricot pulp using Refractometer the TSS value noted was 15.8. The color values of apricot were analyzed using hunterlab colorimeter. The moisture content was found to be highest in apricot pulp(88%) followed by apricot jam(68.8%), apricot juice(58.9%), and apricot bar(20.8%). Therefore production of apricot bar could be a suitable option for processing of apricots among juice and jam. Difference in the antioxidant properties between the fresh apricot pulp and its processed foods was examined. The apricot fruit bar possessed highest antioxidant properties among other processed products.

Discussion: Apricot fruit possesses huge potential for processing into jam, jelly and apricot fruit bar. Apricots are cultivated throughout the temperate regions of the world. They are a good source of dietary fiber. Due to less shelf life of apricot, a lot of production gets spoiled so processing of apricots into suitable products not only reduces the postharvest losses but also increases their market value by making them available in the off season.

FETP 15

Mushroom Chips by Microwave and Baking Processing

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Abstract

At present, nutritious as well as convenience foods are the prime demand of the consumers. Keeping it in mind, a study had been planned to develop value added crispy chips from button/white mushrooms (*Agaricus bisporus*). Mushrooms are the fruiting bodies of the fungus and sometime called as poor man's meat. They are the excellent source of vitamins, especially vitamin B₂, B₃ and B₅. They are also considered as a good source of the fiber and minerals such as phosphorus, potassium and zinc. In the present study raw white mushrooms were dipped in the KMS solution followed by slicing. Half of the sliced mushrooms were processed by microwave processing only while the other half of the sliced mushrooms was processed by the combination of baking processing and microwave processing. Resulted mushroom chips were analyzed for proximate composition, ascorbic acid content, antioxidant activity, total phenol content, color values and yield. Proximate analysis showed that the resulted chips were high in proteins, fiber and ash content while no significant difference was observed between the both types of chips. Fat content of chips was in the range of 12-13 per cent. Total phenol content and antioxidant activity of the chips were found to be approx. 3.5 mg gallic acid equivalents (GAE)/g and approx. 4 per cent radical scavenging activity respectively. Results obtained for sensory evaluation of chips defined that they were well accepted by the consumers. Chips made from white mushrooms were found to be high in nutrition value and have



good organoleptic properties. Therefore, they can be a great alternative to the various types of chips present in the market.

Keywords: Mushroom, Chips, Vitamins, Minerals

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FETP 16

Optimized whey fermentation with an in vitro-screened LAB

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Abstract

Whey is a dairy concomitant formerly viewed and disposed as waste is fast gaining reputation as a nutritious food component. In this study, the probiotics – *Lactobacillus plantarum* (NCDC 374), *Lactobacillus fermentum* (NCDC 141) and *Pediococcus pentosaceus* (NCDC 35) in their lyophilized states were revived and their proteolytic activities in the fermentation of whey protein concentrate examined. *L. plantarum* was found to be superlative based on the evaluation and subsequently used for fermentation. The pH, proteolytic activity and fermentation periods of the combination of *L. plantarum* with WPC70 substrate were investigated. Readings obtained showed that fermentation was optimal after a 7 h duration. This research findings are employable for savant consultations especially for the fermentative isolation of one or more bioactive components from WPC.

Keywords: Whey, Proteolysis, *L. plantarum*, Fermentation

Methodology Proposed

This research was contrived with the intent of evaluating the growth rate of probiotics in culture medium, determining the proteolytic activities of various probiotic strains on whey protein concentrate and formulation of an optimally fermented whey-based product. Lyophilized probiotic strains of NCDC 141, 35 and 374 were revived using the serial inoculation technique in primary, secondary and tertiary cultures with each culture incubated at 37°C for 24 h. Their individual tertiary cultures were collected and



centrifuged at 10,000 rpm for 15 mins after which their pellets were collected and aseptically inoculated in WPC70 (70% w/w whey protein) and incubated at 37°C for 7 days. Their proteolytic activities were examined using the OPA method as described by Pescuma et al. (2010) after every 24 h. The LAB strain found to have the highest proteolytic activity and was subsequently used for the fermentation of WPC70 following the same procedures. The pH, proteolytic activity and fermentation periods of the preparations were analysed at every 1 h and the combination with the maximum fermentation process was selected for a more accurate preparation of the fermented product.

Results and Discussion

As shown in Figure 1, *Lactobacillus plantarum* (NCDC 374) displayed the highest proteolysis on the WPC70 substrate and was thus selected for further studies. These readings are in correlation with those obtained by Partovi, Gandomi and Akhondzadeh, 2018. The superlative proteolytic strength of *L. plantarum* could possibly be associated with the proficient enzymes it efficiently releases in the course of fermentation (Margono et al., 2014).

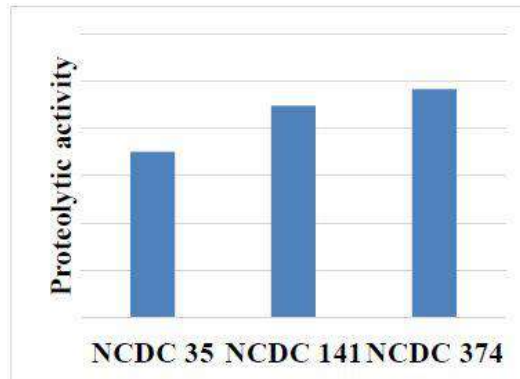


Figure 1: In vitro proteolytic assessment of the probiotics

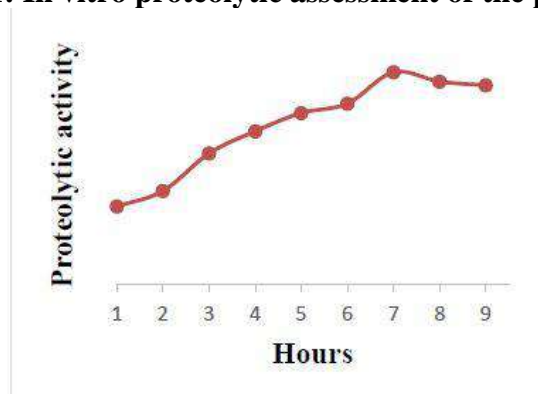


Figure 2: Hourly inspection of *L. plantarum* proteolysis

Maximum fermentative breakdown of inherent proteins was achieved at the 7th hour of fermentation as shown in Figure 2. A progressive rise in the consumption of the amino acids by the probiotic is could be the cause of low proteolysis at the initial periods of fermentation (Pescumat et al., 2010)

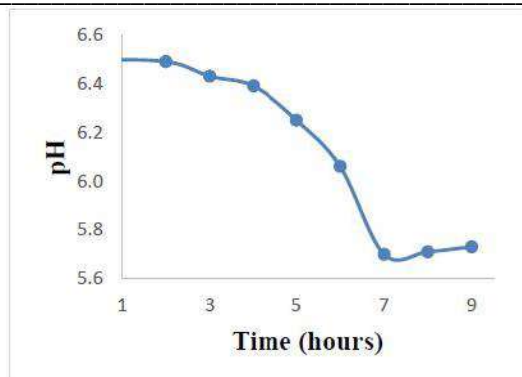


Figure 3: Relationship of pH with time

The minimum pH reading was obtained at the 7th hour, thus affirming the optimal conversion of available inherent lactose to lactic acid. Further fermentation caused no significant change in the pH value, probably due to the complete exhaustion of lactose.

Conclusions

This study proves the possibility of obtaining a more serviceable food product from whey with the proper use of probiotics, a material otherwise considered as a dairy effluent. The proper synergy between more scientific researches and industrialization could give rise to the evolution of novel and functional food products on a global scale.

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FETP 17

Development of green tea and spice based herbal candy

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Abstract

Tea, the second most consumed beverage in the world, is made from the leaves and buds of *Camellia sinensis* and is a shrub. Green tea is non-fermented and is prepared by steaming the fresh leaves before drying which inactivates the polyphenol oxidase (PPO) and thus preserves the catechins. Catechins are the major flavonoids present in green tea that act as an antioxidant and is the active compound of green tea. These antioxidants help to reduce oxidative stress which is caused by high concentration of free radicals in cells and tissues. These catechins also have anti-aging process. However, its use has been limited to tea infusions so far. Most often due to disliking towards this product the benefits of green tea fail to reach to the masses. Thus the current product aims to deliver the benefits of green tea in form of a popular product such as hard candies. Hard candy products with spice flavour is attempted to increase the acceptability of green tea in the society. Cinnamon is used as it is effective against cold and associated fever and headache, muscular pain, arthritic pain and amenorrhea.

Keywords: Green tea, Herbal candy, Antioxidant activity, Sensory analysis

Methodology

Standardization of the process for hard candy was done. Optimization for the development of herbal candy using green tea was done on the basis of sensory profiling of standardized candy. The standardized green tea candy was then used for preparing different blends with cinnamon. Different blends were prepared and the sensory analysis was done by panelists. The control hard candy, green tea candy and green tea-cinnamon candy were then evaluated chemical analysis including total phenols, total catechins, antioxidant profiling by DPPH and ABTS.

Results

Hard candy samples prepared using the green tea powder was optimized using sensory evaluation. Sensory properties such as color and appearance, flavor, body and texture and overall acceptability of the hard candies were evaluated and KD9 was most acceptable and scored better than KD1 (control). KD1 (hard candy control) scored less i.e. color and appearance (7.5 ± 0.37), flavour (7.5 ± 0.17), body and texture (7.5 ± 0.35), mouthfeel (7.3 ± 0.58) and overall acceptance (7.6 ± 0.25) and KD9 (hard candy with 4 g green tea powder) scored color and appearance (7.9 ± 0.77), flavour (8.2 ± 0.56), body and texture (8.1 ± 0.25), mouthfeel (7.9 ± 0.66) and overall acceptance (8.0 ± 0.25). Then the KD9 sample was blended with different concentrations of cinnamon and the resulting candies were evaluated on sensory parameters. The CZ10 was the most accepted formulation (hard candy with 4 g green tea powder and 0.9 g cinnamon powder) ranking highest according to the color and appearance (8.0 ± 0.58), flavour (8.1 ± 0.54), body and texture (8.1 ± 0.49), mouthfeel (8.4 ± 0.75) and overall acceptance (8.2 ± 0.47). The total phenols were 110.85 ± 0.53 GAE and 126.66 ± 0.67 GAE, total catechins 72.22 ± 25.45 CE and 111.11 ± 34.69 CE and antioxidant activity $41.11 \pm 1.11\%$ and $62.22 \pm 1.11\%$ (DPPH), $20.09 \pm 0.45\%$ and $81.04 \pm 0.64\%$ (ABTS) for green tea candy and green tea-cinnamon candy respectively.



Conclusions

Out of the three hard candies i.e. hard candy (control), green tea hard candy and green tea-cinnamon hard candy, the green tea candy incorporated with cinnamon showed best results.

FETP 18

Effect of different pre-treatments on antinutrient content of Ricebean (*Vigna umbellata*)

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Abstract

Rice bean (*Vigna umbellata*) is a multipurpose legume crop belonging to *Vigna* species. It is an 'under-utilized' or 'orphan' crop which is native to Indo-China. Rice bean is known to possess high nutritional potential with high protein content, essential amino acids, vitamins, minerals (Ca, Fe, Zn, Cu and Mn) and low fat content which helps to supplement cereal diets. But the use of rice bean in routine is limited despite its high nutritional profile due to the presence of non-nutritional factors.

Keywords: Ricebean, pre-treatments, phytic acid, tannins.

Methodology Proposed

Various pre-treatments like soaking, germination, oven roasting, sand roasting, boiling and pressure cooking were carried out to reduce the anti-nutritional content of rice bean. Soaking was carried out for 6, 12 and 18 hours and germination was carried out for 24, 48 and 72 hours. Roasting treatment like oven roasting was carried out at 170°C for 5, 10 and 15 min, whereas sand roasting was done at 200°C for 5, 10 and 15min. Cooking treatment like boiling and pressure cooking was carried out for 5, 10 and 15 min. Anti-nutrients like phytic acid and tannins were evaluated using these pre-treatments.

Results

Raw rice bean is known to have tannin and phytic acid content of 933.33±35.91 mgTAE/100g and 0.58±0.14% respectively. Soaking beans for 18 hours resulted in reduction of tannin and phytic acid to 576.19±29.91 mgTAE/100g and 0.26±0.07% respectively. After germinating the beans for 72 hour, tannin content was found to be 548.87±30.54 mgTAE/100g and phytic acid content was found to be 0.19±0.09%. Oven roasting for 15 min showed reduction in tannin and phytic acid to 847.6±35.91 mgTAE/100g and 0.41±0.13% respectively, whereas sand roasting resulted in reduction



to 723.80 ± 35.91 and $0.39 \pm 0.09\%$ respectively. After boiling the beans for 15 min, tannin was found to be 676.19 ± 32.42 mgTAE/100g and phytic acid was found to be $0.31 \pm 0.15\%$, whereas after pressure cooking for 15 min, tannin content was found to be 657.14 ± 27.75 mgTAE/100g and phytic acid was found to be $0.29 \pm 0.05\%$.

Conclusions

All the pre-treatments like soaking, germination, oven roasting, sand roasting, boiling and pressure cooking were effective in reducing the anti-nutritional content of rice bean.

Among all the pre-treatments, soaking for 18 hours followed by germination at 72 hours showed greater reduction upto 52%.

FETP 19

Nutritional and nutraceutical potential of kafal (*Myrica esculanta*)

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Abstract

Due to rapidly increasing knowledge on nutrition and medicine, concepts about food and health has dramatically changed and resulted in consumption of nutraceuticals and natural plant foods. Use of nutritional therapy and phytotherapy has become progressively popular to improve health, and to prevent and treat diseases. Plants have long history of their uses as ingredients of human nutrition and folk medicine, because of availability of huge array of high-value components and multiple-activity bio-actives. *Myrica esculenta* (Myricaceae) commonly known as “box berry” or “kaphal” is an important Indian medicinal plant. It is found in foothill tracks of Eastern Himalayas, Meghalaya, Nepal, China and Pakistan. Local tribes mainly use its fruits to prepare pickle and refreshing drinks. Traditionally, the bark has been used for the treatment of cough, asthma, fever, chronic bronchitis, diarrhoea, rheumatism and inflammation; roots have been used in bronchitis, asthma, cholera and flowers claimed to treat earache, diarrhoea, paralysis. Phytochemical studies of the different parts of plant revealed the presence of various bioactive phyto constituents such as phenolic compounds, alkaloids, glycosides, triterpenoids and volatile oils. The plant is also reported to have innumerable significant pharmacological activities like analgesic, anxiolytic, antiallergic, antidiabetic, antimicrobial, antihypertensive, antiulcer, antioxidant and anti-inflammatory. It can be used as a potential nutritional supplement due to its above mentioned health benefits and wide range of properties, which also indicates that in future the plant could serve as a “lead” for the development of novel foods having good efficacy in treating various disorders.

Keywords: Nutritional therapy, phytotherapy, Nutraceutical, kaphal



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FETP 20

Nutritional analysis of oleaginous algae

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Abstract

Microalgae are single-celled and in the form of microscopic plants are called "phytoplankton". Microalgae have the ability to synthesize many compounds, some of which have been recognized as a source of functional ingredients for nutraceuticals with positive health effects. Promyaet al., (2008) reported that algae are significant source of human food, especially in Asia and cultivated for nutrition and pigments for supplemental use as human food and animal feed. Nutritional value of *Cladophora* show that it contains significant amounts of protein and carotenoids, which are essential for human and fish nutrition (Khuantrairong and Traichaiyaporn, 2009; Traichaiyaporn et al., 2010). Epifanio, (1979) studied that the nutritional value of a microalgal diet contains both essential macro- and micronutrients to the target animal consumer. Microalgae provide many phytonutrients, including in particular PUFAs e.g. Eicosapentaenic acid (EPA), arachidonic acid (AA) and docosahexaenoic acid (DHA), which are known to be essential for various marine animals (Nichols, 2003). Microalgae contain 30-40% protein and 10-20% lipids in the late-logarithmic growth phase (Renaud et al., 1999 and Brown, 1997). Lipid membranes contain sterols such as fucosterol and β -sitosterol (Fahyet al., 2005) that also have reported health benefits (Arul et al., 2012). Most microalgal species contain 7-34% EPA and 0.2-11% DHA (Brown, 1997). The brain is a structural-lipid rich organ that uses highly unsaturated fatty acids, particularly AA and DHA, for structure and function (Crawford et al., 1997; Crawford and Sinclair, 1972). It is usual to consider that AA and DHA are synthesized from their parent precursors, linoleic (LA; 18:2n26) and alpha-linolenic (ALA; 18:3n23) acids.



FETP 21

Study of Antioxidant Potential of Bitter Gourd Peel

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Abstract

Karela (*Momordica charantia* L.) belong to kingdom plantae and family Cucurbitaceae is slender, tendril climbing, annual vine. The bitter taste is due to the presence of phytochemicals (alkaloid) and flavonoids. Indians have traditionally used the leaves and fruits as a medicine to treat diabetes, colic and to heal skin sores and wounds. *Momordica charantia* has many medicinally useful properties, such as anticancer, antibacterial, anti-hepatotoxic, antioxidant, antiviral, antiulcerogenic and larvicidal effects. Bitter gourd is very low in calories but dense with precious nutrients. It is an excellent source of vitamins B₁, B₂, B₃, Vitamin C, magnesium, folic acid, zinc, phosphorus, manganese and has high dietary fiber. It also contained anticarcinogens or chemopreventive agent. The proximate chemical composition analysis of Bitter gourd peel powder was observed. The protein and fiber content of Bitter peel powder 17.66±2.0 and 17.08±1.9. The extraction capacity of methanol is higher than the ethanol and acetone so methanol extractor showed high antioxidant activity. In the study it was determined that Bitter gourd peel powder showed higher antioxidant activity. Bitter gourd is often used in Chinese cooking for its bitter flavour, typically in stir-fries, soups and also as tea, Aloo karela bhaaji in India, stir-fried karela with onion. Bitter gourd powder is used due to its bioactive compounds.

FETP 22

Isolation Techniques and Application of Potato Starch in Food

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Abstract

Potato (*Solanum tuberosum* L.) is one of the significant horticultural crop and world's fourth most important food crop after rice, wheat and maize. Potato contains good amount of carbohydrates, vitamins, minerals, essential amino acid, dietary fiber and other health promoting bioactive components such as anthocyanins, carotenoids and total phenols. Starch is the principle constituent of potato tubers and covers between 65-80% of the tuber dry weight depending upon variety. About 3% of world crop of potatoes is used for production of starch. The world production of potato starch is 2 million tonnes. For extraction of Potato Starch, general steps include i.e. washing, peeling, defibering, dewatering and drying. But we can divide these methods as Commercial level and lab or



pilot scale method. Moreover, any variety of potato can be used for production of starch. Sub-standard potatoes (two small, two large, misshapen), damaged or surplus potatoes which are not suitable for table or processing are satisfactory for making starch. Potato starch stands out with distinct characteristics that make it a choice ingredient in food manufacturing. Potato starch has excellent viscosity and texture creating properties. It forms a solution with no taste, no off-flavours, no colour and almost completely transparent while grain starches have a grainy taste and are opaque in colour. Due to these unique properties it has widely used in food and non-food applications e.g. as an water binder, thickener, anti-caking and glueing agent.

FETP 23

Advance Techniques in Retort Processing of Food

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Abstract

Retorting is the old reliable of food processing providing safe, effective shelf stability with fairly simple equipment and packaging. But that doesn't mean there is nothing new in the retort room. New packaging formats that have emerged in the past decade make retorting more desirable. In addition, the latest agitation processes have reduced cook times, making for both energy savings and less degradation of food quality. Retort processing of foods in rigid, semi-rigid and flexible packaging systems is the most acceptable form of food preservation. It represents unique combination of package, process and product technology with potential, economic benefits. Traditionally, tin containers have contributed to a large extent in building the confidence in processed foods. Shelf life of a food is integrally related to its packaging and the product conditions. The major driving forces for innovation in food packaging technology had increased due to the rise in consumer demands. Retort technology systems use steam or superheated water to cook food in its own package, thus extending shelf life and ensuring food safety. Manufacturers of food products who face a challenge in making their packaging product attractive to consumers should design packages with an innovative look. The revolution in packaging technology has boost up food suppliers mind to be creative in providing a convenient food to the consumer. In fact most of the grocery shops or supermarkets want the food product they buy from the manufacturer to be as convenient as possible. In fact, from the consumer point of view, the less time they spend to prepare a meal, better it is. As mentioned before, new advance in technology of packaging has begun to transform the marketing and goods of food products. Retort pouch technology is the solution to meet consumer demand that will help consumers save time and energy.



FETP 24

Effect of various pre-treatments on popping yield and volume expansion ratio of black rice.

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Abstract

Black rice is a kind of rice species *Oryza sativa* L. cultivated mainly in Asian countries. The most of black rice (62% of global production) is cultivated by china. In black rice nutrient content such as protein, minerals and dietary fibers are present in more amount as compare to white and brown rice. This rice is gluten free, Cholesterol free, sugar, salt and fat content is low. Presently ready to eat snack having higher market demand. Popped rice is commonly used in ready to- eat breakfast cereals, infant foods and snack products, such as granola bars. Popped rice is made by exposing black rice to high temperature. To make popped rice various pre-treatments were given and the effect of the pre-treatment on the popping yield and volume expansion ratio were checked.

Keywords: Black rice, pre-treatment, popping yield, volume expansion ratio

Methodology

Popping is a simultaneous starch gelatinization and expansion process, during which grains are exposed to high temperatures for short time. During this process, super-heated vapour produced inside the grains by instantaneous heating, cooks the grain and expands the endosperm suddenly; breaking out the outer skin. The pre-treatments were done using different temperature-moisture combination. The different conditions were 150-250°C temperature range and 10-15 % moisture content. The popping yield and volume expansion of the sample was optimized using response surface methodology.

Results and Discussion

The maximum popping yield of 38.66 % was obtained at temperature 200°C and Moisture content 13.5 % and Volume expansion ratio was 12.42 at temperature 200°C and Moisture content 13.5 %. As the moisture content increased from 10% the popping yield and the volume expansion ration gets increased. Maximum result of popping yield and volume expansion was obtained at 13%. As the moisture content increased above 13.5 % the popping yield and the volume expansion ratio gets decreased. The popping was achieved up to moisture content 17 % moisture content. As the temperature increased from 150°C popping yield and volume expansion ratio increases and maximum result was at 200°C. As the temperature increased above 200°C the popping yield and volume expansion ration gets reduced.



Conclusions

It was found that the highest popping yield and volume expansion ratio was at 13.5 % moisture content and temperature of 200°C.

FETP 25

Microencapsulation of bioactive compounds by complex coacervation technique

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Abstract

Recent innovations in microencapsulation technology have revolutionized the food sector. This technology has emerged as a reliable method to protect and stabilize sensitive compounds from adverse environmental conditions as well as improves the bioavailability of these compounds. By using a proper microencapsulation technique, microcapsules of desired quality with high encapsulation efficiency can be achieved. Coacervation is one of the most promising and extensively employed microencapsulation techniques. It is based on the colloidal phenomenon which includes interaction of two oppositely charged polymers in an aqueous solution. Owing to the high encapsulation efficiency, protection as well as controlled release of encapsulated compounds, this technique is considered as a good option for encapsulation in food sectors. Applications of coacervation have emerged in the field of food sector for the encapsulation of compounds, food packaging, food additives and formation of food emulsions. A wide variety of polymers and core-shell combinations have also been evaluated for the encapsulation of compounds. This review intends to summarize the recent advances in coacervation technique for the encapsulation of different compounds as well as its applications in food sectors.

Keywords: Microencapsulation, Coacervation, Polymers, Food sector, Encapsulating efficiency



FETP 26

**Starch based Pickering emulsions and its potential applications in food:
A Review**

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Abstract

Pickering emulsions stabilized by food-grade solid particles have drawn researchers' interest, due to their low toxicity, eco-friendliness and high stability. Different plant derived solid particles such as starch have been used to create Pickering emulsions. Pickering particles are solid particles capable of stabilising an emulsion by the adsorption of solid particles to the oil/water interface. Starch granules have been shown suitable for Pickering type stabilization after chemical modification with octenyl succinic anhydride (OSA) to adjust their wetting behaviour. Starch based Pickering emulsions have been used in various food applications. These include Pickering emulsion polymerization, encapsulation of bioactive components for functional food applications, and food product formulation. Starch based Pickering emulsions may be used in other potential areas such as dairy products, drug delivery and controlled release of flavour and environment response materials. The aim of this review is to study the applications and challenges of incorporating starch-based Pickering emulsions in food industry. Keywords: Pickering emulsions, encapsulation, bioactive components

FETP 27

**Meghalayan cherry (*Prunus nepalensis*): A potential source of
polyphenols and antioxidant compounds**

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Abstract

Meghalayan cherry (*Prunus nepalensis* L.) an underutilized fruit belongs to family Rosaceae and distributed in different parts of Northeast India. It is mainly present in Khasi and Jaintia hills of Meghalaya and locally known as Sohiong (Meghalayan cherry). Sohiong fruit is round in shape with smooth surface and dark purple in colour with unique flavour and taste. Biochemical properties of fruits has shown that fruits are rich in minerals (calcium, magnesium, zinc and iron), sugars and protein. Meghalayan cherry found to be predominant source of phenolics i.e. 812.8 -1131.30 mg GAE/100 g. The fruit found to have good radical scavenging activity and iron chelating capacity because



of several bioactive phytochemicals. Its phenolic composition and concentrations are known to be influenced by growing conditions and maturation. Cherry fruit extract have protective effect on hepatotoxicity and also exhibit anti-inflammatory activity. Purpurin, resperine, gallic acid and rutin are the major phytochemicals found in methanolic extract of fruit. The purple coloured fruit has high anthocyanin content (9.89 ± 0.24 mg C3G equivalent/g dm) which can be used as a colourant for various food and other products and owing to its antioxidant properties can be effective for the prevention and treatment of diseases.

Keywords: Antioxidant, Anthocyanin, Meghalayan cherry, polyphenols.

FETP 28

Effect of different fat globules size on their in vitro digestion by simulated gastrointestinal conditions

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Abstract

Milk of all the mammals comprising of the same principal nutritional component such as fat, protein, lactose, minerals, and vitamins but of having a varying concentration between breeds and species. Fat in milk present in the form of spherical droplets called as milk fat globules (MFGs) and the size distribution of MFGs varies among different lactating species. Fat globules are mainly composed of triacylglycerides, diglycerides, monoglycerides, phospholipids, sterols, carotenoids, and fat-soluble vitamins. Although the bioavailability of dietary lipids is of primary importance in human health and nutrition, the mechanisms involved in lipid digestion are not fully understood and are of growing interest. In the present study, three fractions of MFGs were obtained by gravity separation carried out at 4°C/12 h for buffalo milk and 4°C/10 h for cow milk. Mastersizer was used to confirm the size of the different separated class of fat globules in milk and their respective in vitro digested samples. Milk was subjected to a 2-step in vitro digestion viz. gastric and intestinal condition. Changes in the globule size and surface charge of different size fat globules during digestion were examined. Free fatty acid (FFA) release behaviour of different size fat globule were examined through pH-stat titrimetry and found that after 150 min of intestinal digestion followed by 60 min of gastric digestion release of FFA was more in small fraction of cow (d_{43} 3.61 μ m) and buffalo milk (d_{43} 3.35 μ m) 876 and 896 μ mol per 10 ml of milk. The trend for the release of FFA after 150 min of intestinal digestion was small > control > medium > large classes of fat globule size in cow and buffalo milk. The study also revealed that different



size fat globule has different digestion pattern and the rate of lipolysis varies with the different classes of fat globules.

Keywords: Fat globule size, In Vitro, FFA

FETP 29

Quality of Kinnow Processing waste as Affected by Drying Method

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Abstract

India is the third largest citrus producing country in the world. It is one of the important citrus fruit crops in Northern Indian States (Sharma et al 2007). It is a primary citrus crop of Punjab with annual production of 1.1 million tonnes from an area of 48000 hectare (Punjab Horticulture Mission 2015-16). Hoshiarpur and Abohar are the main kinnow producing belts of Punjab. During the industrial processing of kinnow juice large amount of kinnow waste are produced. Being rich in soluble and insoluble carbohydrates it shows great potential for value added products through subsequent biological and chemical processes (Rivas et al., 2008). However, due to unavailability of technology for utilization of waste generated from the kinnow juice processing at Punjab Agro Juices Plants located at Hoshiarpur and Abohar, huge amount of this waste is dumped on the adjacent landfill/rivers or burned causing environmental pollution and depletion of dissolved oxygen level in contaminated water (Wadhwa and Bakshi 2013). The aim of present work was to find the effective condition for drying kinnow processing waste, so that this by-product can be utilized effectively.

Keywords: Kinnow waste, mechanical drying, quality parameters, pectin content

Methodology

The kinnow waste remained after extraction of juice was obtained from the Punjab Agro Juices Plants located at Hoshiarpur. The samples of kinnow waste were dried at different temperatures of 50, 60 and 70⁰ C in hot air tray dryer and sun dried (average temperature (26⁰C) and humidity (40%)) from an initial moisture content of 80 % (wb) to final moisture content of about 7 % (wb). Different quality parameters viz., titrable acidity, ascorbic acid, phenols, flavonol, anti-oxidative activity and pectin content was determined for all the dried samples using standard methods.

Results and Discussion



Kinnow waste (peel and pomace) was properly cleaned and kept in a tray with a perforated bottom to remove the excess water from the sample. Initial moisture content of kinnow peel was found to be 80% (wb). Drying kinetics study conducted at different temperature showed that tray drying has higher rate of drying which takes 22 to 28 hrs to obtained 7% (wb) compared to sun drying (48 sunshine hrs) at ambient 24°C and 40% relative humidity. Relation of moisture ratio and drying time shown in Fig1 indicated that drying time decreased with increase of drying air temperature with least drying time (22 hrs) required at 70°C temperature.

Physico-chemical characteristics of dried Kinnow waste

Different quality parameters viz., titrable acidity, ascorbic acid, sugar, phenols, flavonol, anti-oxidative activity and pectin content was determined for all the dried samples. Results indicated that sugar, phenols, flavonol, anti-oxidative activity and pectin content decreased with increase in drying temperature whereas titrable acidity increased with increase in drying temperature (Table 1). The highest retention of these constituent observed at drying temperature of 50°C was sugar (55.45mg/gm), phenols (2.33 mg/gm), flavonol (0.825 mg/gm), anti-oxidative activity (1.26 mg/gm) ascorbic acid equivalent and pectin content (12.84%), which then reduced at drying temperature of 60 and 70°C. Decline in content of ascorbic acid, phenols and Flavonoids at higher temperature might be due to thermal degradation of phenolic compounds at higher temperature. Decrease of antioxidant activity might be due to decrease in phenolics compounds.

Table1: Physico-chemical qualities of dried kinnow waste

Temperature (°C)	Drying time (hr)	Titrable acidity (%)	Ascorbic acid (mg/100gm)	Sugars (mg/gm)	Flavonoids (mg/gm)	Phenol (mg/gm)	Anti-oxidative activity (mg/gm)	Pectin(% dry wt)
50	28	0.82	45.0	55.45	0.825	2.33	1.26	12.84
60	24	0.96	40.0	52.37	0.586	2.21	0.53	12.78
70	22	1.12	32.5	37.27	0.453	2.07	0.45	9.16
Sun drying	48	0.90	33.2	53.18	1.000	2.13	1.08	12.00

Conclusions

Although, the drying time was highest i.e. 28 hrs for drying the samples at 50°C, but the quality of the samples were comparatively better than drying at 70 and 60°C. Based on the physical observation, quality parameters as well as of recovery of pectin it can be concluded that the samples of kinnow waste should be dried at low temperature i.e. 50°C and should be dried immediately after extraction of juice in continuous drying system line. Dried kinnow peel could be source of pectin.

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FETP 30

Physicochemical and pasting characterization of starch isolated from weed rice starch

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Abstract

Rice (*Oryza sativa* L.) is one of the important cereal crops for food in Asia. Many people obtain nutrition and calories from rice and its products (Lin et al., 2011). Starch is abundantly present in rice along with protein, minerals and B vitamin (Gunaratne et al., 2013; Falade and Christopher, 2015). Recently, the attention of the consumers looking for healthier foods has increased towards pigmented rice, such as red rice, black rice, wild rice (Deng et al., 2013). The consumption of colored rice varieties is being related with improvement in human health. Due to their antioxidant potency and presence of phenolic compounds, they are classified as functional foods (Slavin, 1994). It may also help in delaying the oxidative process resulting in increasing the shelf life of perishable foods (Vargas et al., 2016). Out of these pigmented rice, red and black rice are used to manufacture the various products like colored noodles, cakes, alcoholic beverages, etc (Itani, 2000). It may also possess the excellent source of starch. Physicochemical and pasting properties of starch isolated from weed rice were examined. Amylose content of weed rice starch was observed similar to cereal starches i.e. 13.77 %. Water binding capacity (WBC) was observed 90.62 % for weed rice starch. Swelling power and solubility of weed rice starch increased with temperature and were observed the highest at temperature 90°C. Swelling power and solubility of barnyard starch ranged from 2.22-19.80 g/g and 0.74-20.73%. The value of light transmittance of starch paste within storage period of six days ranged from 7.57 to 18.92%. Pasting characteristics of starch were studied using rapid visco analyzer. Peak viscosity, breakdown, final viscosity, setback and pasting temperature were observed 1111, 192, 2296, 1377cP and 80.0°C for weed rice, respectively. In general starch from weed rice has similar physicochemical properties as compared to conventional cereal starches.

FETP 31

A survey of diet drinks consumption patterns the consumers of Punjab (Jalandhar)

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Abstract

Over the past decade, with the change in dietary lifestyle and rise in health awareness the demand of health drinks (diet drinks) has increased among different gender and age group consumers. Therefore, to investigate the consumption pattern of the diet drink in Jalandhar (Punjab). A self-administered, semi-quantitative, 23-item questionnaire was developed to assess the intake of diet drinks along with their demographic detail. Survey was conducted determining the consumption pattern of diet drinks among young to middle aged (18-40 years) adults. Of the particular concern, a total number of n=102 of which 40.10 % were males and 59.80 % were females. The responses indicated that 72.5% of the population consumed diet drinks whereas others 27.5% do not prefer to consume any type of diet drink due to various reasons viz., cost, peer pressure, variety, and composition; and after effects. In addition, it was also observed that safety and safe doses of active ingredients chiefly caffeine in diet drinks also affects the acceptability of the diet drinks. Beside these, many of the negative consequences have also been observed by the consumers. However, in nutshell it is concluded that the diet drinks are being consumed by young adults with frequency of few times in a week. Future research is highly required in this regard to fix the consumption pattern as per the age and gender to overcome the side effects of the drink.

Keywords: diet drink, consumption pattern, age group

FETP 32

A survey of tea bag consumption patterns among the consumers of Punjab (Jalandhar)

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Abstract

The consumption pattern of the tea bag is increase day-by-day with increase in the socioeconomic status of the consumers, which may vary as per the location and purchasing power. An attempt has been made to study the consumption pattern of tea bags Punjab (Jalandhar). A self-administered, semi-quantitative, 28-item questionnaire was developed to assess the intake of tea bags along with their demographic detail from a total number (n=104) respondents. Results indicated that out of the total number of people involve in survey, 50.96% were male, whereas, and 49% were females; having different age ranges i.e. 17-27 years (97.1%), 28-30 years (1.9%), 31 years and above (0.96%). Different respondents gave different reasons for their likes and dislikes for the tea. According to the taste and preference, majority of the people preferred black tea followed by green tea, white tea, herbal tea, iced tea, kava tea, spiced tea. Different type



of tea bag brands are available and the consumer preference showed that lipton tea was most preferred. Regarding the way of consumption, majority of the people liked dipping the tea bag (60 seconds) in milk. 10.5% of the total respondent don't know the benefits of herbal tea while 25.9% knows about its benefits. Majority of the people said that the price of herbal tea bags are high. Majority of the people are satisfied with the packaging of the tea bags. The results of the present study is indicating the bright future of the tea bags in India over loose tea.

Keywords: Tea bag, consumption pattern, age group

FETP 33

Consideration for development of low-cost supplementary foods for lactating women

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Abstract

Malnutrition is a serious public health problem, which occurs due to an inadequate supply of nutrients and therefore, affects numerous children and women (especially pregnant and lactating women of low economic class) throughout the world. Although various nutritional supplements and food products are already available in the market, they are generally expensive and beyond the purchasing power of middle- or lower-class households. In addition, some efforts have traditionally been made to prepare such supplements at home, but the composition of these products varies according to the economic status of consumers. Thus, nutritional status is clearly compromised due to poor standard of living which necessitates a great need to develop nutritious food products at low cost, accessible to all and that meet the appropriate nutritional, sensory and economic attributes without ignoring regulatory guidelines. This Abstract will enlighten the specific considerations, namely, finding an alternative source, ensuring nutritional and sensory quality features, and economic aspects for the development of complementary low-cost food products for breastfeeding women with the goal of eliminating malnutrition.

Keywords: malnutrition, specific considerations, supplementary foods, lactating women

FETP 34

Comparative Study-Effect of Different Nanoparticles on the Properties of Nanobiocomposite Film

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Abstract

The Silver nanoparticles (AgNPs), titanium oxide (TiO₂) and Zinc oxide (ZnO) nanoparticles potentially gaining great interest because of their promising effect to change the properties of packaging materials and also having antibacterial effect. Under the present investigation, nano-biocomposite film based on corn starch with addition of plasticizers such as glycerol served as an effective base for incorporating above mentioned nanoparticles using sonication technique. The optimization of ingredients like different nanoparticles, corn starch and glycerol and processing parameters like drying temperature and time for preparation of nanobiocomposite was selected based on preliminary trials. The different film properties like thickness, solubility, WVTR and mechanical strength was analyzed and compared with each other. Minimum inhibitory concentration (MIC) is a technique which evaluates the antimicrobial effect of these nanoparticles in nano-biocomposite films. MIC of nanoparticles was performed at a concentration of (0-1%) each using well diffusion method against pathogenic organisms like E. coli and Bacillus cereus. From the results, it was concluded that AgNPs, TiO₂ nanoparticles and ZnO nanoparticles have shown potential antibacterial activity and also improve the mechanical properties of the film.

FETP 35

Colour measurement of flavoured milk using image analysis

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Abstract

A Machine Vision System (MVS) was developed for colour measurement of dairy products. Scilab program was used for image analysis and colour measurement of milk powder in CIE L*a*b* units. MVS was manually calibrated and different calibration models (linear, quadratic, cubic and quartic) were validated for each of L*a*b* channel. The program was successfully applied for image processing and extraction of colour values. In the performance evaluation, linear model was found best with low mean normalized error and RMSD. System was found suitable for colour measurement of flavoured milk and can be used as an alternative to food color spectrophotometer.

Keywords: Machine vision, color, flavoured milk

Methodology Proposed

The objective of this study was to develop a low-cost colour measurement system for dairy product on the basis of machine vision technology. The developed Machine Vision



System (MVS) consisted of a cabinet with standard illumination. It was calibrated using semi-automatic calibration algorithm. Macbeth 24 colour gloss shade chart was custom designed by Serif Drawplus (v. 5.0) software on the basis of RGB values. CIE $L^*a^*b^*$ values of each colour shade were measured using colour spectrophotometer (ColourFlex, Hunter Associates Laboratory Inc., USA) and MVS. The colourimetric and MVS $L^*a^*b^*$ values were plotted in MS-EXCEL (Microsoft Corporation, USA). Regression equations (linear, quadratic, cubic and quartic) were generated. These equations were used in colour correction algorithm for each channel L^* , a^* and b^* to get corrected colour values. Root mean square deviation (RMSD) and mean normalized error (MNE) were used to measure the accuracy of the calibration models [1]. The mean normalized error was obtained by comparing colourimeter measurements (L^* , a^* , b^*) with model estimates [2]. In our case $N = 21$ as number of shades in validation chart were 21. The errors have been normalized according to the range of each of the scales. The measurements are in the intervals $0 \leq L^* \leq 100$, $-120 \leq a^* \leq 120$ and $-120 \leq b^* \leq 120$. Thus in the above equations the intervals were considered as $\Delta L = 100$, $\Delta a = 240$ and $\Delta b = 240$.

The MVS was evaluated for color measurement of strawberry flavoured milk (Experimental Dairy, NDRI, India). CIE $L^*a^*b^*$ color values of flavoured were determined using Colorflex spectrophotometer (Hunter Associates Laboratory Inc., USA) and MVS. Statistical analysis was done using SPSS, Version 16.0 (SPSS Inc., USA). Analysis of variance was applied with 95% confidence level. Regression analysis was carried out in MS Excel (Microsoft Corporation, Washington, USA).

Results and Discussion

In this study MVS was manually calibrated and calibration equations were developed using regression analysis for each of the colour channels L^* , a^* , b^* and were used in the colour correction algorithm. R^2 values for different models were in the range of 0.736-0.946 (L^* channel), 0.931-0.943 (a^* channel), and 0.975-0.977 (b^* channel). During validation of developed system using test chart, it was observed that linear calibration model has low RMSD and MNE values. Linear calibration model was used in the colour correction algorithm as MNE was in the range of 0.075 to 0.092. Low MNE indicates that better accuracy in colour measurement of food products. The calibration method proposed in this study is simpler as compared to calibration method in which model was developed as $RGB \rightarrow L^*$, $RGB \rightarrow a^*$ and $RGB \rightarrow b^*$ [2]. In another study $RGBVS \rightarrow RGBCOL$ calibration model was evaluated and non-linear relationship was observed among RGB values. To obtain linear relationship model was selected in the form of $XVS \rightarrow XCOL$, $YVS \rightarrow YCOL$, and $ZVS \rightarrow ZCOL$. The expected gamma correction value to be applied to each of the tristimulus values was determined. Gamma transformation helped to obtain linear relationship with a reasonable fit between CIE XYZ and values from the vision system and XYZ values from the colourimeter [3]. In our case, calibration model was in the form of $L^*VS \rightarrow L^*COL$, $a^*VS \rightarrow a^*COL$, and $b^*VS \rightarrow b^*COL$ and the relationship was linear. Thus, the proposed method can be used for colour calibration of vision systems. Calibrated system was successfully used for color measurement of flavoured milk (Table 1).



Table 1 Comparison of instrumental and MVS colour values

		Colour Values
L*	ColourFlex	70.58 ± 0.30 ^a
	MVS 0.3 mp	71.29 ± 0.21 ^b
	MVS 2 mp	70.50 ± 0.37 ^a
	MVS 8 mp	70.50 ± 0.25 ^a
	MVS 16 mp	70.36 ± 0.36 ^a
a*	ColourFlex	31.81 ± 0.12 ^c
	MVS 0.3 mp	31.57 ± 0.29 ^d
	MVS 2 mp	31.53 ± 0.31 ^c
	MVS 8 mp	31.35 ± 0.11 ^c
	MVS 16 mp	31.80 ± 0.12 ^d
b*	ColourFlex	-0.04 ± 0.06 ^e
	MVS 0.3 mp	-0.19 ± 0.06 ^e
	MVS 2 mp	-0.09 ± 0.05 ^f
	MVS 8 mp	-0.08 ± 0.04 ^f
	MVS 16 mp	-0.07 ± 0.04 ^f

Mean values of 5 replications

Conclusions

MVS was found successful in measurement of CIE L*a*b* values of flavoured milk. Manual calibration using regression analysis in MS-Excel is simple to implement but requires technical expertise and training.

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FETP 36

Application of Electro-Dialysis in Food Industry as A Novel Processing Technology

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Abstract

Electrodialysis (ED) is a membrane-based separation technology which is gaining a lot of magnetism in the food processing industries. ED is a membrane process in which ions were transported through semi permeable membrane, under the influence of an electric potential, which helps to concentrate, purify, or modify food products. The low energy consumption, modular design, efficiency and ease of operation, as well as the heat sensitivity of many food products are prime reasons favouring this technology. There are two methods involved in the electrodialysis process: Conventional electrodialysis and Bipolar-membrane electrodialysis (BMED). Conventional electrodialysis consists of two membrane systems: cation selective membrane and anion selective membrane through which either positive or negative charged ions will flow. In the food processing industries conventional electrodialysis is employed for demineralization of whey, deacidification of fruit juices, tartaric acid stabilization of wine, desalination of sauces and molasses desalting. Bipolar-membrane electrodialysis consists of both cation and anion exchange layer. BMED is an environmentally friendly technology with a wide-ranging application potential. BMED is engaged in food processing industries for the inhibition of enzymatic browning in cloudy juices, inhibition of the polyphenol oxidase enzyme in apple juice, purification and fractionation of proteins, separation of phospholipids, and regeneration of waste water resulting from food processing. Electro-dialysis with filtration membrane (EDFM) is a relatively new approach which is used for the separation of macromolecules according to their charge and molecular weight. ED technologies can be used for the production of bioactive compounds having beneficial effect on the cardiovascular, gastrointestinal, and nervous and immune systems preventing hypertension, diabetes, cancer and other diseases. Electro-dialysis processes offer better stability and performance, and also facilitate way for new applications of novel processing technology in food industry.

FETP 37

Effect of Microwave heating on Juice Yield and Quality of Chicory Root Juice

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Abstract

Chicory (*Cichorium intybus* L.) is rich source of the dietary fiber and polyfructans. The different chemical constituents, phytochemicals, phenolic compounds are present in the roots. Chicory has been mainly used as coffee substitute and raw material for inulin



extraction. The present study has been planned to development of value-added products from chicory which can be commercialized. The present study is conducted to study the effect of microwave heating on processing of chicory juice. The microwave treatments given are ranges from 180, 360, 540, 720 and 900W for a time ranges 2, 4 and 6 minutes. The treatment enhanced the yield of juice (%) (42.00 ± 0.00 to 83.00 ± 1.41) using microwave heating as processing aids and by changing the microwave power from (180-900W) and time (2-10min) as compared to the control ($34.00 \pm 1.41\%$). There was a significant difference observed in all the treatment as compared to control. The juice yield increases with increase in power and treatment time but the further increase in both power and time causes decrease in juice yield, the same trend shown in case of radical scavenging activity (DPPH). In case of TSS increase in power causes significant difference as compared to time. In case of viscosity there was no significant difference seen at higher power only it shows significant difference. In case of % acidity power and time did not bring any significant difference.

Keywords: Chicory Roots, Microwave treatment, Juice Yield, Antioxidant Activity Methodology

Microwave heating is a novel process used in processing of food for its application for different uses i.e. blanching, evaporation, dehydration, fermentation and extraction. Studies shows that the extraction of juice from fruits and vegetables by the application of microwave heat is gives benefits in terms of juice yield and juice recover. The principle of microwave is nitration of microwaves with non homogenous food product and the water present in the food interacts with the microwaves and produces heat. The experiments were performed to study the effect of microwave treatment on juice yield and juice recovery. The Chicory roots which are collected from supplier with the given specification of uniform size, color and without physical damage. These roots was thoroughly washed with water, peeled and cut into small cubes (approximately 1 cm^3). The peeled chicory roots are subjected to blanching pretreatment. The blanching of cubes of chicory carried on hot water steam. Blanching of these cubes was done by hot water steam for 8 min at 100°C . The blanching of chicory root cubes were crushed and pressed in the juicer with 1:2 (W/V). For the application of microwave we got the 1:2 ratios (w/v) of chicory to water. The different time (2-6min) and power (180-900 w) combination are obtained. The experiments were carried out by microwave heating of pulp of 1:2 ratios. All the samples were suitably filtered by using muslin cloth and then taken for analysis. The analysis of Juice Yield (%), TSS ($^\circ\text{Brix}$), Viscosity, Acidity (%) and Antioxidant activity (DPPH) was done for getting better quality with better yield.

Results and Discussion

The different microwave treatments given were 180, 360, 540, 720 and 900W for a time period of 2, 4 and 6 minutes. The treatment enhanced the yield of juice (%) (42.00 ± 0.00 to 83.00 ± 1.41) using microwave heating as processing aids and by changing the microwave power from (180-900W) and time (2-6min) as compared to the control ($34.00 \pm 1.41\%$). There was a significant difference observed in all the treatment as compared to control. The juice yield increases with increase in power and treatment time. The highest juice yield was observed at 360W power for 4 min treatment time but the further increase in both power and time causes decrease in juice yield. It might be because of heating



increases the moisture diffusion across cell membrane and it also save the pressing work in juice expression by pre-softening cellular tissue. These results are similar to finding of Wei-Chi Wang (2002). Similar trend was observed in case of radical scavenging activity (DPPH). DPPH activity in all the treatments has shown an increase (34.55 ± 2.65 to $67.48 \pm 8.08\%$) as compared to DPPH activity of control ($15.23 \pm 0.48\%$). This is because increase in microwave power significantly decreases in heating time and the further increase in power generates the energy which is too high to trigger deterioration. These results are similar to Dhuan and Kumar (2017). In case of TSS increase in power causes significant difference as compared to time, it ranges 7° Brix to 11° Brix. The TSS of the control was 7° Brix. The reason of high $^{\circ}$ Brix in value could be cell break down during microwave heating. These results are similar to Baysala et al., (2011). In case of viscosity there was no significant difference seen, at higher power only it shows significant difference. At lower power range viscosity was nearly same as compared to control, but as power increases viscosity increases (1.59 ± 0.00 to 4.01 ± 0.03) and in control viscosity was 1.83 ± 0.00 . In case of % acidity power and time did not bring any significant difference. These results are similar to Rayman and Baysal (2011).

Conclusion

In this study, MW heating was used for investigating yield and quality characteristics of Chicory root juice. The result shows the significant increase in juice yield and antioxidant activity with increase in power and treatment time was observed in comparison to control further research can be undertaken for optimizing microwave treatment conditions.

FETP 38

Importance of High Pressure Processing (HPP)

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Abstract

High pressure processing (HPP) is a processing “non – thermal” technology that has been developed with the aim of obtaining microbiologically safe food product while avoiding undesirable change in the sensory, physicochemical and nutritional properties food. Thus HPP has become one of the innovative food processing technologies most accepted by consumers. High pressure processing first research in 1890s for milk production. Non – thermal processing technology (combination with heat possible). High pressure applied at short periods of time (20 min.). High pressure processing (HPP), is a method of preserving and sterilizing food, in which a product under very high pressure, leading to the inactivation of certain microorganisms and enzyme in food. High pressure processing (HPP) is a cold pasteurization technique by which products, already sealed in its final package, are introduced into a vessel and subjected into a high level of isostatic pressure (300-600mpa/ 43,500 – 87,000 psi) transmitted by water. Consumers nowadays increasingly expect the food to be safe, of a high quality, minimally processed, ‘natural’, additive-free and high in nutritional value. HPP is proven to be effective in the



destruction of harmful pathogenic micro-organisms, the activation and deactivation of food spoilage enzymes. The change of functional properties, such as foams, gels and emulsion, and the control of phase change, such as fat solidification and ice melting point. The sterilization properties of highpressure food processing have been compared to that of heat treatment. Bacteria, yeast and molds are readily destroyed by high isostatic pressure while bacteria spores and some viruses are particularly resistant. Which take time and often involves over-cooking of the surface, pressure is applied instantaneously and uniformly. Usually, 600MP is the optimum pressure for processing commercial food products. High pressure processing can kill microorganisms by interrupting their cellular function without the use of heat that can damage the taste, texture, and nutrition of the food.

FETP 39

Sustainable products from fruits and vegetables waste: value addition and waste utilization

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Abstract

India is the second largest producer of fruits and vegetables but a lot of waste is being extensively produced because of improper post-harvest chain. Processing also generate surplus amounts of waste. Quantity and types of fruit and vegetable waste (FVW) vary from commodity to commodity & morphological components. FVW produced from processing ie. Pomace peels & seeds. It has been observed that the food waste consists of marketable component's that bears a potential to reach to the plates of ultimate consumer as they are rich source of phytochemicals, phytonutrients and bioactive compounds that can be processed into essential oils, polyphenols, edible oil, enzymes, pigment, dietary fibre, fermented edible products, protein and some bear potential to be directly used as food additive after certain pre-treatments. Investigations proved that the products up listed haul anti-diabetic, anti-cancerous, anti-inflammatory properties. Essentials oils of the citrus peels are used for masking certain flavors. FVW also holds potential natural flavoring and coloring substances. Dietary fiber from pomace of apple, carrot, beetroot and mango peel and seeds are extensively used as functional components in baked goods. Fermented products obtained from FVW such as lactic acid, citric acid, ethanol, free fatty acids has extensive role in the industry. Additionally, Lycopene pigments from tomato peel act as the antioxidants against free fatty acid in the dairy industry. It could be concluded that utilization of the FVW will not only solve the pollution problems but also adds sustainability to environment.



FETP 40

Chia Seeds: Antioxidant properties and health benefits

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Abstract

Chia is herbaceous plant that belongs to Lamiaceae family and its botanical name is *Salvia hispanica*. This plant requires less water to grow as compared to other cereal crops, therefore it is considered as a future crop. Its moisture, fiber, oil, protein, carbohydrates, ash and energy are approximately 5.7%, 22.0%, 33.5%, 21.2%, 37.0%, 8.07% and 536Kcal, respectively. Chia seeds are richer in essential amino acids such as leucine, lysine, isoleucine and valine; these play imperative role in human metabolic activities. The seeds also play indispensable role for the supplementation in marine diets to enhance the omega-3 fatty acids contents. Omega-3 fatty acids present in chia seeds exhibit many biological functions in the skin such as prevention of transepidermal water loss, maintenance of the stratum corneum epidermal barrier. Chia has been reported to be effective for allergies, angina, athletic performance enhancement, cancer, coronary heart disease, hormonal disorders. The daily recommended dosage of seeds is around 15-25g/day since it has multifarious nutritional benefits. Chia seeds are claimed to decrease the cholesterol and blood pressure. It also provides relief from joint pain and contributes in weight loss. It can be used as a seed, oil, flour and mucilage. The mucilage from chia seeds is used for the replacement of egg and oil in bakery industry. It is also aided to inhibit the melanin hyperpigmentation due to the function of good epidermal barrier. Moreover, the antioxidant property of chia seeds working against oxidants that can promote cell damage and evolve in neurodegenerative diseases such as Alzheimer and Parkinson. Due to its antioxidant property it is used as natural additive in food products for the preservation of food. Chia has numerous applications in bakery foods, dairy products, meat products, gluten free products and other food products as functional food.



FETP 41

Scope for Preparation of Bread crumbs Using Extrusion Technology

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Abstract

Breadcrumbs are the tiny pieces of bread having sandy or powdery texture. Breadcrumbs manifest a broad spectrum of applications in the food industry as they possess characteristic physicochemical, functional and organoleptic attributes that enables them to act as a binding as well as thickening agents. Breadcrumbs made by the conventional process are called small Oven baked method. This method include the process of cutting the bread loaf into thin slices then drying at 150⁰C-170⁰C for bringing moisture down to 3-8%. Then crushing is done using a crusher or hammer mill followed by sieving. All these processes are very time taking and are labour and cost intensive. Now day's the complications faced in conventional breadcrumb manufacturing is possible to overcome by producing a material comparable to breadcrumb. It should be possible to make breadcrumbs by using extrusion technology. In this process the raw material is forced from an orifice under high temperature condition. It is a continuous process that includes the modification of raw material into final product of desired shape and attributes. Extrusion technology is relatively less expensive, flexible as well as efficient technique that has been used worldwide for production of various snacks. As extrusion technology is versatile, economical and gives better product quality, so breadcrumbs can be prepared using extrusion technology. There is a possibility to use alternative raw material in place of wheat flour. Further there is a need to compare the breadcrumbs conventional (oven baked) and modern (extrusion technology) method of with respect to quality and cost.

FETP 42

Characterization of starch granules of wheat (*Triticum aestivum L.*) varieties

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Abstract

Starch granules of wheat varieties were isolated and their morphological, thermal, structural and pasting properties were evaluated. The pasting properties of starches from two wheat varieties showed significant differences. Unfractionated starch of variety WH-147 has higher pasting temperature than variety C-306. On contrary wheat variety C-306, the unfractionated starch showed higher peak, trough, breakdown, final, and setback viscosities than the starch isolated from wheat variety WH-147. Differential scanning



calorimetry results revealed that unfractionated starch exhibited the higher gelatinization enthalpy, peak and conclusion temperatures than the isolated starch granules from. Scanning electron microscopy results revealed that large A-granules appeared to be smooth and displayed disk or lenticular shape having diameter 13–35 μm , while B-granules showed a spherical shape with diameter of 2–6 μm . The difference in structure and content would result in starch granules with different chemical and physical properties.

Keywords: Starch; Granules; Pasting; Thermal

FETP 43

Techno-functional characterization of protein isolates recovered from two Indian species of *Chenopodium* seeds: A comparative study

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Abstract

The main aim of the present research was to evaluate the techno-functional characteristics of protein isolates recovered from *Chenopodium album* and *Chenopodium quinoa* seeds by acid and alkaline extraction method. For temperature sweep tests dynamic rheological parameters showed that both G' (storage modulus) and G'' (loss modulus) were higher in quinoa protein isolates than album protein isolates. Enthalpy of denaturation (ΔH) was found significantly ($p \leq 0.05$) higher in quinoa protein isolates; however, denaturation temperature (T_d) was found higher in album protein isolates. Thermal gravimetric analysis showed that album protein isolates were degraded much faster than quinoa protein isolates with respect to increasing temperature. Quinoa and album protein isolates had two diffraction peaks at $2\theta = 10^\circ$ and $2\theta = 20^\circ$ respectively, but the peaks were more intensive in case of album protein isolates. Circular dichroism showed a negative peak confirming more α -helical structure for both quinoa and album protein isolates, however, negative peaks were more dominant in album protein isolates. FTIR showed characteristic peaks at 1200, 1500, 1700 and 3100-3300 cm^{-1} for both album and quinoa seed proteins respectively. SDS-PAGE results confirmed the presence of globulins in quinoa and album protein isolates. Surface hydrophobicity, free and total sulfhydryl groups were found significantly higher in quinoa protein isolates, confirming the flexibility of quinoa protein isolates to that of album protein isolates.

Keywords: protein isolate; dynamic rheology; thermal properties; secondary structure; XRD, FTIR



FETP 44

An upward trend in nanotechnology and its application in food: A review

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Abstract

Nanotechnology is a multifaceted science that involves administration of an object at diminutive range (1 to 100 nanometers). Food nanotechnology is a field of emanating passion and embarks up novel potentialities. Contemporary advancement of nanotechnology covers numerous areas of food technology, mainly those associated with processing, packaging, transportation, storage, functionalities, and other features of food. Nanotechnology is a great innovation that is revolutionizing and invading the food sector with great potential. The applications of nano-sensors, nano-composites, nano-particles, nano-emulsions, nano-capsules, nano-coatings and Nano-barcodes are escalating in variant divisions, including food processing and production, functional food development, nutritional supplements, food safety, food packaging and shelf life extension of the products, production of strong flavors and color quality, detection of microbes in packaging and increasing the safety by improving the barrier properties due to their unique capability of enhancing the characteristics. The aim of this review is to analyze the present, forthcoming applications and challenges of incorporating nanotechnology in food industry.

Keywords: Nanosensors, Nanocomposites, Nanoparticles, Nanoemulsions, Nanocapsules, Nanocoatings, Nanobarcodes

FETP 45

Spray drying: A convenient method for producing powders, encapsulated oils, fruit and vegetable powder

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Abstract

The main focus for this review article is to study the benefits of spray drying method for fruit and vegetable juices powders, meat products like (fish oil), and usage in starch production. Spray drying is a vividly used in different sort of products and their by



product utilization like spray drying of maize starch with ascorbyl palmitate at 185°C resulted in formation of type I amylase lipid complex. By this method, spray drying of maize starch can be used to encapsulate ascorbyl palmitate to form amylase-lipid complexes with a higher amount of ascorbyl palmitate bound with maize starch. Spray dries dairy powders produced using different oil types which were spray dried at different outlet temperature. As per the studies conducted related to the spray drying techniques revealed that the fat-filled dairy formulation prepared from the lactose, sodium caseinate, palm oil and sunflower oil, the type of oil has no effect on the powder moisture, bulk density, water activity, particle size and fat globule size of reconstituted fat filled dairy powders and its usage was also done in encapsulation of fish oil with hydroxypropyl cellulose(HPC) with water and solvent like ethanol, methanol and acetone, in order to observe the effect of solvent on the encapsulation efficiency and micro particle properties and stability of fish oil during storage at 40°C. It resulted that oxidative stability of fish oil significantly improved by spray drying with methanol when observed both in surface and encapsulated oil fractions. Spray drying trends are modifying day by day along with application of the ultrasound technique during atomization, vacuum drying chamber with controlled atmosphere and supply of dehumidified air into drying chamber of basic spray dryer have improved potential of conventional spray drying.

Keywords: Fish oil, encapsulation, amylase starch, ultrasound, oxidative stability

Methodology Proposed

Different methodology were adapted during this procedure like preparation of model emulsion, checking its rheological properties along with determination of physio-chemical properties and fat free content with usage of differential scanning calorimeter, preparation of fish oil microparticles with conventional spray drying, determining morphology and particle size of microparticles obtained under optimal conditions, encapsulation efficiency of fish oil, release of fish oil from fish-oil microparticles and storage stability assays of fish-oil microparticles.

Conclusions

It was observed that spray drying techniques with different types of product provide varying results as this article showed fish oil emulsion, encapsulation of ascorbyl palmitate with maize starch. These results effected by the air inlet-outlet temperature, glass transition temperature, solubility, hygroscopicity, bulk density bioactive compounds, and ultrasonic atomization provided narrow particle size distribution, reduced moisture content of produce, protected heat sensitive compounds from thermal loss and pressure stress along with reduced yield stress and improved solubility.

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FETP 46

Proximate, Fatty acid and Anthocyanin Analysis of Kokum (*Garcinia indica*)

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Abstract

Kokum (*Garcinia indica*) is one of the important indigenous and underexploited fruit of Sahyadri mountain range of Western ghats of South India. The kokum fruit consists of different chemical constituents such as moisture (80%), carbohydrates (35%), crude fibre (14-15%), crude fat (10-25%) and protein (1.5-2%). Its seed fat commercially known as “kokum butter” is a substitute for cocoa used in chocolate and confectionery product preparation. Kokum butter consists of different fatty acids such as palmitic, stearic, oleic, linoleic acid and glycerides viz. tristearin, oleodistearin, oleopalmitostearin, palmitodioleic, triolein. Kokum is enriched with B-complex vitamins and minerals viz. potassium, manganese and magnesium, which positively regulate heart rate and blood pressure that reduce stroke and coronary heart disease. Kokum rind consists of three very important active compounds –garcinol, hydroxy citric acid (HCA) and anthocyanin pigment which have anticancer, antiobesity, antioxidant and anti-inflammatory properties. Cyanidin-3-glucoside and cyanidin-3-sambubioside are the major anthocyanin pigments present in this commodity. It can also be used in preparation of cool and refreshing drink like sharbat. Kokum as an economic and low maintenance crop, is used in nutraceutical, food supplementary, beverage and cosmetic industry.

FETP 47

Proximate, amino acid and carotenoids analysis of Jackfruit

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Abstract

Jackfruit (*Artocarpus heterophyllus* Lam.) is an ancient fruit belonging to Moraceae family grown in tropical and subtropical regions throughout the world. In India, it is majorly grown in southern region. The jackfruit contains free sugar (sucrose), fatty acids



and amino acids like arginine, cystine, histidine, leucine, lysine, methionine, theonine, tryptophan. Its seeds also contains good amount of protein (6.6-18%), starch (12.86-17.90%) and crude fibre (1.56-3.60%). Jackfruit is a good source of vitamin A, vitamin C, thiamin, riboflavin and minerals viz. N, P, K, Ca, Mg, S, Zn, Cu and also contains different bioactive compounds such as phenolic acids, lignans, isoflavones, and saponins which have antioxidant properties that plays vital role to cure the cardiovascular health, cancer and anemia. The jackfruit contains different carotenoids viz. β -carotene, α -carotene, β -zeaxanthin, α -zeaxanthin, β -carotene-5, 6-epoxide and a dicarboxylic carotenoid, crocetin. The Ripe fruits can be eaten raw, or cooked in creamy coconut milk as dessert, made into candied jackfruit, edible jackfruit leather, chips, fruit-rolls, juice, jam, jelly, marmalades, and ice cream. The seed is also widely consumed as a dessert, as an ingredient in Asian culinary preparations and used in cooked dishes. The seed flour has high water absorption capacity and oil absorption capacity which indicates good ability of the flour to bind water and lipid, thus can be used in manufacturing of different baked products.

FETP 48

Utilization of deoiled maize germ for the preparation of bun from frozen dough

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Abstract

Formulation of fortified flour is vital for the development of value-added products with optimal functionality. Fortified flour technology is the process of mixing various flours to make the use of raw material to produce high quality food products in an economical way. De-oiled maize germ (DMG) could be incorporated or substituted in either cereal or pulse based foods without affecting the organoleptic appeal in bakery products. Deoiled maize germ meal is reported to have better functional behavior with excellent water and oil retention along with good gelling and emulsifying properties, thus resulting in better quality products. Deoiled maize germ flour being a cheaper source of nutrients decreases the cost of fortified flour blends or finished product besides improving the nutritional profile. Frozen dough has huge potential of growth due to its high market potential value and there is a rapid growth in the frozen dough sector. In the present study, bun was prepared by fortifying wheat flour with deoiled maize germ flour. Dough was prepared from 10 % de-oiled maize germ fortified flour and kept for deep freezing at -18°C temperature. The buns were made from frozen dough and evaluated for various physical and sensory parameters. The effect of proofing time and storage period on various parameters of bun was studied. The bun prepared from 40 minutes proofing time after 30



days of storage at -18°C was found to be better than all other proofing time and storage treatments.

Keywords: Deoiled maize germ, bun, freezing, proofing time, fortification

FETP 49

Food hydrogel as a vehicle for delivery of bioactive compound

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Bioactive compounds are known to possess enormous health benefits, but in their native form, they are unstable. They can be easily degraded when comes in exposure to different environmental conditions. In order to overcome these drawbacks, researchers are engaged in developing a suitable vehicle for delivery of bioactive compounds to reach specific site. In this area, hydrogel serves as a new platform for delivery of bioactive compounds that get bind within the polymer network. The porosity of hydrogel allows the incorporation of the bioactive compounds into the matrix and delivers the active ingredients through the polymeric gel network. Loading and release of bioactive compounds from hydrogel can be easily controlled by adjusting the density of cross-links and the water affinity of polymer matrix. Exploitation of starch from millets to develop a suitable hydrogel system for the delivery of bioactive compounds are currently been studied widely including our laboratory at SLIET-Longowal.

Keywords: Delivery vehicles, Bioactive compounds, Hydrogel, Millets

FETP 50

Development and quality evaluation of chia seed fortified nutribar

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Abstract

A non-cooked bar is substantially non-perishable, readily portable and rapidly consumed. In order to meet the nutritional needs, fortified non-cooked bars were introduced which provided a portion of the daily requirement of minerals and vitamins. Chia seeds possessing high nutritional and functional value were added in the development of



nutri-bar. The objective of this study was to develop a date nutri bar incorporated with chia seed flour and coated with sesame seeds.

Keywords: Nutri-bar, Chia seed flour, Date, Sesame seeds, Nutritional quality

Methodology

The different formulations were developed containing 5%, 10%, 15%, 20% of chia seed flour. The developed bar was evaluated for nutritional quality, sensory attributes, storage quality and other physicochemical properties.

Results

The result revealed that the 10% incorporation was highly acceptable in terms of sensory attributes and shown protein content ($3.72 \pm 0.11\%$), crude fibre content ($10.52 \pm 0.08\%$), ash content (2.0%), crude fat ($3.52 \pm 0.19\%$), carbohydrate ($51.00 \pm 0.24\%$) and antioxidant ($32.23 \pm 0.23\%$). The shelf life study revealed that the nutri bar when placed in freezer in zip bag tend to have more shelf life as compared to those stored at room temperature or in incubator. The gross energy of the chia flour nutri bar was in the range of ($250.65 \pm 0.63\%$) kcal.

Conclusions

Out of all the formulations, the one containing 10% chia seed flour was highly acceptable in terms of nutritional quality and sensory attributes.

FETP 51

Synthesis and characterization of ellagitannin-silver nanoconjugate

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Abstract

The peels of *Punica granatum* have been shown to have antioxidant, antibacterial and anticancer properties due to the presence of bioactive compounds like ellagitannin (Ellagic acid, punicalagin). The research deals with the synthesis of ellagitannin silver nanoconjugates from the aqueous ethanolic extract of pomegranate peels. The highest amount of hydrolysable tannins (ellagitannins) was present in 70 % ethanol assisted peel extract. The presence of ellagitannins was confirmed using HPLC. Various conditions were used for the rapid synthesis of silver nanoconjugates such as ultrasonicator and sunlight. The reduction and conjugation of silver ions with ellagitannin extract was confirmed by color changes, absorption spectroscopy, dynamic light scattering methods. Among the two different methods, sunlight was proved to be best for the synthesis of silver nanoconjugates. The bioactivity of the silver nanoconjugates was also evaluated through antioxidant activity. The results showed that the ellagitannins from pomegranate peel were a good reductant and stabilizer for the ellagitannin silver nanoconjugates synthesis.

Keywords: Ellagitannin, Nano-conjugate, Antioxidant, particle size, zeta potential



FETP 52

Potential of Potato in Valorisation of Extruded Products: A Review

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Potato is one of the important staple crops that plays vital role in the diet in both developed as well as developing countries. Potato has a massive production of 300 million metric tons, annually consumed by more than a billion people worldwide. Besides its massive consumption, surplus amount of potato in the glut season can be utilized in the formulation of value added products. Potato offers a good amalgamation of nutritional as well as functional characteristics which not only enhance the nutritional profile but also confers good functional attributes to the extruded products. The good functionality of extruded products valorised with potato flour is due to inherited features of large granule size, absence of lipids and high phosphate content of potato starch that improves the solubility, viscosity, toughness and smoothness of extruded products. Furthermore, the neutral taste, high transparency and flexibility of potato starch confers it huge versatility in extrusion based food applications. Due to its higher gelatinization temperature potato starch is often used in extruded snacks to provide enhanced functional attributes by increasing the nucleation of bubbles within the extrudates during expansion and creating a finer texture and crispness in end product. Due to its low protein content incorporation of potato flour leads to significant decrease in water absorption of dough thereby increasing dough tolerance, which in turn aids in their cold extrusion. These characteristic features accounts for the superior structure, appearance and flavour of extruded products. Thus, potato exhibits great potential in valorization of extruded products.

FETP 53

**Nanoparticles as an emerging technique for the detection of food
contaminants**

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Abstract

Food safety has become a major issue of concern as unsafe food pose a severe threat to human health. There is a wide need of new techniques to detect food contaminants. Traditional methods for the detection of food contaminants, including instrumental analyses and polymerase chain reactions are time consuming, expensive, and laborious and are therefore difficult to implement. Nanoparticles has emerged as a new technique to



detect food contaminants, food allergens and even mycotoxins as these can detect the presence of single or multiple substances using very small samples. The sensors based on nanomaterials (nanosensor), both chemical sensors (chemical nanosensors) and biosensors (nanobiosensors) can be used online and integrated into existing manufacturing process as they are rapid, simple, and portable as well as disposable. Thus, nanosensors are more cost-effective, rapid, and more sensitive than instrumental and conventional procedures. Food contaminants could be residues of pesticides, veterinary and human drugs, microbial toxins, preservatives, contaminants from food processing and packaging, and other residues. This study summarizes the various nanoparticles based sensors, explaining their principles and discussing their applications in the food contaminant detection. The future role of these nanosensors will become even more important as the food laboratory is faced with the increasing pressure to reduce cost, time, and complexity.

FETP 54

Effect of different concentration of Invert Syrup and Pectin on the shelf life of prepared apple bar stored at ambient temperature

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Abstract

The aim of the study was to evaluate a suitable combination of apple juice , invert syrup, pectin and citric acid for the preparation of apple bar, stored at ambient temperature. The treatments were T₀, T₁, T₂, T₃, T₄ and T₅. The samples were wrapped in butter paper and then packed in polyethylene bags and evaluation was carried out for total period of 60 days. Physico-chemically analysis, acidity, brix°, moisture and sensory characteristics of color, taste, texture and overall acceptability were evaluated at 15 days interval. The moisture content of apple bar was decreased from 16.76 to 11.55 throughout the storage. Maximum increased was observed in T₄ (53.26%) followed by T₅ (34.16%), in compare minimum fall was observed in T₀ (17.65%) followed by T₁ (21.23%). The TSS of apple juice was 14 brix° invert syrup was added in different ratio, after drying the TSS of apple bar was increased from 14.41 to 88.26 during storage. Maximum increased was observed T₅ (86.34%) followed by T₃ (84.33%), while lowest raise was observed in T₀ (82.81%) followed by T₁ (81.022%). The titrable acidity of apple bar was increased from 0.16 to 1.39 for the period of storage. Maximum increased in T₀ (93.69%) and T₂ (89.2%) followed by T₂ (90.605%), while lowest raise was observed in T₄ (63.090%) followed by T₅ (77.61%). The storage intervals had effect on the mean scores for organoleptic properties. Mean scores of juries for the color of apple bar was reduced from 7.20 to 5.73 for the period of storage. Similarly decreased in T₄ (50%) followed by T₄ (33.33%), while lowest fall was observed in T₁ (9.88%) followed by T₀ (10.71%). Mean totals of



juries for the taste of apple bar was reduced from 7.83 to 5.73 for the storage period. Maximum reduced was detected in T₄ (53.85%) followed by T₅ (42.86 %), while lowest fall was observed in T₁ (9.88%) followed by T₀ (13.71%). Mean scores of judges for the texture of apple bar was reduced from 7.75 to 5.67 for the period of storage. Maximum decreased was perceived in T₅ (55.57%) followed by T₄ (53%), while lowest fall was observed in T₁ (12.43%) followed by T₀ (14.90%). Mean scores of juries for the overall acceptability of apple bar was reduced from 7.54 to 5.54 throughout the storage. Maximum decreased was perceived in T₅ and T₄ followed by T₃ (23.33%), while lowest fall was observed in T₁ (11.43%) followed by T₀ (14.21%). Overall results showed that the treatment T₁ was found most acceptable.

Key Words: Apple bar, pectin, storage, physico-chemical properties, Organoleptic properties

FETP 55

Physico-chemical, Color and mineral content-based characterization of unifloral Honeys from India

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Abstract

The current study was conducted to determine the physico-chemical properties (moisture content, ash content, reducing sugars, colour, pH and HMF), enzymatic activity (diastase and invertase activity), color characteristics (mm Pfund), mineral content (K, Ca, Na, Cu, Fe, and Zn) and sugar parameters of three different varieties of honey samples from northern region of India. Ten samples have been taken from each source (*Litchi chinensis*, *Dalbergia sissoo* and *Ziziphus mauritiana*) that were significantly ($p < 0.05$) different from each other based on the physico-chemical characteristics, enzymatic activity, mineral content and color properties. The analysis revealed the physico-chemical properties of honey samples fall within the framework of revised codex standards for honey. Principal component analysis identified two principal components (93.60% variance) to differentiate the honey samples and cluster analysis classified the honey samples into two groups successfully.

Keywords: *Litchi chinensis*, *Dalbergia sissoo* and *Ziziphus mauritiana* physico-chemical properties, color, mineral, principal component analysis.

FETP 56

Vitamin C and Phenolic compound in Fruits and vegetables: a review

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Abstract

Now a days, increasing attention has been focused on the role of diet in human health. In human diet, Fruits and vegetables are the major sources of antioxidants. Several epidemiological studies have shown that a high intake of plant products associated with a reduced risk of a number of chronic diseases, such as atherosclerosis and cancer. Vitamin C also known as ascorbic acid is responsible for many biological functions in our body. Climatic conditions also might alter vitamin C level among vegetables. Phenolic compounds, ever-present in plants are an essential part of the human diet, and are of considerable interest due to their antioxidant properties.

Keywords: Ascorbic acid, antioxidants, diseases

Introduction

Now-a-days, increasing attention has been focused on the role of diet in human health. Consumption of abundant amount of fruits and vegetables in diet has been associated with lower mortality rates of cancer among the people and recommended in case-control studies for all common cancer sites (Ames et al., 1993; Doll, 1990; Dragsted et al., 1993). There is a highly significant negative association between intake of total fruits and vegetables and cardio and cerebrovascular disease mortality (Acheson and Williams, 1983; Verlangieri et al., 1985). Vegetarians and nonvegetarians with a high intake of fruits and vegetables also have reduced blood pressure (Ascherio et al., 1992; Sacks and Kass, 1988). The protection that fruits and vegetables provide against diseases, including cancer and cardio- and cerebrovascular diseases, has been attributed to the various antioxidants, especially antioxidant vitamins, including ascorbic acid and R-tocopherol, contained in these fruits and vegetables (Ames, 1983; Gey, 1990; Gey et al., 1991; Riemersma et al., 1989; Stahelin et al., 1991a,b). Several epidemiological studies have shown that a high intake of plant products associated with a reduced risk of a number of chronic diseases, such as atherosclerosis and cancer (Gosslau & Chen, 2004; Gundgaard, Nielsen, Olsen, & Sorensen, 2003; Hashimoto, Kawamata, Usui, Tanaka, & Uda, 2002; Kris- Etherton, Etherton, Carlson, & Gardner, 2002). These beneficial effects have been partly accredited to the compounds which possess antioxidant activity. The major antioxidants of vegetables are vitamins C and E, carotenoids, and phenolic compounds, especially flavonoids. These antioxidants scavenge radicals and inhibit the chain initiation or break the chain propagation (the second defense line). Vitamin E and carotenoids also contribute to the first defense line against oxidative stress, because they quench singlet oxygen (Krinsky, 2001; Shi, Noguchi, & Niki, 2001). Flavonoids as well as vitamin C showed a protective activity to atocopherol in human LDL, and they can also regenerate vitamin E, from the a-chromanoxyl radical (Davey et al., 2000; Zhu, Huang, & Chen, 2000).

Among vegetables, Brassica vegetables including cabbage (white, red, savoy, swamp, chinese), cauliflower, broccoli, Brussels sprouts and kale possess both antioxidant and anticarcinogenic properties (Cohen, Kristal, & Stanford, 2000; Chu, Sun, Wu, & Liu,



2002; Verhoeven, Verhagen, Goldbohm, van den Brandt, & van Poppel, 1997). In addition to antioxidant vitamins, carotenoids, and polyphenols, Brassica vegetables provide a large group of glucosinolates, which according to Plumb et al. (1996) possess rather low antioxidant activity, but the products of their hydrolysis can protect against cancer (Keum, Jeong, & Kong, 2004; Paolini, 1998). Variation in the antioxidant contents of Brassica vegetables is due to: variety, maturity at harvest, growing condition, soil state, and condition of post-harvest storage (Jeffery et al., 2003; Kurilich et al., 1999). In addition, Brassica vegetables can be cooked in many ways, while cabbage, broccoli and cauliflower may be eaten raw as the ingredients of different salads. Kale may be prepared in the same way as spinach and its small amounts are used as an excellent component of salads. The present work has been reviewed on water soluble and lipid soluble anti-oxidants.

Water soluble antioxidants

Vitamin C

Vitamin C also known as ascorbic acid is responsible for many biological functions in our body Block et al. (2004) have reported that vitamin C can reduce levels of C-reactive protein (CRP), a marker of inflammation and possibly a predictor of heart disease. Fruits and vegetables provided than 85% of vitamin C in human diets (Davey et al., 2000; Lee & Kader, 2000). Ascorbic acid is able to scavenge the superoxide and hydroxyl radicals, as well as regenerate α -tocopherol (Davey et al., 2000).

Table 1 has shown the significant variation for vitamin C content among Brassica vegetables along with their subspecies (Anna Podsedek, 2007). The level of Vitamin C varied over a 4 times in broccoli and cauliflower, 2.5-fold in Brussels sprouts and white cabbage, and twice in kale. The cause of reported variations in vitamin C content might be related to the differences in genotype (Kurilich et al., 1999; Vallejo et al., 2002). Climatic conditions also might alter vitamin C level (Howard, Wong, Perry, & Klein, 1999). Lisiewska and Kmiecik (1996) reported that nitrogen fertilization did not affect the content of vitamin C in broccoli, but increasing amount of nitrogen fertilizer from 80 to 120 kg/ha decreased the vitamin C content by 7% in cauliflower. Generally, among Brassica vegetables, white cabbage is the poorest source of vitamin C. However, for example in Poland, white cabbage is the most popular species of Brassica vegetables.

**Table 1**

Ascorbic acid content of Brassica vegetables (mg/100 g edible portion) [Anna Podsedek, 2007]

Vegetable	AA Content	References
Broccoli	34-93	Favell (1998)
	41-64	Frank et al. (2004)
	74.8	Bahoun et al. (2004)
	75	Hussein et al. (2000)
	84	Hrcirik et al. (2001)
	93	Chu et al. (2002)
	103	Zhang & hamauzu (2004)
	112	Murcia et al. (2000)
	113	Davey et al. (2000)
	54-120	Kurilich et al. (1999)
Brussels sprouts	43-146	Vallejo et al. (2002)
	76	Pfendt, VukasinovicBlagojevic, and Radojevic (2003)
	87-109	Davey et al. (2000)
White cabbage	192	Czarniecka-Skubina (2002)
	18.8	Bahorun et al. (2004)
	25.6	Gokmen et al. (2000)
	28.2	Pfendt et al. (2003)
	23-33	Kurilich et al. (1999)
Kale	32	Chu et al. (2002)
	43	Puupponen-Pimia et al. (2003)
	44	Hrcirik et al. (2001)
Cauliflower	46-47	Davey et al. (2000)
	92.6	Pfendt et al. (2003)
Cauliflower	186	Davey et al. (2000)
	17.2	Pfendt et al. (2003)
	40-44	Kurilich et al. (1999)
	49.9	Bahorun et al. (2004)
	64	Hrcirik et al. (2001)
	64-78	Davey et al. (2000)
	81	Puupponen-Pimia et al. (2003)

FETP 57**Anti-nutritional Factors in Pulses**Harjot Singh¹, Mandeep Saini^{2*}

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Abstract

Pulses are rich in proteins and can be valuable for developing countries. Consumption of pulses is highest in India where majority of the population is vegetarian. The protein content of pulses are generally about double that of most cereals. Pulses contain 18 to 32% protein and 1 to 5% fat. They are also rich in iron, thiamine, riboflavin and nicotinic acid as compared to cereals. Pulses contain several Anti-nutritional factor, such as trypsin and chymotrypsin inhibitors, lectins, Polyphenol, flatulence factors, lathyrogens,



Saponins, antihistamines and allergens. Anti-nutritional factors are mainly used for protection of pulses as it affects the bacteria and animal who consume it raw. These can be proteinous or non-proteinous. The protease inhibitors, lectins and other anti-nutrients cause toxicity. A number of so-called anti-nutrients have been shown to possess beneficial -anticancer, antimicrobial- properties which also vary according to their level in the diet. Scientists are also identifying optimal level for maximizing the benefit-to-risk ratio, thereby providing plant breeders, molecular biologist, and food processors with additional goals for maximizing overall product quality. For obtaining the nutritional value, it is necessary that heating temp. and length of processing do not exceed the optimum temp. required to eliminate the effect of inhibitors. Protein in pulses are known to react with tannins, lipids and pigments. It decreases the bioavailability of proteins. Similarly, tannins and phytates also interact with minerals and vitamins resulting in a decrease in their bioavailability. Pulses are subjected to various processing techniques like milling, dehulling, soaking, germination, fermentation and cooking. These processes techniques not only save time, energy and fuel but have several nutritional advantages and produce edible product and lower the toxicity of these compounds.

Keywords: Temperature, Advantages

FETP 58

Food as Medicine

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Abstract

Food as medicine: Nutraceuticals are products, which other than nutrition are also used as medicine. Nutraceutical is a term derived from "nutrition and pharmaceuticals". The term is applied to products that are isolated from herbal products, dietary supplements (nutrients), specific diets and processed foods. "Let food be your medicine and medicine be your food". Nutraceuticals as medicine used to improve health, delay the aging process, prevent chronic diseases and are also effective in curative disorders related to oxidative stress including allergy, Alzheimer, cardiovascular, cancer, diabetes, eyes, immune, inflammatory and Parkinson's disease as well as obesity, increases life expectancy and support the structural function of the body. The food sources used as nutraceuticals as medicine are all natural and can be categorized as Dietary fibre, probiotics, PUFA, antioxidant vitamins, polyphenols, spices. Nutraceuticals act as essential amino acid, drug-like regulatory biochemical metabolite and as phytohormone in the body. It inhibits metabolic activity of cancer. Majority of cancer prevention comes from phytochemicals, fat, flavones, phytoestrogens, isoflavones, Curcumin, capsaicin, epigallocatechin-3-gallate, gingerol, lycopene, antioxidants, vitamins and minerals.



FETP 59

A study on pre-treatments, drying and storage of ber fruits

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Abstract

Ber fruits commonly known as jujubes from *Ziziphus jujuba* belong to the buckthorn family (Rhamnaceae) and are cultivated in more than 30 countries around the world. Jujubes are rich in fiber, sugars, organic acids, trace minerals, proteins, and vitamins. Fresh jujubes are perishable after harvest and deteriorate within a few days, resulting in loss of commercial value. However, dried jujubes are consumed directly and also used as raw materials for other products, such as jujube drinks, candied jujube, and jujube powder. The jujubes may be wrapped with perforated (2%) polyethylene bags of 200 μm thickness film after stored at low temperature for maximum shelf-life and minimum quality loss. Blanching shows significant effect to storage quality of jujube using any method like hot water blanching. Drying also has direct effect on respiration rate and moisture losses during storage. Different types of drying are used to dry ber fruits like sun drying, oven drying, microwave drying and freeze drying. Drying temperature has significant effect on shrinkage and rehydration capability and a higher drying temperature is recommended to achieve decreased shrinkage and increased rehydration capability. Fruit dried at higher temperature has lower density. The study presents various scientific studies conducted for pre-treatments, drying and storage of ber fruit.

Keywords: ber, blanching, drying, rehydration, packaging, storage temperature

FETP 60

Comparative fat digestibility from milk of different breeds using simulated GI conditions

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Abstract

Milk fat being the most important constituent of milk, plays a significant role in economics, nutrition, flavour and physico-chemical properties of milk and milk products. Although, the bioavailability of dietary lipids is of primary importance in human nutrition and health, the mechanisms involved in lipid digestion are not fully understood and are of growing interest. Hence, the differences in the milk fat digestion from milk of different



breeds using an in vitro digestion model were investigated. The milk samples were collected from healthy animals of indigenous cow breed Sahiwal, indigenous buffalo breed Murrah and cross bred Karan Fries and gastro intestinal digestion study was conducted. The samples were withdrawn at particular interval of time and analysed for the release of free fatty acid and Fat globule size which is important as it affects the final absorption in the intestine. The release of free fatty acid was found to be 709.21 μ mol/10 ml, 656.79 μ mol/10 ml, 618.517 μ mol/10 ml for Sahiwal, Murrah and Karan Fries respectively. The volume weighted mean (d_{43}) of particles were found to be 31.5, 35.3 and 49.8 (μ m) for Sahiwal, Murrah and Karan Fries respectively after 120 min of digestion.

FETP 61

Statistical optimization of carotenoid pigment extraction from *Epicoccum nigrum* fermented wheat bran

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Abstract

Food colors utilized in the processed food industry are produced either synthetically or extracted from natural sources. Nevertheless, recently the use of synthetic colors has steadily declined, owing to the allergic reactions shown by some of them such as azorubin and tartrazin. Microbial pigments are considered beneficial over their counterparts i.e. plant pigments owing to their easy availability, stability, high yield, cost effectiveness and easy downstream processing. The extraction of bioactive molecules such as pigments derived from natural sources by different solvents is an essential downstream process. In this work, the influence of extraction time, temperature and solvent to the solute ratio of the carotenoid yield from the substrate fermented with *E. nigrum* was investigated using Box-Behnken experimental design. The extraction parameters used under study are: extraction temperature (30-50 °C), solvent to solute ratio (10-30 ml/g) and extraction time (30-120 min). The experimental data obtained was analysed by analysis of variance. Data were fitted to a second order polynomial equation using multiple regression analysis. The optimized level of different variables was obtained by using the procedure of the desired function,. It showed that an extraction temperature of 40.27 °C, 20.21 ml/g of solvent to solute ratio and extraction time of



76.22 min resulted in carotenoid pigment yield in the order of 432.18 µg/g with overall desirability value of 0.96. The developed polynomial empirical model for the optimal recovery of the carotenoid pigment from *E. nigrum* fermented mass could be used for further studies in the prediction of yield under specified variable conditions.

Keywords: *Epicoccumnigrum*; microbial pigment; carotenoid; extraction; Box-Behnken design

Methodology Proposed

Epicoccumnigrum isolated from the agricultural fields of Lovely Professional University, Phagwara, Punjab and identified by the National Fungal Culture Collection of India, Pune was used for the study. For the preparation of substrate, 20gm of wheat bran taken in the flask was hydrated with distilled water to increase the moisture content to 60%. The flasks were autoclaved (121°C for 20 min) before inoculation. The inoculum was prepared by scrapping the 7 day old slant with distilled water (10 ml). Inoculum (10%) was added to the substrate and flasks were kept for incubation at 25±2 °C for 10 days. After the period of incubation the substrate autoclaved and dried at 50°C for 24 h and milled to a powder (Babitha et al. 2006).

The extraction parameters used under study are: extraction temperature (30-50 °C), solvent to solute ratio (10-30 ml/g) and extraction time (30-120 min). For the extraction process the experiments were conducted as per the Box-Behnken experimental design generated by Design Expert software version 7.0. The dried fermented mass was soaked in HCl solution (3mol/l) at 28°C, shaking the contents at 100 rpm for a period of 30 min, and afterwards centrifuged at 10,000 rpm for 20 min. The supernatant was discarded, and acetone was then added to the one gram of sample as per design.

Carotenoids extraction was undertaken at time and temperature conditions of design under the shaking condition of 100 rpm. The supernatant obtained after extraction by centrifugation (10,000 rpm, 20 min) was used for estimation (Gu et al. 2008).

The absorbance of supernatant was determined by UV-vis spectrophotometer (Shimadzu Corporation, Tokyo, Japan) at 430 nm. The total carotenoids yield (mg/g dried mass) was evaluated using the formula given by Deming et al. (2006) as follows:

$$\text{Carotenoid yield } \left(\frac{\mu\text{g}}{\text{g}} \text{ of dried mass} \right) = \frac{1000 A D V}{0.16 W} \quad (1)$$

Where, A represents absorbance of the extract at 430 nm, D denotes the dilution factor, V is the volume of acetone, 0.16 is the extinction coefficient of carotenoids, and W is weight of dried fermented mass.

The experimental data obtained was analysed by analysis of variance. Data were fitted to a second order polynomial equation using multiple regression analysis. The optimized level of different variables was obtained by using the procedure of the desired function,

Results and Discussion

It showed that an extraction temperature of 40.27 °C, 20.21 ml/g of solvent to solute ratio and extraction time of 76.22 min resulted in carotenoid pigment yield in the order of 432.18 µg/g with overall desirability value of 0.96. The developed polynomial empirical model for the optimal recovery of the carotenoid pigment from *E. nigrum* fermented mass could be used for further studies in the prediction of yield under specified variable conditions.



$$\text{carotenoid yield } \left(\frac{\mu\text{g}}{\text{g}}\right) = 432.03 + 2.36x_1 + 6.71x_2 + 3.62x_3 - 70.22x_1x_2 + 54.84x_1x_3 - 4.61x_2x_3 - 29.54x_1^2 - 85.71x_2^2 - 116.86x_3^2$$

Where x_1, x_2, x_3 are extraction time, min, temperature and solute: solvent ratio
The experimental values obtained were 430.85 $\mu\text{g/g}$ which is within 95 % of the predicted results which shows the suitability of the model.

Conclusions

In the current study, the box behnken design was found to be appropriate in finding out the optimized conditions viz. extraction temperature of 40.27 °C, 20.21 ml/g of solvent to solute ratio and extraction time of 76.22 min for extraction of carotenoid pigments (432.18 $\mu\text{g/g}$) from *Epicoccum nigrum* fermented wheat bran. The results showed that the process parameters have a significant influence on the extraction process.

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FETP 62

Study of Mixed Culture Fermentation on Ethanol Content of Wine

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Abstract

Mixed strain fermentations are not being much explored for the production of wine. While considering the fact that two favourable strains are known to enhance flavour and other organoleptic attributes of the wine on the other hand two antagonistic strains may lead to production of undesirable compounds, foul odors and decreased yield. A number of studies are being performed using *Saccharomyces* starter culture for initiating the fermentation which is being carried out further by non-*Saccharomyces* strain, but no study has come to our notice involving only two *saccharomyces* strains. *Saccharomyces cerevisiae* has been the unquestioned leader in alcoholic fermentation for ages now. Two strains of *S. cerevisiae* viz. *S.cerevisiae* MTCC 11815 and *S. cerevisiae* MTCC 170 were used to study the effect of mixed strain fermentation on ethanol production and concentration of nitrogen, phosphorous and phenolic compounds produced. From initial 17°Brix content of must, 5.33% (w/w), 3.8%(w/w) and 7.53%(w/w) ethanol was obtained from mixed culture, *S. cerevisiae* MTCC 170 and *S. cerevisiae* MTCC 11815 cultures respectively. Nitrogen content was higher in mixed strain fermentations whereas phosphorous content decreased as compared to individual fermentation while the phenolic content was in accordance to the ethanol produced by the strains.

Keywords : Mixed cutlers, *Saccharomyces cerevisiae*, wine, ethanol production

FETP 63

Nutrigenomics an emerging field in food research

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Abstract

“Leave your drugs in the chemist’s pot if you can heal the patient with food.” There is increasing need for knowledge regarding healthy food. This need has increased among researchers, nutritionist and food technologist. Food and environment have an impact on human health. As the aggrandize of our concepts in science has taken place specially after human genome project, many researchers as well as scientist have questioned the interaction of genes with food bioactive compounds. Nutrigenomics is the area of nutrition that uses molecular tools to search, access, and understand the several responses obtained through a certain diet applied between individuals or population groups. It tells us how nutrition influences metabolic pathway and homeostatic control. With the help of nutrigenomics the interaction between genes and nutrients will aid to prescribe customized diet according to genotype. Moreover, it helps to mollify the symptoms of existing disease and to prevent future illness. Nutrigenomics may offer a new approach



for understanding the beneficial effects of dietary compounds on the development of severe polygenic diseases, such as cardiovascular disease, diabetes, and hypertension. It is key science platform to promote health and prevent disease through nutrition that better meets the requirements and constraints of consumer groups with specific health conditions and particular lifestyles.

Keywords: Nutrigenomics, genes, food bioactive compounds, metabolic pathway.

FETP 64

Bioactive compounds in by-products from cereal and pulses processing industry

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Abstract

An enormous number of by-products is generated during the processing of cereal and pulses for example bran, husk, germ meal etc. Cereal (rice, wheat, corn) and pulses (black gram, pigeon pea, chickpea) by-products have gained attention due to the presence of bioactive compounds in considerable amounts. The major compounds include phenolic acids (ferulic, gentisic, p-hydroxybenzoic, gallic, sinapic, syringic, vanillic, caffeic, p-coumaric), dietary fibers (β -glucan), vitamins (thiamin, riboflavin, niacin, pantothenic acid) etc. These unique bioactive compounds are associated with various health benefits such as anti-inflammatory, antioxidant and anti-diabetic, anti-carcinogenic etc. They also have the potential to modulate the metabolic processes and promote good health. Therefore, these valuable compounds can be extracted and further utilized in food, pharmaceutical and nutraceutical industry. This review provides the information about bioactive compounds from by-products produced from cereals and pulses processing industries.

Keywords: Bioactive compounds, cereal and pulses by-products, valorization

FETP 65

Nutritional value, polyphenols and antioxidant property of *kaphal fruit* (*myrica esculenta*)

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Abstract

Kaphal (*Myrica esculenta*) is one of the tastiest wild fruits of the sub-Himalayan region which is well known for its therapeutic potential. It contains good amount of nutritive components such as ash (2.18%), moisture (72.33%), fat (4.93%), protein (9.62%), crude fiber (5.22%) and carbohydrates (78.03). It also contains various minerals such as Na, K, Ca, Mg, Fe, Zn, Mn, Cu. It is the rich source of vitamin C. It is also rich source of polyphenols, alkaloids, glycosides, triterpenoids and volatile oils. Chlorogenic acid, gallic acids, catechin and *p*-coumaric acid are major polyphenols found in Kaphal fruit. These polyphenols can play vital role in reducing the oxidative stress and preventing from certain degenerative diseases and possess anti-inflammatory and antimicrobial properties. The fruit is widely consumed as raw as well as in processed form such as jam, murabba, squash etc. Local tribes also utilize tree as timber, fuel, fodder, wood as well as used for tanning and obtaining yellow colored dye.

FETP 66

Optimization of hydrocolloid mixture for gummy confection development

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Abstract

An attempt was made to develop a hydrocolloid mix using pectin, agar and sugar combination with a soft texture to be used as base material for confection development. The optimization of pectin : agar : sucrose was done using D-optimal design. For the soft gel pectin (1-3 g), agar (1-3 g) and sugar (24-28 g) were combined as per experimental design. The responses evaluated were hardness, gumminess and syneresis. The experimental data obtained was analyzed by analysis of variance. The hardness, gumminess and syneresis were significantly and positively affected by all the variables at linear level ($p < 0.05$) while the interactive effects were negative at $p < 0.05$ for hardness and gumminess while for syneresis agar and pectin and agar and sugar interactive effect was positive but pectin sugar effect was negative at $p < 0.05$. The basis for numerical optimization was kept as minimum syneresis and keeping rest parameters in range. The optimum combination generated by the software for hydrocolloid mix i.e pectin 1 g, agar 1 g and sugar 28 g results in confection having hardness of 3.23, gumminess 123.67 with minimum syneresis of 11.25%.

Keywords: Hydrocolloid, mixture design, pectin, agar

FETP 67

***Pterocarpus marsupium*: Bioactive compounds, health benefits and utilization in food and pharmacy industry**

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Abstract

A wide range of flora is well known traditionally because of their salient features and are vital for humankind. Among those, *Pterocarpus marsupium* is one such, belonging to the family of “Fabaceae”, a multipurpose tree that is known for its various medicinal properties. Different parts of the plant (wood, bark and leaves) have a wide range of beneficial physicochemical and phytochemical properties as well as possess numerous health benefits such as antidiabetic/antihyperglycaemic, antihyperinsulinaemic, cardiogenic, anticataract, hepatoprotective, analgesic, anti-inflammatory, antioxidant and antibacterial. Evidences shows the different parts of plant are also being utilized traditionally for curing different diseases such as toothache, dysentery, urinary complaints, tongue diseases, cough, hemorrhages, ophthalmopathy, urethrorrhea, grayness of hair and stomach ache, beside their utilization as fodder (leaves). Recently, the different products of the plant have been introduced in market by different companies with the claim of curing different diseases. The present review/Abstract is aimed to provide a complete overview of its composition, health benefits and utilization.

Keywords: *Pterocarpus marsupium*, health benefits and utilization

FETP 68

HMO (Human milk oligosaccharides): synthesis, health benefits and utilization in food industry

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Abstract

Human milk is considered as the one and complete dietary source for infant in early ages of life as it contains essential nutrients needed by them for proper growth and development. The mature human milk is majorly composed of fat, protein and carbohydrates [mono-saccharides (3-10), disaccharides, oligosaccharides (12-14 g/L), glycoproteins, glycopeptides and glycolipids]. The human milk is known to be most abundant of complex soluble oligosaccharides than any other mammalian milk. The HMO's are synthesised by glycosyltransferases enzyme in mammary gland during lactation and when ingested with milk reaches the colon of infant, as they are not digested



in the intestine. Thus leading to the development of bifidogenic flora and act as first prebiotic in the colon. Being the third major component of milk, the HMO possess various health benefits such as prevention of infant's mucosal surface from pathogen, lowers the risk of infections due to virus, bacteria or protozoa, prevention of pathogen adhesion and prebiotic effect. Due to the limited accessibility of human milk oligosaccharides, they are being used in the formulation of nutrient-rich foods and the one with fucose and N-acetyl are proved good ingredient for such foods. A handful of HMO requires a large amount of human milk to be synthesised, thus, thus making its products quite expensive. The actual process behind the synthesis of HMO's in the mammary gland would help in development of the technologies for initiating the production of more complex HMO's mixtures, so that those can be utilized for functional food product development.

Keywords: oligosaccharides, synthesis, health benefits, neonate, formulated feeds

FETP 69

Preparation and quality evaluation of nutritionally enriched spiced curd using *Nigella sativa*

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Abstract

Curd- a widely consumed product all over India is designated as functional food because of its health enhancing property and high nutritional potential. It boosts natural as well as acquired immunity and stamina, but lacks in various phytochemicals. Therefore, present study was carried out to enhance the phytochemical profile of curd by incorporating *Nigella sativa* seeds.

Keywords: *Nigella sativa*, Curd, Phytochemical, FT-IR

Methodology

Powdered *Nigella sativa* sample was added in the pre-cooled milk in different concentration i.e., 0%, 0.5%, 1%, 1.5% respectively followed by inoculation of every sample which were further and incubation at 37°C for 4 hours. All the parameters (physicochemical, phytochemical, microbial and sensorial attributes) of curd got significantly affected by the fermentation time and concentration of *Nigella sativa* seeds

Results

Among all the treatments, curd containing 0.5% *Nigella sativa* seeds was rated as best (on the basis of phytochemical and sensorial attributes). A clear effect of *Nigella sativa* seeds was also observed while doing the FT-IR (qualitative) analysis of the optimised sample as compared to control.



Conclusions

Thus, in a nutshell it can be concluded that the developed technology can be successfully used for enhancing the phytochemical potential of the product.

FETP 70

Study on frying performance and oxidative stability of flaxseed oil blends during continuous deep fat frying process using physico-chemical analysis and FTIR spectroscopy

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Abstract

Canola oil (CaO), soybean oil (SoyO), rice bran oil (RbO), sunflower oil (SunO) and hydrogenated fat (HF) used to prepare the blends in the ratio of 20:80 with 20% flaxseed oil. The physico-chemical parameters such as peroxide value, iodine value, tocopherol content, specific gravity, density and refractive index etc. of all the oil blends were estimated to find out frying performance of flaxseed oil blends after 8 hours of continuous frying. The tocopherol content shown highest decrease in FSO and SunO blend about 40.75% whereas highest increase in FFA content was observed in FSO and RbO blend of about 36.7%. The FTIR frequencies at 3008 cm^{-1} , 2922 cm^{-1} , 2854 cm^{-1} , 1744 cm^{-1} , 1377 cm^{-1} , 1160 cm^{-1} , 1097 cm^{-1} , 966 cm^{-1} FTIR absorption at 1744 cm^{-1} and 2922 cm^{-1} were found to differentiating the separation between fresh and fried oil blends.

After performing the physico-chemical analysis and FTIR spectroscopy of all the five flaxseed oil blends we came to conclusion that in terms of frying performance and oxidative stability, the best among these oil blends is FSO and HF blend which is followed by FSO and SoyO blend, FSO and CaO blend, FSO and RbO blend and FSO and SunO blend respectively.

Keywords: flaxseed oil, peroxide value, iodine value, tocopherol content, specific gravity

FETP 71

Thermoelectric Cooling System for Agricultural Perishable Commodities

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Abstract

Refrigeration and cold storage is important post-harvest operation which slows down the chemical and biological processes and extend the storage life for several weeks or month. The refrigeration technology consists mainly the mechanically or electrically driven vapour compression cycle using refrigerants such as CFCs, HCFCs, HFCs or ammonia. The CFC and HCFC refrigerants not only cause the greenhouse effect, but also damages ozone layer, leading to increased harmful ultraviolet radiation reaching the ground. Thermoelectric cooling as alternative cooling method is based on principle of Peltier effect which states that when a direct electrical current is passed through the junction of two dissimilar conducting materials, the heat flux is developed between its junctions causing one junction to cool down and the other to heat up. The working lab scale model of 4 lit capacity thermoelectric cooler was developed using 12V peltier module and polystyrene. The water cooled heat sink was used for cooling hot side of the peltier module. At the end of 40 min of operation at 5 amp 12V, the temperature inside cabinet was reduced from 42°C to 27°C. The major advantages of thermoelectric refrigeration system includes compactness, absence of a working fluid thus avoids environmental dangerous leakages and has no moving parts. Thus thermoelectric refrigeration system will be applicable for maintaining cold chain of perishable agricultural commodities from field to consumers end.

Key words: Agricultural produce, Cold chain management, Peltier effect, Thermoelectric cooling

Materials and Methods

The cooling chamber of 4 litre capacity was developed of polystyrene of density 1.04 g/cm³. The assembly of peltier module and heat sink is made in such a way that air cooled heat sink is attached on cold side of heat sink using thermal paste and water cooled heat sink (evaporator) was attached to the cold side of the module. The water was circulated through the evaporator from the water storage tank using 18W water pump. The axial fan of 12V, 0.25amp was attached on cold side heat sink for circulation of cold air in the cooling chamber. The 12V DC convertor was used for supplying electric power supply to the peltier module, cooling fan and water pump. The rate of temperature drop was recorded on thermometer inserted in the chamber. The assembly of thermoelectric module, air cooled and water cooled heat sink and fan is as shown in Fig 1.

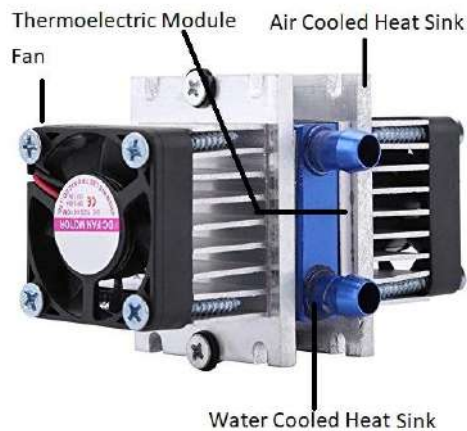


Fig 1. Assembly installed inside the cooling chamber



Results and Discussion: The temperature inside the cooling chamber was recorded at the interval of 10 minutes. It was observed that temperature was reduced from initial 43°C to 27°C at the end of 40 min duration. The electric power consumption for 16°C temperature reduction was observed to be 48 Watt.

Conclusion: The thermoelectric cooling technology can be used for pre-cooling and storage of fruits and vegetable with further modification in system such using heat resistance material such as polyurethane and fogging inside the cold chamber to further reduce the temperature and increase the relative humidity.

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FETP 72

Probiotic and Prebiotic: A conceptual review

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Abstract

Today's world the food quality is very important because due to the lack of quality, food poisoning, obesity, allergy, cardiovascular disease and cancer are the general problem encountering in food manufacturing. Over the last few decades the consumption of probiotic based products has increased and preventing various diseases. Numerous probiotic microorganisms (*L.bifidobacterium*, *Saccharomyces cerevisiae* etc.) used in fermented products and medicinal purpose too. They interact with the immune system and well-established effects are reduction of diarrhea and also lactose intolerance in human. Nowadays probiotic dahi has been available in market by major manufacturer like Amul (launch probiotic ice cream), Dennone (launch Yakult that contain more than 6.5 billion *L.caseishirota* in small 65 ml bottle) and mother dairy (b-activ with curd and



nutrific probiotic). Probiotic foods are kefir, kimchee, yoghurt and Yakult they are used for treat the viral infection disease, diarrhea and decrease the risk of cardiovascular disease and colon cancer.

When food are fermented, live bacteria feasts on the sugar and as preserved in a brine and create lactic acid like pickles, tempeh and miso. When probiotic strains is added in it they can boost population in our gut. Yoghurt is the best source of probiotic that can improve health and reduce diarrhea. Genetic engineering has proven the probiotic bacteria that counteract the symptoms of genetic and age related diseases. Probiotic are well proven in studies they are safe for us and selection consider clinical indication strain and storage.

Keywords: Probiotics, Prebiotics, cardiovascular diseases, cancer

FETP 73

Preparation and characterization of nanoemulsion Encapsulating Curcumin

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Abstract

Curcumin is known for its Antiseptic properties. Encapsulation of curcumin with a whey protein-maltodextrin conjugate increases its stability at different processing and Physiological conditions. Firstly, conjugate was prepared utilising wet heat treatment by optimizing time, temperature, pH, ratio and concentration of protein: maltodextrin at 60min, 60°C, and 7.0 respectively and was analysed for its functional properties . Conjugation was confirmed by SDS-PAGE, TNBS, and FTIR and showed excellent emulsion stability of 95%. There was increase of solubility over the entire pH range with an isoelectric point at 4.0. Emulsions (O/W) were then prepared by homogenizer at pilot scale. Stable formulation of curcumin (1%MCT+ 2%Tween 80 + 0.5% conjugate) showed particle size , zeta potential of 251.2nm and -8.03mV respectively with an encapsulation efficiency of 84.59%. Effect of different temperatures (40-100°C), pH (3-8), Ionic Strength (0.1M-1M) and storage along with In-Vitro conditions including Oral, Gastric and Intestinal phase was analysed by determining the release of bio actives using HPLC and showed a promising approach towards the commercialization of emulsions in near future. These nanoemulsions would not only provide a alternate for whey utilisation but also provide the natural antioxidant and antimicrobial properties of Curcumin and clove oil respectively.

FETP 74

Solar drying of bitter gourd slices and its quality evaluation



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Abstract

Processing of agricultural produce plays a pivotal role in fulfilling the demands of ever increasing population by enhancing the storability and retaining the quality to maximum extent. Drying of food is a basic food processing operation carried out to enhance shelf life of product, to reduce packing costs, to lower the shipping weights and to maintain quality. Solar drying is a clean and hygienic way to process the agricultural produce with the use of renewable energy of the Sun. It requires less area and time for drying in comparison to open sun drying. It overcomes the drawbacks of traditional open sun drying such as contamination from dust, insects, birds, lack of control over drying conditions, possibility of chemical, enzymatic and microbial spoilage due to long drying times. In this study, the PAU multiproduct solar dryer (indirect type) was used for the drying of sliced bitter gourd. The effect of chemical pretreatment on the quality of dried bitter gourd slices was determined. Quality parameters like colour (L, a and b values), hue, chroma, antioxidants, flavonoids, ascorbic acid were determined. The dried product was obtained of good quality with better retention of antioxidants, flavonoids and ascorbic acid. The colour of chemically treated bitter gourd slices was also better as compared to untreated samples dried in solar dryer and sun dried samples.

Keywords: bitter gourd slices, solar drying, ascorbic acid, antioxidants, colour.

Methodology Proposed

Fresh bitter gourd samples were procured from local market and kept in cold store at a temperature of 5°C and 90% RH. The known quantity of bitter gourd samples were withdrawn the cold store and cut into uniform slices. The sliced samples were chemically pretreated which included blanching in hot water (at 96 °C for 4.24 min) followed by dipping in KMS solution for 10 min. Untreated sliced bitter gourd samples were also dried in solar dryer. The ambient and inside temperature and relative humidity was monitored periodically using data logger. The physico-chemical quality parameters including colour (L, a, b, hue, chroma) antioxidants, flavonoids, and ascorbic acid content were determined for fresh bittergourd, chemically pretreated solar dried, untreated solar dried samples and sun dried samples.

Results and Discussion

The physico-chemical quality parameters such as colour, ascorbic acid content, flavonoids content and antioxidants content were found to be better in chemically pretreated sample as compared to untreated solar dried and open sun dried sample. The chemically treated solar dried samples have ascorbic acid: 0.639 mg/g dw sample; flavonoids: 0.024 mg/g dw sample and antioxidants capacity: 54.89% and good



appearance of colour. The sliced bitter gourd sample dried in indirect type solar dryer took lesser drying time as compared to open sun drying.

Conclusions

The treated solar dried sample of sliced bitter gourd showed better retention of physico-chemical parameters than the untreated solar dried sample and open sun dried sample. Solar drying is an efficient way to process the agricultural produce with improved drying time and better quality dried product.

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FETP 75

Studies on Osmotic Dehydration of Hog plum (*Lapsi*) *Choerospondias axillaris*

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Abstract

The present study is conducted to study the mass transfer kinetics and quality changes by osmotic dehydration of hog plum for solute gain and water loss which is experimented for various processing time that ranges from 30, 60, 90, 120, 150, 180 minutes at 30, 40, 50 degree temperature in osmotic agents such as sugar and honey concentrations having solution to fruit ratio 10:1. Empirical kinetic models like Magee and Penetration were used for analysing the data. Among the two of the data Magee model was found to be best fitted for this experiment. The present work depicted that Magee model gave the highest R Square and lowest Chi Square and RMSE. In this experiment it was found that the water loss and solute gain increased with increase in time and temperature. The water loss and solute gain is higher at initial level. In the case of Magee model best coefficient correlation R² (0.99), Chi square less than 10 and RMSE value less than 20.

Keywords: Osmotic dehydration, Hog plum, Water loss, Solute gain, Kinetics



Methodology Proposed

Experiments were performed to study the mass transfer of osmotic dehydration of lapsi. Lapsi used for the experiment were purchased from the market and were thoroughly washed with water to remove dirt and foreign particles followed by peeling and blanching to inactivate the enzymes. Blanching of the samples were done in hot water to prevent from browning. (Ranganna et al., 2001). Initial moisture content of the sample was noted. The objective of this study is to find out the mass transfer kinetics of honey and sugar solutions in hog plum through osmotic dehydration and to analyse it from Magee and Penetration models.

Osmotic Dehydration

Sugar and honey were used as osmotic agents preparing syrup to fruit concentrations of 10:1 to use at a temperature of 30, 40, 50 C. Lapsi's were immersed in osmotic solution and placed in the hot water bath. After specific time intervals of 30, 60, 90, 120, 150 and 180 minutes the samples were taken out from the water bath and then from solution. The extra solutions were removed by blotting with the absorbent filter paper for some minutes and the weight was taken.

Initial and final moisture content were obtained from drying the sample at hot air oven at 70°C. Water loss has been expressed as the net water loss from the freshly peeled lapsi samples after osmotic dehydration based on initial sample mass. Solid gain has been defined as the net solid uptake by the lapsi sample, based on the initial sample weight;

$$\% \text{ Water loss (WL)} = [(W_o - W_t) + (S_t - S_o) / W_o] \times 100;$$

$$\% \text{ Solute gain (SG)} = [S_t - S_o / W_o] \times 100$$

W_o is the initial mass (g) of the sample, W_t is the mass of the sample after osmotic dehydration for time in secs, S_o is the initial mass of solids (dry content) in the sample (g) and S_t is the mass of solids (dry content) of sample after osmotic dehydration for t (h).

Kinetic models for osmotic dehydration

To obtain relation between water loss and solute gain with immersion time during osmotic dehydration, the mass transfer kinetics were modelled as Penetration model and Magee model.

Magee model was conducted to study the mass transfer kinetics through following equation:

$$WL\% = A + k\sqrt{t}; \quad SG\% = A + k\sqrt{t}$$

A and k are Magee law parameters at time t.

Penetration model in this model the water loss and solute gain has the following equation:

$$WL\% = k\sqrt{t}; \quad SG\% = k\sqrt{t}$$

Accuracy for fitting of the kinetic models were obtained from the data given on the (root mean square error) RMSE, Chi Square, R² values. The best model should follow the highest R² and lowest Chi Square and RMSE.



Results and Discussion

In this experiment it was found that the water loss and solute gain increased with increase in time and temperature. The water loss and solute gain is higher at initial level. Magee model at 300 Brix sugar and honey solutions gave the best results.

Table no 1: Water loss at 30°Brix Sugar solution.

Temp (°C)	Magee model			Penetration model		
	R ²	RMSE	CHI SQ	R ²	RMSE	CHI SQ
30	0.94	14.5	4.8	0.94	22.7	5.6
40	0.96	8.0	2.6	0.96	12.7	3.1
50	0.98	6.9	2.3	0.95	29.1	7.2

Table no 2: Solid gain at 30° Brix Sugar solution

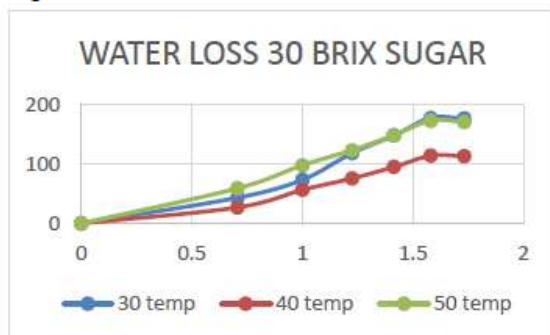
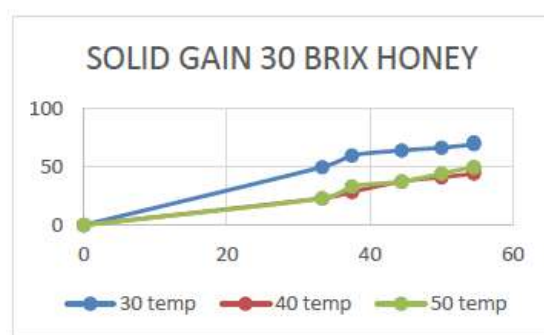
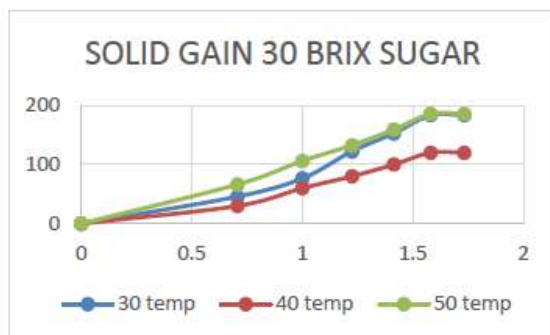
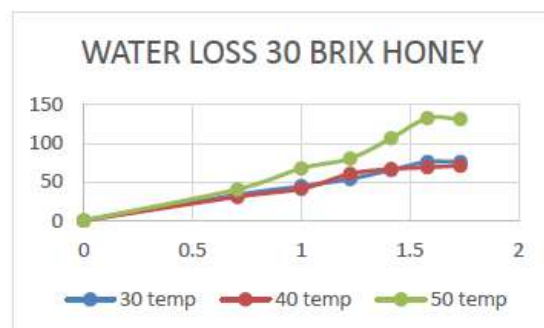
Temp (°C)	Magee model			Penetration model		
	R ²	RMSE	CHI SQ	R ²	RMSE	CHI SQ
30	0.95	14.6	4.8	0.95	23.1	5.7
40	0.96	7.9	2.6	0.96	12.6	3.1
50	0.98	6.3	2.1	0.98	8.2	2.0

Table no 3: Water loss at 30° Brix honey solution

Temp (°C)	Magee model			Penetration model		
	R ²	RMSE	CHI SQ	R ²	RMSE	CHI SQ
30	0.93	15.2	5.0	0.93	67.0	16.7
40	0.97	3.7	1.2	0.98	2.9	0.7
50	0.96	7.9	2.6	0.96	11.4	2.8

Table no 4: Solid gain at 30° Brix honey solution

Temp (°C)	Magee model			Penetration model		
	R ²	RMSE	CHI SQ	R ²	RMSE	CHI SQ
30	0.93	10.0	3.3	0.99	15.1	3.7
40	0.99	1.5	0.5	0.99	2.2	0.5
50	0.99	1.6	0.5	0.99	2.1	0.5

Graphical data 1: Magee model in 30^o Brix Sugar solutionGraphical data 2: Magee model of 30^o Brix Honey

Conclusions

The present study on honey and sugar solutions of 30, 40, 50 Brix of (10:1) syrup to fruit ratio on mass transfer kinetics to hog plum were performed in terms of water loss and solid gain. The experiments indicated the increase in water loss and solute gain with increase in concentration and increase in the temperature. Models which gave the best suited data on the basis of highest R² and lowest RMSE and Chi Square were taken. When these predicted values were compared with the experimental ones it was found that the Magee model was best fitted for the experiment.

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FETP 76

Isolation and characterization of bioactive component from the peanut milk

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Abstract

Peptide is a compound containing of two or more amino acids connected in a chain, the carboxyl group of each acid being linked to the amino group of the next by a bond of the type -OC-NH- (Draelos, 2010). Bioactive peptides are the organic substances formed by amino acids linked by peptide bonds and they are protein synthesized in the cell in the form of large pre-propeptides. People now-a-days are so busy to their work due to which they don't get proper balance diet food for the proper growth and maintenance of the body. The lack of proper nutrition and balance diet food, people are facing so many health problems like malnutrition, heart diseases, obesity etc. the scope of this study to isolation and characterization of the bioactive components and the peanut itself high in nutritive components such as protein, vitamins, minerals, fiber which can helps in to prevent malnutrition problem and also acts as flavoring agent to the product.

Keywords: bioactive component, peptide, fermented peanut milk, characterization, proteolytic activity.

Methodology Proposed

Proteolytic activity of assay

Qualitative assay for proteolytic activity

Proteolytic activity of all probiotic strains was examined by the method given by Beganovic et al., 2013. Agar well diffusion method by using peanut milk agar will use for the assay. Actively grown culture of probiotic strains will place in the well of skim milk agar plate at the centre of plate and incubate at 37°C for 4h. After 4h incubation absence or presence of clear zone around the agar well inoculated with a particular strain was recorded.

Preparation of fermentation medium

For the preparation of fermentation medium peanut was used. Microbial fermentation method was used for the production of bioactive peptide. During fermentation, have to check the pH fermentation medium, titrable acidity, proteolytic and hydrolytic assessment at 2h interval.

Quantitative assay for proteolytic activity

Proteolytic activity of probiotic bacteria in the fermented sample was determined by using the o-phthaldialdehyde (OPA) test. The increase in optical density at 340 nm relative to the control was determined by using the spectrophotometer (Pescuma et al., 2010).



Preparation of OPA solution

For the preparation of 50 ml OPA solution 2.5 ml of 20% (w/v) SDS (Sodium dodecyl sulphate), 25 ml of 100 mmol/l sodium tetraborate, 40 mg of OPA dissolved in 1 ml of methanol, 100 μ l of 2-mercaptoethanol was mixed properly and final volume was made up with distilled water.

Results and Discussion

Fermentation condition

Fermentation of peanut milk with probiotic strains was done for 7 days at 37°C. Fermentation was terminated after 7 days of incubation and pH was 3.99 and probiotic microorganisms are sensitive to pH. At an acidic pH i.e less than 4, probiotic bacterial viable count decreases due to acidification pH thus inhibiting enzymatic reactions and effect the growth (Shabala et al., 2006). The loss of probiotic bacterial viability also reduces its functionality. During the fermentation it was inferred that pH of the fermentation medium decreased to 6.08 ± 0.3 to 3.975 ± 0.3 in case of MTCC 374 and 6.08 ± 0.02 to 3.95 ± 0.03 in case of MTCC 141 which confirms the active growth of probiotic bacteria and lactic acid production.

Conclusions

Bioactive peptides possess potential applications in both food quality and safety, and human health. Considering the consumer demand for less processed and more natural or functional foods, increasing efforts was focused towards the research on peptides and their use as food grade preservatives and functional food ingredients.

Therefore, as per study we can conclude that lactic acid bacteria are able to grow on peanut milk and release bioactive peptides during fermentation. These peptides have several bio functional activities including antioxidant, antihypertensive, antimicrobial activity. Antimicrobial activity of bioactive peptide mainly depends on their amino acid chain. Therefore, there is need to investigate sequence of amino acid those act as pathogen.

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Studies on stabilization of idli batter.

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Abstract

Fermented foods are consumed in various parts of world because of certain essential facts like- high nutritional value, enhanced flavor and aroma. Idli is one of the popular steam cooked fermented food prepared from the batter of combination of rice and black gram dhal. It is popular because of its aroma, softness and spongy texture. Different studies have been done to increase shelf life of idli batter but solution to the problem of stabilization of idli batter lacks. This study mainly focuses on effect of addition of stabilizer and hydrocolloids on stabilization of idli batter. The proposed major objective of study was acquired with the assistance of Response Surface Methodology (RSM) at different levels under suitable refrigerated conditions (2-4⁰C). Physicochemical analysis including- pH, titrable acidity, viscosity and bulk density of idli batter was measured. All these four parameter were found to be pre-eminent in R2 concentration which was correspond to rice: black gram dhal (2:1). This manifested that idli made with high concentration of black gram: rice during same fermentation time was harder as compared to idli prepared with rice: black gram (2:1). It is apparent from the above study that incorporation of preservatives, guar gum and lecithin in idli batter can be successfully done to enhance storage of idli batter with desirability of 0.78. The obtained experimental values based on optimized parameters were consistent to predicted value having very small dissimilarity.

Keywords: idli, fermented foods, 0pH, titrable acidity, viscosity, bulk density

Methodology

Rice and black gram dhal were used for idli batter preparation in the ratio of 2:1. After the preparation of idli batter, physico-chemical analysis was conducted for idli batter using Response Surface Methodology (RSM) including following parameters- pH, titrable acidity, bulk density, viscosity and whey separation. Idli was prepared using traditional method. Sensorial properties of idli were evaluated using the nine (9) point Hedonic Scale.

Results and Discussion

The best results for all the parameters considered were found best in R2 concentration that correseponds to ratio 2:1. There was slight decrease in pH during storage because of production of lactic acid due to presence of certain microorganisms. Titrable acidity has



been increased with increase in hydrocolloids content because of production of carbon dioxide by yeast which later dissolves and form carbonic acid. On increasing the amount of hydrocolloids, viscosity of batter also increased because of thickening of batter. Hydrocolloids were having inversely proportional relationship with whey separation. It might be because hydrocolloids stabilize the interfacial film and prevent collapsing of structure during storage. Hydrocolloids, preservatives and surface active agents showed no significant effect on bulk density. Sensory attributes of idli were greatly influenced.

Conclusions

Scrutiny from the procured results in this research work considering all the parameters, it was found that all the parameters were transcendent in R2 concentration which was correspond to rice : black gram dhal (2:1). It is evident from the current study that embodiment of preservative, guar gum and lecithin in idli batter can be auspiciously done to enhance the storage of idli batter with desirability of 0.78.

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Thermal behaviour of mango seed kernel fat using Differential Scanning Calorimetry

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Abstract

The physicochemical characterization, including thermal behaviour using differential scanning calorimetry of mango seed almond fat (MAF) of variety Amarpali was done. Results showed that mango almond seeds contain about 5.28–11.26% (on dry matter basis) of fat. The values for refractive index, saponification index and iodine index were found to be 1.466, 189.0 and 41.76 respectively. Fatty acids found in MAF are oleic, stearic, and palmitic acids (40.81%, 39.07% and 9.29% (w/w), respectively) as well as smaller amount of linoleic, arachidic, behenic, lignoceric, and linolenic acids. Calorimetric analysis showed that MAF crystallizes between 14.6 and –24.27 °C with a ΔH_c of 56.06 J/g and melts between –17.1 and 53.8 °C, with fusion maxima at 18.54 °C and 40.0 °C for the α and β polymorphic forms. Their fusion enthalpies are 70.12 and 115.7 J/g. The MAF solids content profile is very similar to that of Cocoa butter (CB), both in stabilized and non-stabilized samples.

Keywords: Mango almond fat; Cocoa butter, iodine number, Phase change; Fusion enthalpies.



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Physico-chemical Properties of Groundnut Kernels

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Abstract

Groundnut (*Arachis hypogaea* L.) is one of the most important legume-oilseed crops of the world. India stands first both in terms of acreage (4.59 m ha) and production (6.77 M T) of groundnut in the world (FAOSTAT 2017). It is grown mainly in Gujarat, Andhra Pradesh, Rajasthan, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu and Uttar Pradesh. In Punjab, it was cultivated only on one thousand hectares in a few pockets of the state. Groundnut is rich source of nutrients such as oil, protein, carbohydrates and minerals and therefore is used in various forms. Groundnuts are the major source of edible oils in India. In India, 82% of the total produce of groundnut crop is marketed for crushing purpose, while the remaining 18% are utilized for human consumption and seed purposes. The knowledge of different engineering properties is important for design, manufacturing and operating different equipments used in post harvest processing of any agricultural produce and also for the production of different value added products. So, the aim of present study was to determine different physic-chemical properties of groundnut kernels.

Keywords: Groundnut decortications physical properties oil content

Methodology Proposed

For the present study, the most popular variety of groundnut grown in the state i.e. SG 99 was selected. Clean and healthy kernels were selected for the study as shown in Figure 1.



Fig. 1. Whole groundnut and shelled kernels

The crop was decorticated using manual groundnut decorticator as shown in Figure 2. Different engineering properties of the groundnut kernels i.e. moisture content, size, shape, bulk density, true density and angle of repose were determined using standard methods described by (Mohsenin, 1986). Color is the most important parameter for acceptability of a product. Colour properties of groundnut kernels were determined by Lab Colorimeter. Ash content, protein content and fiber content were determined by (AOAC, 2000). The oil content is determined by solvent extraction method by using



soxhlet apparatus and defatting ratio was estimated as the ratio of extracted oil and total oil.



Fig.2 Hand operated groundnut decorticator

Results and Discussion

The results of different physico-chemical properties of groundnut kernels are presented in Table 1.

Table 1. Physico-chemical properties of groundnut kernel

Sr. No.	Properties	Value
1	Moisture content (% wb)	10.17
2	Bulk density (g/cm ³)	597
3	True density (g/cm ³)	320
4	Angle of repose (°)	9.9
5	Size (mm)	a = 13.88; b = 8.29; c = 7.93
6	Geometrical mean diameter (mm)	9.48
7.	Fibre content (%)	11.67
8.	Oil content (%)	47.5
9.	Defatting ratio (%)	88.35
10.	Ash content (%)	3.0

Table 2. Color value of groundnut kernel

Sr. No.	L	A	B
1	52.9	+10.1	+16.4
2	47.4	+11.0	+13.7
3	45.1	+5.5	+11.8

Table 3. Hardness value of groundnut kernel

Sr. No.	First break point (N)	Peak force (N)
1	2489.32	14369.619
2	4525.857	8046.024
3	5610.676	6109.384

It was observed that the moisture content of groundnut kernels was 10.17 % (wb), bulk density was 597 g/cm³, true density was 320 g/cm³ and angle of repose was 9.9°. The average value of length (a), width (b) and thickness (c) were recorded as 13.88 , 8.29 and 7.93 mm, respectively. The geometrical mean diameter was calculated to be 1.09. The defatting value came out to be 88.35%. Average colour value of the groundnut kernels i.e. ‘L’ value, ‘a’ value and ‘b’ value were recorded to be 48.4, 8.8 and 13.9 respectively.



The total oil content in the groundnut kernels was 47.50%, fibre content was 11.67% and ash content was 3.0%. The defatting ratio was observed as 88.35%. Similar results were reported by Aydin (2006) and Atasié et al (2009) for groundnut kernels.

Conclusions

In the light of development of mechanized package of technologies for processing of groundnut i.e. for cleaning, grading, drying, decortications, extraction of oil, suitable packaging and storage the knowledge of these engineering properties will be helpful.

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FETP 80

Development and assessment of an energy bar

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Abstract

The present study was carried out to develop energy bar for nutritional and health benefits. Energy bar was standardized for optimum addition of ingredients and nutritional, textural and storage quality was assessed. Organoleptically acceptable optimized energy bar had 50% date fruit, 8.5% flax seeds, 10% almonds, 10% musk melon seeds, 7% coconut powder and 5% cashew nut. A comparison between the developed energy bar and commercial bar based on nutritional value, sensory evaluation and textural qualities were made. The energy content was slightly lower in the developed energy bar (416.4 Kcal) in comparison with commercial bar (431.8 Kcal). The developed energy bar was higher in carbohydrates (60.42g), fat (14%) and moisture (10.8%) and lower in protein (12.2%) and ash (2.3%) comparing to the commercialized bar (21.32N). Storage quality of developed energy bar was determined. Moisture, peroxide value and free fatty acids values at room temperature and in refrigeration condition during storage period of 60 days were within the safety levels. Mean sensory scores for energy bar samples stored at room temperature were slightly lower than the samples stored in refrigerator but were in the same hedonic scale category.

FETP 81

Changes in major flavonols and quercetin glycosides upon sprouting in onion powders

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Abstract

This study demonstrated the effects of sprouting on the major flavonols and quercetin glycosides in onion powders by High performance liquid chromatography and Fourier transform infrared (FTIR) spectroscopy. The major flavonols were quercetin, myricetin and kaempferol, which were found to significantly ($p < 0.05$) higher in sprouted onion powders. Quercetin glycosides also increased with sprouting, while non-significant decrease was found in onion powders from Punjab Naroya and Commercial variety. FTIR analysis revealed the presence of functional groups with O–H and C–H bonds and the structural similarities and differences between onion powders was found following sprouting. Quantitative analysis of flavonoids by HPLC showed that sprouted onion powders contained more phytochemicals than raw onion powder. This research suggests the potential of sprouting in onion for product development with enhanced bioactive compounds.

Keywords: onion variety, quercetin glycosides, sprouting, phytochemicals, High performance liquid chromatography

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Gum arabica and sodium alginate based noval composite edible coating affects biochemical and physiological responses of ber fruits during cold storage

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Abstract

Gum arabic and alginate-based edible coatings and films attract interest for maintaining quality and extending the shelf-life of fruits. Gum arabic is a neutral or slightly acidic salt of a complex polysaccharide. Alginate is a naturally occurring polysaccharide derived from brown algae species. Gum arabic and sodium alginate solutions were used in 12 different concentrations for treatment of fruits. The weight loss and soluble solid concentration of fruits treated with 10% gum arabic and 1.0% sodium alginate are 24 and 54% lower, whereas fruit firmness, total carbohydrates and reducing sugar are 31, 59 and 40% higher than controlled fruits at temperature 13°C for 28 days. The coating of 10% gum Arabic and 1.0% sodium alginate also reduced the respiration rate of the ber fruit during storage. Similarly, sensory evaluation results also proved the effectiveness of 10% gum arabic and 1.0% sodium alginate coating by maintaining the overall quality of ber fruits. The result of scanning electron microscopy also confirmed that fruits coated with 10% gum Arabic and 1.0% sodium alginate has very few cracks and showed a smooth



surface. These findings suggested that 10% gum Arabic and 1.0% sodium alginate coatings can be used commercially for extending shelf life of ber fruit up to 28 days.

Keywords: Ber, Gum Arabic, Sodium Alginate, respiration, scanning electron microscopy, Shelf life, sensory characteristics

FETP 83

Parboiled Millets: Purpose, Scope and Status

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Abstract

Millets are the coarse grain cereals grown in the tropical and rainfed areas in arid and semi-arid regions of the world. These small seeded grains are resilient to draught conditions, have short growing seasons and contain myriad of essential nutrients. Gluten-free nature and lower starch digestibility of millets maximizes the potential of their usage for the development of numerous food products and as an alternative source of nutritional security for the diabetic as well as wheat allergic patients. As per the FAOSTAT 2017, millets are cultivated in an area of about 3,12,44,432 ha land worldwide with a yield of 9109 hg/ha having production of 28.459MT per annum. Despite their higher production, adequate processing techniques for the better utilization and milling of the grains is still lacking. Parboiling or hydrothermal treatment is one of the pre-treatments involving three steps soaking, steaming and drying of the grains. Parboiling of millets is associated with hardening the internal structure of grain which results in the lesser breakage during milling thus ultimately increases the decortication yield, enhancement in the overall physicochemical and nutritional profile. Apart from having excellent nutritional profile, parboiled millet grains are also darker in color and takes longer time to cook than the native ones. Thus, parboiling process can open new horizons for the development of new food products with good nutritional and sensorial characteristics.

Keywords: Millets; production; parboiling; nutritional properties

FETP 84

Physico-chemical and functional properties of pearl millet cultivars

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Abstract

Pearl millet (*Pennisetum glaucum* L.) commonly known as 'Bajra' is a coarse cereal crop cultivated mostly in arid or semi arid areas of Asia and Africa. It can grow under difficult ecological conditions and tolerate high temperature, poor soil fertility and drought. It is underutilized crop can be grown at low maintenance cost and it is cheaper source of nutrition and food for poor people. Nutritionally, it is comparable even superior than major cereal due to high energy, fat, dietary fiber, minerals composition, high quality protein and phenolic components. Physicochemical and functional properties of flour from



pearl millet were observed. Bulk density and 1000 kernel weight of pearl millet grains was observed and ranged from 0.86-0.89g/ml and 7.0-9.2g, respectively. Bulk density is important for determining the packaging requirement, material handling and application in wet processing in the food industry. Moisture, fat, ash, protein and fiber contents of flours ranged from 7.79-8.69%, 5.4-6.7%, 1.66-1.90%, 9.8-11.19% and 2.7-3.9%, respectively. Pearl millet flour is a good substitute for other cereals as it possesses excellent functional properties such as water absorption capacity, oil absorption capacity, foaming capacity and emulsion activity etc. The water absorption capacity (WAC) was observed from 147.52-183.75% and oil absorption capacity (OAC) was observed from 123.75-136.59% for pearl millet flour. In general physiochemical and functional properties of pearl millet flour possess similar properties as compared to other cereal crops.

FETP 85

Nutritional and Antioxidant Properties Of Oats

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Abstract

Oats (*Avena sativa*) are grains from the cereal plant. It is a dual purpose crop. The oats are rolled, cut or ground to produce flakes, oatmeal or flour for human consumption. Different processing methods such as steaming, heating and cooling are done for its processing. Oats is ranked as number one by nutrient density among grains. It has been recognised as a healthful and nutritious cereal containing high concentration of soluble fibre and dense nutrients such as carbohydrates (66.3g/100g); dietary fibre (10.6g/100g); β -glucan [soluble fibre (4g/100g)]; fat(6.9g/100g); protein(16.9g/100g) and some vitamins viz. vitamin B1, vitamin B2, vitamin B3, vitamin B5, vitamin B6, vitamin B9 and vitamin B12. Oats are also good source of several minerals viz. calcium, iron, magnesium, zinc, copper, manganese and potassium. The major components of oats include β -glucan, protein (prolamine and avenin), oil and starch. Oats have a good antioxidant property due to presence of various polyphenols viz. tocotrienols, phytic acid, phenolic compounds and avenanthramides such as AVA-A, AVA-B and AVA-C. Germination of oats has been reported to increase the bioavailability of the proteins due to increase in the free amino acid content. There is approximate increase of 20% in AVA content in oat grains following the germination process. Hence, oats are highly nutritious cereal grain which is used for production of functional food having physiological effect on human health.

FETP 86

Insects as an alternate source of food

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Abstract

Potential food shortages due to the ever-increasing human population, health concerns and environmental threats, drive the search for alternative and sustainable food sources. The production of sufficient protein from livestock, poultry, and fish represents a serious challenge for the future. The consumption of insects, known as entomophagy, is the potential solution to the inevitable global food security and sustainability issues humans will be facing in the coming years.

Keywords: Entomophagy, Alternate food source, sustainability, protein source, insect farming

Methodology Proposed

The literature was reviewed extensively to know about the current status of entomophagy and the emerging interest in it.

Results and Discussion

Entomophagy is already being practiced and is a part of cultural eating habits of many communities around the world. Consumer acceptance needs to be enhanced by various interventions and processing techniques.

Conclusions

Considering that insects already form part of the human diet in many countries, their potential needs to be re-evaluated. Insects offer to be potential sustainable source of protein with minimum utilization of resources and should be given their due importance.

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FETP 87

Process standardization for the production of fufu flour cake

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Abstract

Fufu is a fermented cassava product commonly food found in West and Central Africa especially Nigeria, Ghana and Cameroon and some other part of world such as Caribbean and in many nation with population of West Africa origin. Fufu is presented in different from for consumption. The sour taste, flavor, appearance and texture are generally recognized as the main factors that determines the acceptability of the product. Fufu is locally a wet paste and it has a highly perishable short shelf life Cake is not a new concept ,several flour like maize flour, rice flour, oat four gram flour etc. which are available in the market which are from combination with various flours. The addition of these flours changes the structural and the texture properties of baked cake .Fufu cake will prepared with refined flour not pleasure only but for it nutritious purpose.

Keywords: Fufu flour, refined flour, cake, antioxidant activity, carotenoids and total phenols.

Methodology Proposed

Standardization of the process for the production of fufu cake was done. Cake made of 100 % refined flour was taken as control. Different concentrations of fufu flour was incorporated into control cake for the production of standardized fufu flour cake. The cake was baked at 180°C for 35 min. Chemical analysis of all the cakes was done including total phenols, carotenoids and antioxidant profiling by DPPH and ABTS.

Results

All the cakes were chemically evaluated. The antioxidant activity increased with the increase in fufu flour concentration. DDPH and ABTS value for C1 (control), and C6(RF:FF= 50:50) was found to be 23.36±5.55 and 26.11±6.26 (%) and 33.02±0.59 and 33.65±0.95 (%) respectively. The total phenolic content of for C1 (control) and C6 (RF:FF=50:50) was found to be 35.33±1.52 and 39.36±1.52 (mgGAE/100g) respectively. The carotenoid content of C1 (control) and C6 (RF:FF=50:50) was found to be 0.015±0.02, 0.075±0.18 (g/l) respectively.

Conclusions

The process for the production of fufu flour cake contained different concentrations of fufu and refined flour. Out of all the cakes, the cake containing 50:50 fufu and refined flour concentration showed the best results.

FETP 88

Cultivar effects on the physical characteristics of rice (rough and milled) (*Oryza sativa L.*) of Punjab

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Abstract

The aim of present research was to evaluate physical and engineering properties of paddy and rice cultivars i.e., PR 114, PR 121, PR 122, PR 123, PR 124, PR 126 and PR 127 native to Punjab state of India. Physical properties like length, width, thickness, equivalent diameter, surface area, aspect ratio, volume, bulk density, true density, porosity, thousand kernels weight, angle of repose and coefficient of friction were evaluated that in turn play a critical role in outlining the frame work for various post-harvest operations and storage structures. The low bulk density of cultivar may be due to the presence of long awns possessed by these cultivars which were bulky and occupied more space. The wide variations were found in rice kernels with respect to colour, which determined the functional properties and energy requirement during polishing of these cultivars. Results indicated significant differences in the physical properties among various paddy and brown rice cultivars when compared with earlier reported results. Thousand kernel weight, width, arithmetic mean diameter and equivalent diameter showed significant positive correlations with sphericity, surface area, volume, true density, and angle of repose; but negatively correlated with bulk density. These desirable characteristics exploit agriculturists/institutions to preserve these races and encourage farmers to cultivate these cherished rice cultivars.

Keywords: Cultivars, aspect ratio, porosity, equivalent diameter,

Methodology Proposed

The initial moisture content of paddy samples was determined on wet basis by automatic moisture analyzer. Length (L), width (W) and thickness (T) of both paddy and brown rice kernels chosen randomly from each particular cultivar was measured by Digital caliper with an accuracy of 0.01 mm. Physical properties such as volume (V), surface area (S), equivalent diameter (De), geometric mean diameter (Dg), sphericity (ϕ) and aspect ratio (Ra) of both paddy and brown rice samples were then determined from these three major linear dimensions (Jain and Bal 1997). The true density of kernel is defined as the ratio of mass of seed to the volume occupied by it and was calculated by means of toluene displacement method (Garnayak *et al.* 2008). Porosity (e) defined as the percentage of air between the grains as compared to a unit volume of grains, was calculated from bulk and true densities (Jain and Bal 1997). Thousand kernels (seed) weight was determined by weight of randomly selected 100 kernels by means of electronic balance (accuracy of 0.001 g) and multiplying their weight by 10. The angle of repose (ϕ) is defined as the angle in degrees with the horizontal at which the material will stand forming a heap, when piled. It was determined by using an empty cylinder of known diameter and height and filled with rice grains and raised gradually until it forms a heap of grain. The static coefficient of friction of paddy and rice grains against three different surfaces, namely,



glass, galvanized iron sheet and plywood was computed by using a shallow cylinder of 75 mm diameter and 50 mm depth and filled with grains.

Results and Discussion

No significant variations were observed between the selected individual samples collected over a period of two seasons for their dimensional analysis and thousand kernel weights. This might be due to sample purity and somewhat consistent growing conditions maintained by the substations and centres. Grain moisture content has an important effect in determining the different parameters of paddy and rice quality. It is an essential parameter in ensuring the optimum milling potential in order to obtain highest yield of head rice. The lower temperature had been reported to enhance the milling quality of rice having moisture in the range of 11–13%. The structure of endosperm tissue in the rice grains is damaged by increasing the temperature, as the thermal stress and the resulting shrinkage affects the network structures between starch granules and protein. Seeds can be graded homogeneously according to size, which give increased harvesting yield by ensuring uniform germination. Effective grading according to width occurs when the particles lie along the axis perpendicular to the surface of the sieve vibrating vertically. However grading is satisfactory even on sieves vibrating horizontally. These principal dimensions of paddy and rice grains are useful in grading of grains by selecting sieve separators. Sphericity gives an indication of how the shape of a grain deviates from a sphere and is thus useful in depicting the drying behaviour of grains by considering the sphericity value with the shape of grain, as the sphericity values for rounded grains are higher than cylindrical shaped grains. The lower sphericity values indicate that the paddy or rice kernels would slide rather than roll on the surface thus play essential role in the designing of grain hoppers. The volume to surface area called as characteristic length, is an important criterion in determine the handling of different grains. The volume to surface ratio has an important role in the designing of grain cleaners, aspirators, pneumatic separators and fluidised bed dryers, as it determines the projected area of the grains suspended in turbulent air stream. Temperature has a significant effect on the physical properties of paddy and rice grains. The transfer of heat into the grain as in case of drying, milling and storage causes simultaneous diffusion of water from the grains to the surrounding air, thereby resulting in different physical properties of grains. Heat transfer at higher temperature leads to the shrinkage of the rice grain and results in internal cracking of the rice kernels. Shrinkage of grains also had a significant effect on reduction of the geometric dimensions of the grains and thus on the volume and surface area of the grains. The cultivars having highest equivalent diameter (ED) possess higher values of thousand kernel weight as compared to the cultivars having lesser values of ED. The porosity values showed significant difference among different cultivars for paddy and brown rice. The frictional properties like the angle of repose and the coefficient of static friction have been validated by the engineers as important properties dealing with design of seed bins and other storage structures.

Conclusions

This research concluded with providing information about the physical and engineering properties of different traditional paddy and rice cultivars of Punjab (India). Significant



differences were observed in the principle dimensions and physical properties among cultivars. The colour parameters of the analyzed rice cultivars were observed to be significantly different from each other. The presence of awns in some paddy cultivars was found to have a significant effect on the physical properties of these cultivars. Results indicated significant differences in the physical properties among various paddy and brown rice cultivars when compared with standard data available in the literature.

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FETP 89

Effect of edible antimicrobial film on shelf life, physico-chemical and microbiological properties of composite sweet (*Doda-Burfi*)

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Abstract

Doda burfi, a composite sweet prepared from milk and germinated wheat flour is relished by all the age groups across the country. Being a condensed form of milk with germinated wheat flour, it is a very good source of milk and wheat nutrients viz., proteins, fat, minerals and vitamins. The limited shelf life of *doda burfi* at room temperature has caused the researchers to look for new means to retard the physiological, microbiological and deteriorative processes occurring in the product during storage. Therefore, present study was envisaged to study the effect of edible film with antimicrobial substances on shelf life and intact freshness of *doda-burfi* stored at 25 °C. The product was examined for physico-chemical and microbiological parameters at an interval of 3 days. Elevation in SPC, yeast and mold count was observed as the storage period progressed while there was no change in the *E. coli* count. With the progress of storage, an increase in titratable acidity, reducing sugars, FFA, HMF, TBA, peroxide value and tyrosine value was also observed in both control and treated sample. However, loss of most quality attributes was rapid in control compared to edible antimicrobial film wrapped *doda-burfi*. The shelf life of control sample was 12 days at room temperature while an increase in shelf life by 6 days was observed in the treated sample. India being a tropical country and the unavailability of cold chain; application of edible antimicrobial film will be a scientific approach to reduce the losses owing to spoilage of the product.



FETP 90

Drying kinetics of naturally ventilated greenhouse dried white button mushroom (*Agaricus bisporous*)

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Abstract

Mushrooms are edible fungi of commercial importance. It contains about 90% moisture with a shelf life of 1–2 days at ambient temperature. Extending the shelf life of mushrooms is important and drying is one method that would extend the shelf life. As mushrooms are very sensitive to temperature, choosing the right drying method is very much important. Drying using greenhouse has a lot of potential at present scenario. In this study, drying of mushrooms was conducted by two methods: open sun drying and greenhouse drying. The changes in moisture content, drying rate and moisture ratio with time during drying were observed. The final moisture content for open sun dried mushroom was recorded to be 9.0 ± 1 (% db) and 7.0 ± 1 (% db) for greenhouse dried mushroom. The drying continued for 2 days and 3 days for greenhouse and open sun drying respectively. In order to determine the moisture ratio as a function of drying time, drying models, namely Lewis, Henderson and Pabis, and Page model, were fitted with experimental data and their coefficient of determination (R^2) were calculated. The Lewis followed by Page and Henderson & Pabis model explained empirical models for drying of mushrooms and were the best fit.

Keywords: Mushrooms; greenhouse; drying; moisture ratio; drying models

Methodology Proposed: Studies on drying on mushrooms were conducted by two methods: open sun drying and greenhouse drying. To fulfil the objectives of the study, a greenhouse constructed at the Research Farm, Department of Soil and Water Engineering, Punjab Agricultural University, Ludhiana was used. The total area of the greenhouse is 192 square meters with the dimensions of 24x8 m. Both treated and untreated samples of white button mushrooms were put on the tables and kept inside the greenhouse and in open sun for drying. The temperature and relative humidity of outside and inside air was recorded using thermo-hygrometer. The drying parameters viz. moisture content, moisture ratio, drying rate, drying air temperature, relative humidity were recorded at regular intervals. In order to determine the moisture ratio as a function of drying time, drying models, namely Lewis, Henderson and Pabis, and Page model, were fitted with experimental data and their coefficient of determination (R^2) were calculated. To assess the suitability of the model, coefficient of determination (R^2), standard error of estimate (SEE), root mean square error (RMSE) were calculated.



Conclusion: The final moisture content for open sun dried mushroom was recorded to be 9.0 ± 1 (% db) and 7.0 ± 1 (% db) for greenhouse dried mushroom. The drying continued for 2 days and 3 days for greenhouse and open sun drying respectively. The Lewis followed by Page and Henderson and Pabis model explained empirical models for drying of mushrooms and were the best fit.

FETP 91

Red wine health benefits: evidence-based study

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Abstract

Wine is an alcoholic beverage made with the fermented juice of grapes. Two types of wines are available depending upon juice derived from grapes with skin or without skin. Red wine made from juice of grapes with skin and white wine from juice without skin. The red wine is famous for its organoleptic properties and presence of antioxidant compounds. Apart from the colour difference, red wine and white wine differ in polyphenolic concentrations. Red wine has around 10 times more polyphenolic compounds than white wine. Major bioactive polyphenols in red wine are flavanols, anthocyanins, and resveratrol. Table 1 presents the typical phenolic composition of red wine and white wine.

Table 1: Major phenolic compounds in red and white wine

Component	White Wine (mg GAE/L)	Red Wine (mg GAE/L)
Catequin	35	191
Epigallocatechin	21	82
Gallic Acid	7	95
Cyanidin-3-glucoside	0	3
Malvidin-3-glucoside	1	24
Rutine	0	9
Quercetin	0	8
Myricetin	0	9
Caffeic Acid	2.8	7.1
Resveratrol	0	1.5
Total Phenolics Content	239	2567

(Source: Markoski MM., et al., *Molecular properties of red wine compounds and cardiometabolic benefits, Nutrition and Metabolic Insights* 2016:9 51–57)



A number of studies are available in literature showing a negative correlation between wine consumption and ischemic heart diseases,. The higher amounts of polyphenolic compounds in red wine are advocated for benefits associated with red wine. On the other hand, a parallel body of literature is available which shows that cardiovascular effects shown by red wine are at par along with other alcoholic beverages. Studies with dealcoholized red wine have shown that alcoholic content per serve is responsible for the beneficial effects of red wine. Studies comparing beneficial effects of red wine, beer and other alcoholic beverages have shown that cardio-protection offered by red wine is comparable with other alcoholic beverages. In the present study, the available literature showing beneficial cardiovascular effects of red wine and literature showing cardiovascular benefit due to alcohol per se were reviewed. Based upon the evidence available in literature it is concluded that although red wine has higher amounts of polyphenolic compounds but currently the form in which these compounds are present in red wine have poor bioavailability. Hence are not able to exert the beneficial effects.

FETP 92

Active Packaging of White Button Mushrooms

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Abstract

White button mushrooms (*Agaricus bisporus*) is one of the most consumed varieties among all the identified species of the mushrooms. They are saprophytic fungi having no leaves, roots or seeds. They are consumed throughout the world not only for their taste but also for their nutritional value in fresh form. As fresh mushrooms have a low post harvest shelf life of 2-3 days under ambient conditions, there is a need for their shelf life enhancement. One of the methods for exploring advanced technologies like active packaging. The present study was conducted to study the effect of oxygen absorber, different packaging materials and storage conditions on the shelf life of white button mushrooms. Analysis of various quality parameters including colour, firmness and head space gas analysis showed that there was increase of shelf life upto nine days for samples packed in punnetswith oxygen absorbing inserts and stored at 2°C temperature and 90% RH.

Keywords: Mushroom, active packaging, shelf life, oxygen absorber

Methodology Proposed



Fresh white button mushrooms were packed in two different types of packages viz. polypropylene pouches and punnets overwrapped with PVC cling film. Samples were stored with and without oxygen absorbers and kept at different temperatures (2, 5 and 15°C). The Head space gas concentration and physicochemical parameters (water accumulation, texture, colour, phenolic content and ascorbic acid content) were recorded at regular intervals of 3 days.

Results and Discussion

Various quality parameters showed a decrease with increase in storage temperature for all samples regardless of the packaging material and oxygen absorber. As compared to samples in punnets, samples packed in polypropylene packages showed a greater water accumulation leading to off odour development and spoilage. Samples packed in punnets with oxygen absorber and stored at 2°C retained better quality for approximately nine days of storage period as compared to 6 days for samples stored without oxygen absorbers under similar conditions. Active modification of packages helped in enhancing the shelf life of mushrooms by maintaining the quality parameters for longer time. Storage temperature, oxygen absorber and packaging material were observed to have a significant effect ($p < 0.05$) on quality and shelf life of fresh white button mushrooms.

Conclusions

White button mushrooms packed in PET punnets over wrapped with PVC cling film using oxygen absorber could be stored at 2°C and 90% RH for nine days with acceptable quality.

Acknowledgement

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FETP 93

**Heat-acid induced cottage cheese (Chhana) manufacturing process:
Understanding the effect of seasonal variation**

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Abstract

The effect of milk composition (cow, buffalo, and mixed milk) with seasonal variations in *chhana* manufacturing process was studied from molecular level bonding pattern development to macroscale physical properties (textural and rheological). Milk fat and protein content varied approximately 0.4% and 0.2% in summer samples than winter samples respectively for both buffalo milk and cow milk samples. Due to more total solids and less moisture content, *chhana* samples prepared with higher percentage of buffalo milk had higher yield %, firmness and elastic modulus as compared to *chhana* samples with higher percentage of cow milk. Spectral data showed the presence of higher stretching vibration of C=O and N-H band of amide I band of proteins, saturated/unsaturated (CH₂) functional groups of fat and O-H band of moisture in buffalo milk as well as *chhana* samples made from buffalo milk compared to cow milk or *chhana* manufactured from cow milk.

Keywords: Chhana, heat-acid coagulation, rheology, texture, FTIR

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FETP 94

Studies in development of low glycemic index food

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Abstract

Carbohydrates (CHO) are widely consumed food ingredients and hold a great importance in the diet of people all over the world. Glycemic index (GI) is the ability of CHOs to release glucose after consumption of particular amount of food and Glycemic load (GL) is another term to express the glucose response. In this study, relation of GI is explained with starch digestibility, total starch and resistance starch contents. There are different factors such as particle size, fiber, beta glucan, amylose content along with various cooking methods which influence the GI, GL and starch digestibility of food products. Cooking methods such as microwave and convectional have been included. Low glycemic index khakra is prepared for the people suffering from chronic health ailments like diabetes, cardiovascular disorders, hyperlipidemia etc.

Keywords: Glycemic load, starch digestibility, Low glycemic index khakra

FETP 95

Effect of corn starch and whey protein concentrate level on development and characteristics of biodegradable cup

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Abstract

Food packaging is concerned with the preservation and protection of all types of foods and their raw materials from spoilage and also to extend their shelf-life characteristics. Increased use of synthetic packaging films has led to serious ecological problems due to their total non-biodegradability. Continuous awareness by one and all towards environmental pollution by the latter and as a result the need for a safe, eco-friendly atmosphere has led to a paradigm shift on the use of biodegradable materials. Keeping the above concerns in mind, attempt was made to prepare composite biodegradable cup using Corn starch, whey protein, Carboxy methyl cellulose and glycerol. Two methods were tried for formation of cup i.e. casting method and layering method. In casting method for film was made and it was cast in between two silicon cups with weight in it. This arrangement was kept in oven at 60-80°C. In layering method, slurry was prepared and layer was coated on silicon cup with brush, after each layer it was dried in oven at 60 °C.



Number of layers were increased from 4-9 and standability and thickness of cup formed was checked. For cup formation, corn starch (5-7%), WPC (1.5-3%), CMC (0.5-2%) and glycerol (2-4%) range was selected after preliminary trials. To decide upon temperature at which the slurry attains final viscosity, samples were tested under rapid visco-analyser to conclude that layering was enabled at 50 °C. Based on observations three biodegradable cups combinations were selected (corn starch 7%, WPC 3%, cellulose 2%, glycerol 2.5%); (corn starch 7%, WPC 2%, cellulose 2%, glycerol 2.5%); (corn starch 7%, WPC 3%, cellulose 2%, glycerol 4.0%). Properties like thickness, solubility, puncture strength, water vapour transmission rate, biodegradability, moisture, lightness and thermo gravimetric analysis were studied for three samples to select the final cup. The capacity of final cup was observed as 55.5ml/47.1gm. Based on observation final composition was selected as (corn starch 7%, WPC 3%, cellulose 2%, glycerol 4.0%). The value for thickness, solubility, puncture strength, WVTR, moisture and lightness was observed as 0.5 ± 0.025 mm, $48.50 \pm 0.66\%$, 2579.03 ± 167.22 g, 1.14 ± 0.086 g/m²/hr, $7.74 \pm 0.16\%$, 41.96 ± 1.86 respectively. The lower diameter was observed as 5.5cm, upper diameter 7.5cm and height of cup was observed as 4.0 cm.

Keywords: Biodegradable cup, whey protein, corn starch, SEM, thermo gravimetric analysis

FETP 96

Effect of buttermilk powder and milk protein concentrate on emulsion stability of processed cheese

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Abstract

Emulsifying salts are used in preparation of processed cheese to provide stability to processed cheese emulsion. Usually these are sodium based ingredients and the excess of these is considered as not good for health. Common of these are tri-sodium citrate (TSC) and disodium phosphate (DSP). Efforts are being carried out globally to reduce the load of sodium in foods and thus the replacement of these ingredients in cheese industry also remains a challenge as these are required for providing good functional characteristics to the final product. Owing to the advances in technologies such as membrane filtration, fractionation etc. dairy based ingredients are being manufactured for use in food industry. Milk protein concentrates (MPC), buttermilk powder (BMP), sodium caseinate, whey protein isolates (WPI) and concentrates etc. are several of these ingredients being used in food industry as replacement of the conventional ones. These ingredients can also be used in cheese industry for replacement of TSC/DSP. Research efforts are required to explore



the possibilities of their use in processed cheese. Therefore, in this project, effects of addition of BMP and MPC have been evaluated in processed cheese. Free oil content, meltability and area of the oil ring were measured to evaluate their effect in processed cheese. It was observed that control cheese (prepared with TSC) had significantly ($p < 0.05$) better properties as compared to cheese prepared with MPC and BMP. It is concluded that stand alone replacement of TSC with BMP or MPC does not improve the emulsion stability of processed cheese. Research efforts may be carried out to use these ingredients in combination to further explore their emulsion stabilizing potential in processed cheese.

Keywords: Buttermilk powder, milk protein concentrate, processed cheese, free oil emulsion

FETP 97

Effect of inulin on rheological and sensory attributes of low fat cream cheese

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Abstract

Cream cheese is one of the fresh acid coagulated cheeses that have attracted enormous attention of consumers for possessing gourmet attributes. It is a soft, rich, creamy white, unripened cheese having slightly acidic taste with diacetyl flavour, usually manufactured by the coagulation of high fat milk through in situ acid production by starter culture. However, concerns regarding its high fat content and associated heart diseases may hamper the growing demand among consumers. With this pretext, attempts have been made to reduce the fat content of cream cheese without jeopardizing its richness. In the present study, inulin has been added to replace half of the milk fat of cream cheese and its effect on the rheological characteristics were studied. Three types of cheeses were manufactured viz. double cream cheese with full fat (DCC); single cream cheese with 50% less fat (SCC) and single cream cheese with 6 % inulin (SCC+I). Frequency sweep test was carried out to study its viscoelastic behaviour. It was observed that storage and loss modulus were significantly ($p < 0.05$) reduced in SCC as compared to DCC. However, there was no significant difference ($p > 0.05$) observed between storage and loss modulus of DCC and SCC+I. It was also observed that creaminess of SCC+I was similar to DCC while SCC had comparatively more firmness indicating that inulin is effectively contributing towards proving richness to cream cheese with lower fat content.

Keywords: cream cheese, low fat cream cheese, fat replacer, inulin



FETP 98

Physicochemical, functional and structural properties of *Chenopodium album* starch

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Abstract

The growing market of starch is leading to a continuous search for non-conventional or underutilized starch sources to facilitate development of new innovations in various sectors such as food, textile, paper and pharmaceutical industry. To accomplish this purpose, a pseudo-cereal, *Chenopodium album* was explored owing to its good starch content and easy availability. The aim of the study is to standardize the method of starch extraction with maximum yield and purity as well as the characterization of *Chenopodium album* starch for physicochemical, pasting and structural properties. Peak gelatinization temperature of *Chenopodium album* starch was found to be 63.20 °C. Water binding capacity and oil binding capacity were 178±2.75 and 225±1.59, respectively. Starch affinity towards oil was more than that of water which may be due to accessibility of hydrophobic sites within the molecules of starch. From the result of different characterization, it shows the potential usage of *Chenopodium album* in formulation of different product.

Keywords: *Chenopodium album*, starch, pseudo-cereal

FETP 99

Mechanical and barrier properties of biodegradable Pearl millet starch films as affected by concentration and cultivar type

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Abstract

A biodegradable alternative to petroleum based plastics is imperative for environmental waste management and starch is a fascinating choice for the same. In the present study underutilized source of starch, Pearl millet was explored for its film-forming



characteristics. Two varieties of Pearl millet viz. ProAgro 9444 and HHB 67 differing in amylose content were chosen for the study. Amylose content of ProAgro and HHB 67 was 20.21 and 15.05%, respectively. Films were formed at three concentrations of starch (3,4,5% w/v). At respective concentrations, the tensile strength and barrier properties were better for films from ProAgro 9444 owing to higher amylose content, whereas the solubility of films from HHB 67 was higher. Regardless of the variety, the thickness of films increased and light transmittance decreased with increase in concentration. Overall, the study manifested that films from ProAgro 9444 were better than from HHB 67.

Keywords: Films, ProAgro 9444, HHB 67, Starch

FETP 100

Studies on starch digestibility and glycemic load of various Indian traditional crops

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Abstract

The term Glycemic index (GI) was coined by Jenkins and his colleagues in 1989. Glycemic index refers to the classification of foods based on the ranking of their blood glucose release. It came into existence and prominently grabbed the attention of the healthcare professionals at an alarming rate. A generalized survey was carried out to check the knowledge of the people about GI, importance, health hazards and other complications. A minimum sample size of 50 individuals above 18yrs was opted and sample expanded to as great as 275 individuals. Since cereals act as a major source of carbohydrates so, chickpea flour and barley were used to prepare low GI breakfast series. Appe, dhokla were prepared chiefly in various concentrations, Response surface methodology (RSM) was also used to set the parameters and check its significance/ non significance. Generally, Barley affected the hardness of the product and the hardest dhokla was obtained was barley: chickpea ratio was 86.879: 13.72 at 130° C for 12 minutes. Whereas appe prepared in appam stand (ordered from amazon) were smooth in texture due to the presence of curd and seasonings. Thus, the preparation of breakfast series was challenging and so as to avoid the spike in GI/GL a lot of factors were taken care of.

Keywords: Glycemic index, Glycemic load, RSM, Health hazards



FETP 101

Preparation and evaluation of fiber biscuits from by-products of sweet lemon juice using different concentration of pomace

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Abstract

Mosambi (*Citrus limetta*) belongs to the family Rutaceae. In India, *Citrus limetta* is commonly known as “Mosambi”. In India, Mosambi cultivar is grown almost 207 ha area of land is cultivation having an average productions 28011mT in 2016-2017 (Govt. of India Ministry of Agriculture and Famers Welfare). It is grown in Asia, India, China, southern Japan, Vietnam, Malaysia, Indonesia and Thailand. Mosambi is important source of vitamin C and replenish energy. Citrus contain flavonoids and has biological activity including antifungal, antibacterial, antiviral, antidiabetic and anticancer activities. Duthie and Crozier (2000) reported that Flavonoids can function as direct antioxidants and free radical scavengers, and have the capacity to modulate enzymatic activities and inhibit cell proliferation. The proximate chemical composition analyses of fiber biscuits were observed. The protein content of fiber biscuits with 4% incorporation of dry pomace (6.2%) was higher than fiber biscuits with 8% incorporation of dry pomace (6%). The fiber content of fiber biscuits with 4% incorporation of dry pomace (4.5%) was lower than fiber biscuits with 8% incorporation of dry pomace (7.5%). During evaluation it was noticed that higher percentage of sweet lemon pomace in biscuits increases their fruity smell and taste, as well as bitter taste at the end while the sweet taste is perceptible at starting and middle. Fibers provided health benefits on human include risk reduction of heart disease, certain types of cancer, obesity, diabetes, lowering blood lipid levels, prevention of constipation, enhanced gastrointestinal immunity and stimulation of beneficial colon micro flora growth.

FETP 102

Fortification of wheat flour with millet flour of dough rheology

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Abstract

Wheat is an important food crop cultivated in India. Wheat is used in the production of products as diverse as glue, licorice and ice cream cones etc, but most commonly it is ground to extract flour which is then used in baking - particularly the baking of bread. Protein malnutrition a serious problem of people whose diets consists



mainly of cereal & starchy foods, has around keen interest in fortifying flours & other products with protein rich additives. Fortification with vitamins and minerals is one of the most effective methods to improve health and prevent nutritional deficiencies according to new studies. The success of food fortification programs lies in the selection of vehicle and fortificant. Wheat flour fortification with minerals, phytochemicals seems to have a greater influence compared to many other vehicles in the India, where the wheat flour is mainly consumed as a dietary staple to meet energy requirements. Fortification is the practice of adding nutrients such as essential vitamins and minerals to staple foods to improve their nutritional content. It is a safe, effective way to improve public health that has been used around the world since the 1920s. The fortificants added should not impart undesirable characteristics to the food, such as changes in color, taste, smell, and texture. Bioavailability of fortified flour has long been debated and highlights the fact that use of novel iron sources in the presence of phytic acid in wheat flour could be a better choice for fortification. In recent years, there has been growing demand for functional bakery products partly due to consumer preference because they are generally perceived as safer & healthier than their synthetic counterparts. The nutritional value of flours can be improved by making composite flours with non-wheat cereals or supplementing its flour with protein rich sources such as millet flours. Millet, being less expensive compared to the other cereals and the staples for the poorer sections of population could be the choice of fortification with micronutrients such as zinc and Iron. Millets are one of the cereals besides the major wheat, rice, and maize. Millets are major food sources for millions of people, especially those who live in hot, dry areas of the world. Millet is one of the oldest foods known to humans and probably the first cereal grain used for household purposes. Millet is highly nutritious, non-glutinous and non-acid forming food, so is soothing and easy to digest. Millets are rich in B vitamins, especially niacin, B6 and folic acid, calcium, iron, potassium, magnesium and zinc. Millets being natural sources of fibre, calcium, magnesium, the medication automatically comes down and other functions are also perfectly balanced. Millets are rich in fibre and nutritional photochemical which fight stress. Fibre rich, millets help prevent constipation, thus, helping toward a healthy digestive system. Utilization of minor millets was less when compared to cereals, because, the production and consumption has been declined due to rapid urbanization (in 2013 – 11520 MT and in 2014 – 9500 MT, USDA), changing food preferences, supply of fine cereals at subsidized prices and social status attached to fine cereals. However, in recent years the resilience of Indian agriculture weathering all the vagaries of the monsoon has resulted in fall in food grain production, in spite of increase in area under the cereals. This necessitates a paradigm shift towards the increase in production and utilization of millets. Further, the global trend towards urbanization has resulted, the diets markedly deficient in dietary fibre, now the food technologies, doctor's and dietician's feels, dietary fibre is essential for preventing various health ailments. Vander *et al.* (2001) reported that change in diet from millet based to refined wheat and rice diets contributed to increased prevalence of diabetes and other health ailments. Decker *et al.* (2002) reported millets contain a wide variety of antioxidants, which aptly complements their fibre content in reducing the risk of cancer and heart disease. Thus, minor millets play an important role in health foods. Hence, there is a need to develop suitable processing technique to suit the needs of the households and food industry. The development of processed ready to cook product from millets by the commercial processing centers will



greatly increases the demand for these crops and also it helps to improve the diet of the consumers. Bread is the major bakery product and consumed worldwide in relatively large amounts. Functional breads formulated with bioactive compounds are becoming important in the bakery industry, and various ingredients are being used to improve the health benefits of the final product. Measuring the rheological properties of dough intended for bread production is relatively complicated, connected with exploitation of specific equipment. Rheology studies relations between tension which the material is exposed to, final dimension of material deformation and time. It is very important to understand the rheological behavior of bread dough as well as mechanical properties of the dough and control finished products (Přihoda et al., 2003, Mirsaeedghazi et al., 2008). The rheological changes, which occur in gluten structure during mixing, greatly determine the final product quality (Dobraszczyk and Morgenstern, 2003). During this operation, hydration of flour particles and formation a gluten network from gliadin and glutenin with viscoelastic structure and specific properties occur. One of the most popular instruments used to evaluate the rheological properties of the dough is the Farinograph who gives information regarding the modifications that appear in the rheological properties of the dough during the kneading process allows the evaluation of the critical factors that influence these properties, such as flour quality and strength (Codina, 2010). The farinograph curve which determines the development time, stability and water absorption of the flour. The characteristics of a flour, such as how much water it absorbs to achieve optimum dough consistency, dough development time and dough stability, have been shown, by experience, to be good predictors of baking quality (Preston K.R. and Kilborn R.H.) So, these are important measures of flour's quality, both the bakers and millers. For this reason they want to evaluate these characteristics of wheat flour before purchase. For this purpose, Hence, the present study was undertaken with the rheological properties of Barnyard (*Echinochloa* spp), millet flour fortified as 15% to 60% to wheat flour determined by farinograph.

Key words: Wheat flour, Fortification, Millet flour, Rheology, Farinograph

Materials and Methods

In the experiment we used refined wheat flour blended with 15% - 60 % of finely grained and homogenised barnyard millet (*Echinochloa* spp), flour. Produced blends (14 % moisture) were evaluated on Farinograph-E, Brabender OHG, Duisburg, Germany (ICC Standard 115/1, 1992, AACC Method 54-21, 1995). wheat flour was used as control. All analyses were performed without additives. Sigma blades of farinograph worked with 3 different speeds: standard - 63 revs. min⁻¹, low - 45 revs.min⁻¹ and high - 120 revs.min⁻¹. Following properties have been evaluated: changes of dough consistency (in FU Farinographic unit) at constant water absorption of 58.1 %, development time (in min), stability (in min) and degree of softening (in FU). Tests were repeated three times and the results presented are means of the three realized measurements.

Results and discussion

The result revealed that 15% & 30 % of barnyard millet flour fortified with wheat flour, water absorption 62.5% and 57.4%, and dough tolerance index range had 23FU which flours indicated that strong flour to make the bread .Further 45% & 60% of barnyard millet flour fortified with wheat flour water absorption had 50.6% and 43.5% and dough tolerance index ranges of these blends were high, which was indicated that weak flour and it was suitable to make cookies and biscuits. Further dough development time of



blended flour (barnyard millet flour with wheat flour 15% to 60%) had 9.7min to 19.7min ,dough stability time of millet flour blended with wheat flour in the range from 7.3min to 15min which was higher than control (wheat flour),

Conclusion

Based on the results obtained by observing the rheological properties of tested doughs can be stated that use of 15% to 30% of barnyard millet flour fortified with wheat flour dough properties is better to bread and other pasta products but 45% to 60% of barnyard millet flour fortified with wheat flour dough properties are better to make cookies and biscuits. So the result concluded that minor millets have immense health benefits as they are rich in phytochemicals and nutrients, particularly beneficial to overcome the current life style diseases. On the other hand, in India more than 50 per cent of children are malnourished. Millet based foods help to overcome these two extremes. Millet based products is economically viable and also it highlights the excellent medicinal and nutritional qualities.

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TRACK II: Research and Innovation in Chemical Engineering and Technology (RICET-2019)



INVITED LECTURES ABSTRACT



Analysis of heat flow visualization and thermodynamic efficiency during thermal convection in cavities with distributed solar heaters

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ABSTRACT

The phenomenon of natural convection plays a significant role in various industrial and thermal processing applications. The conventional method of differential heating within an enclosure may result in the inadequate thermal mixing and that may further lead to the poor thermal management. In order to enhance the overall thermal mixing, the discrete heating strategy may be considered as an attractive alternative. The major application of discrete heaters along the side walls is solar thermal induced natural convection. The single or double discrete heaters are positioned at various strategic locations along the side walls of the triangular (type 1 and type 2) and square cavities in order to enhance the effective mixing of fluid in the entire enclosure. This lecture elucidates natural convection within discretely heated square and triangular (type 1 and type 2) enclosures filled with fluid and porous medium. Overall, five test cases based on the single heater arrangement (cases 1a-1e) and three test cases based on the double heater location (cases 2a-2c) along each side wall have been considered for the present work. The heatline method has been implemented to visualize the heat flow pattern within the cavities for a wide range of parameters involving various dimensionless numbers. In order to solve the governing equations and Poisson equations for streamfunction and heatfunction, the Galerkin finite element method has been used. Heatlines are effective in explaining the complex heat flow patterns from the various discrete heating sources in the cavities. Further, the local and average Nusselt number are largely effective in illustrating the heat transfer distribution along the isothermal walls and discrete heaters. Lastly, the extent of thermal mixing is quantitatively measured using the cup-mixing temperature whereas the uniformity in the temperature distribution is evaluated using the root mean square distribution in each distributed heating case (cases 1a-1e and cases 2a-2c).

The energy efficiency of the various distributed heating strategies has been carried out using the irreversibility or entropy generation estimates. The entropy generation minimization approach has been implemented in order to analyze the destruction of available energy for the various thermal processing applications. The local maps of heat transfer and fluid friction irreversibilities are obtained for the various distributed heating strategies. Also, the heat transfer and fluid friction dominance during conduction or convection dominant regime has been studied. In order to accurately estimate the entropy generation terms, a finite element based numerical procedure has been developed. The current algorithm has been validated with that of the previous works and they are found to be in excellent agreement.

The heatline investigation involving fluid media case clearly illustrates the conduction dominance at low Rayleigh number based on the end to end parallel heatlines whereas convective heatline cells are observed along with the wall to wall heatlines at high Rayleigh numbers. Common to all the cases, the heatline analysis involving porous media exhibits the onset of convection at lower Darcy number whereas enhanced convection is found to occur at high Darcy number based on the presence of intense fluid and heatline



cells irrespective of Prandtl number. At the low Rayleigh and Darcy numbers, the dominance of entropy generation due to heat transfer is found to be higher over fluid friction whereas at the higher Rayleigh and Darcy numbers, the entropy generation due to fluid friction is largely dominant over thermal irreversibility within the cavities.

Overall, the heatline and entropy generation analysis clearly demonstrates that distributed/discrete heating results in the enhanced thermal mixing and a larger extent of temperature uniformity throughout a large region in the square and triangular (type 1 and type 2) cavities for all types of fluids. Based on the thermal mixing studies, it may be inferred that the triangular-type 2 and square configurations exhibit significant thermal mixing compared to the triangular-type 1 cavity. On the other hand, triangular-type 1 cavity demonstrates greater rate of heat transfer compared to square and triangular-type 2 cavities. This lecture also concludes that the effective utilization of energy resources for the processing of materials may be achieved by the thermal management policy based on the distributed heating strategy which significantly enhances the thermal mixing and temperature distribution in the square and triangular (type 1 and type 2) cavities with higher energy efficiency.

Keywords:



Nanotechnology influences food and food waste: A futuristic approach to sustainability

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ABSTRACT

A one-time pre-germination seed priming method using MWCNT augmented growth and improved grain count of bread wheat, oats and rice. We report this study in field conditions, an improvement over laboratory studies reported prior to us for other plants. We find significant changes in vasculature due to translocation of MWCNT through the xylem-phloem bundles. Cell elongation of the order of 80% was recorded, while xylem and phloem sizes dilated to almost 83 and 85% of control, thus enhancing their capacity to conduct water and food. Extra root hairs facilitated the uptake of both water and essential minerals like phosphorus (P) and potassium (K), boosting the grain yield/plant from 1.53 to 2.5g (63% increase). MWCNT (water compatibilized) priming of seeds (70-90µg/ml) is an eco-friendly approach, which may not adversely affect soil conditions (microbes) and neither does it damage the DNA of bread wheat. This study reports, probably for the first time, augmented growth of MWCNT primed wheat, oats and rice in actual soil (field) conditions, by tracking the minute effects like early germination, extensive root hair, and detailed anatomical and physiological impact while gauging no DNA damage. This opens up an entirely new aspect to using cost-effective nanomaterials (the MWCNT were either produced in-house and used in minimal quantities for plant treatments). We also suggest an eco-friendly method to produce mesoporous Carbon from food waste (biowaste) for electrochemical applications.

Keywords:

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Microwave and hydro-thermal extraction of proteins from rice bran

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ABSTRACT

Rice bran is one of the co-products from rice milling process that has high protein content among many other beneficial minerals and nutrients. Rice bran is an inexpensive raw material, and it is a source abundant with essential amino acids. Protein of rice bran is appraised as a high-grade protein due to variation of amino acids and types of protein in the crude extract. Alkaline extraction is the most common method for extracting protein from plant materials due to its simplicity and low cost. However, severe alkaline conditions negatively affect the nutritional and functional properties of the protein. This process also requires a long time for extraction and consumes large volumes of buffer. Nevertheless, there are a few novel methods, that uses only water, have been developed for protein extraction such as subcritical water extraction, hydrothermal cooking and microwave-assisted extraction which both are performed under high temperature and pressure. These methods have gained lots of interest due to uses of water that is harmless and more economical in comparison to other methods.

In sub-critical water extraction, raw rice bran (5%, w/v) in distilled water is autoclaved at different temperatures for various time (15, 30, 45 and 60 min). Then the rice bran extract is cooled down to room temperature for around 15 min in ice water and then centrifuged at 8000 rpm for 15 min. The supernatant is collected and analyzed.

In microwave-assisted extraction, three variables were studied for the analysis of the protein content and these include microwave power, extraction time, and solid-liquid ratio.

Keywords:



Gas hydrates - A future generation fuel

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ABSTRACT

The gas hydrates are available in abundance amounting to be double than the fossil fuel. India is having its amount in abundance and these are exportable one. India has recently completed NGHP02. In the current paper the formation and, the dissociation of gas hydrates through some novel technologies is discussed in detail. The paper will highlight how these fuels of explored can replace all other fuels in detail. If we are able to design a novel viable technology for the dissociation of gas hydrates then this white gold can make India shine.

1. Energy Potential of Gas Hydrates

Gas hydrates are seen as a probable alternative renewable energy source. Gas hydrates have gained a major focus because of the increasing demand of hydrocarbons coupled with their diminishing quantities. The amount of methane stored in the form of gas hydrates is more than 1500 times of current natural gas reserve of India. The energy demand of the country can be met for 100 years if only 10% of this resource can be harnessed. Its amount is estimated to be 105 (TCF) to 108 TCF [1]. Numerical modelling estimated its amount to be 1.4 to 1.7x10⁵ TCF [2, 3] to 4.2x10⁶TCF [4] with some intermediate estimates. Recently Boswell et al. (2011) [5] evaluated 105 TCF of methane tapped in them. Among all renewable (Nuclear, Wind, Wave, Geothermal, Hydro, Solar, Bioprocess etc.) and non-conventional (Basin Centered Gas, Gas Shale, Gas Hydrates, Coal Bed Methane, Tight Gas Shale etc.) energy sources, gas hydrates are considered as one of the most relevant contender for cleaner fuels in this century.

Conclusions

Huge methane is tapped in the form of the gas hydrates. They are found worldwide beneath the sea and in permafrost regions. They are considered as future generation fuel provided a viable technology is developed for their exploitation. At present many techniques we are trying for their exploitation however as of now we are not able to design a viable commercial technology. A detailed study is going on at present and many methods are being tried in combination to utilize this white gold.

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Genetic algorithms – A versatile optimization technique

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Abstract

Optimization involves creating or hunting for the best results under the possible circumstances i.e. constraints of a given situation. The aim of this exercise is either minimization or maximization of certain objective(s) by variation of some independent variables. This optimum so located may fall into the category of local optima or global optimum. Most of the conventional techniques result in local optimum instead of the global optimum. The quest for global optimum requires some special techniques called evolutionary techniques like genetic algorithms, swarm intelligence, simulated annealing etc.

As per the Darwin's theory of natural evolution, new individuals are created by the parent organism(s) where the heredity is passed on through DNA that is stored in chromosomes. The species have adapted to the conditions thereby evolving into newer forms. Also natural evolution involves the principle of survival of the fittest. Mutation is another natural process that has resulted in diversification of the gene pool down the ages. Genetic algorithms (GA) are the mathematical operations that mimic the process of natural evolution, thereby resulting in arrival at global optimum point.

The genetic algorithm uses an initial population of set of solutions called chromosomes – a term borrowed from natural systems. These chromosomes contain the information about all the independent variables. These sets of data are allowed to interchange data (called crossover) as per the predetermined rules to create new sets - like offsprings from parents. Also, mutation of data in the sets is allowed, again a mimic from natural process of evolution, thereby creating an entirely new set of data. These new data sets are analyzed for their fit in terms of the objective function. A new generation of population is selected/created randomly to replace the initial population and the process is repeated using the principle of best fit. Over successive generations, the population "evolves" toward an optimal solution. All these steps are used repeatedly till the objective function achieves a certain value.

GA can handle single or multi objective problems and any type of objective function like discontinuous, non-differentiable, highly non-linear, stochastic etc. The chromosome data type may be binary, integer, permutation etc. These features provide versatility to GAs such that this technique finds wide applications in various streams of science and engineering including chemical process modeling, financial forecasting, industrial product design, internet search, non-linear modeling and simulation.

Keywords:



Photocatalytic degradation as well as detection of common pollutants using prepared nanostructures

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Oral Presentation

S.N.	ABSTR ACT ID	Name	Topic
1	CHO-001	Mandeep Singh	<u>Precipitated silica recovery from rice husk ash</u>
2	CHO-002	Madhvi and Dhiraj Sud	<u>Investigations on swelling characteristics of chitosan based hydrogels: Effect of pH and crosslinker</u>
3	CHO-003	Nidhi Sharotri, Abhinandan Syal, Dhiraj Sud	<u>Effectiveness of as-synthesized N-doped- TiO₂ photo catalyst for photocatalytic treatment of real effluent from paper mill</u>
4	CHO-004	Sonali, Pratima Sharma, D. Sud	<u>Studies on persistence of anti-diabetic drug metformin hydrochloride in aqueous medium</u>
5	CHO-005	Abhinandan Syal, Nidhi Sharotri, Dhiraj Sud	<u>Ultrasonic-assistant one-pot green synthesis of heterostructured Bi₂O₃-TiO₂ nanoparticles: An efficient photocatalyst under solar light</u>
6	CHO-006	Sandeep Kumar Tripathi, Nishi Kant Bhardwaj, Himadri Roy Ghatak	<u>Elemental chlorine free bleaching of wheat straw pulp using ozone – A sustainable and clean process technology</u>
7	CHO-007	Bohar Singh,, Rajiv Arora, B S Walia	<u>Adsorption of crystal violet dye by using carbonized cocos nucifera</u>
8	CHO-008	Raj Kumar, Chetan M. Patel , Arun K. Jana, Srikanth R. Gopireddy	<u>Velocity profiles of rosin-rammler particle-size distribution during hopper discharge: Discrete Element Method Analysis</u>
9	CHO-009	Srinivas Tadepalli, Shyamsunder Mishra, Navneet Kaur	<u>Batch studies for the removal of Cu (II) metal ions from synthetic solutions using activated carbon derived from eucalyptus bark saw dust</u>
10	CHO-010	Amandeep Kaur, Ramanpreet Kaur and Sushil Kumar Kansal	<u>Cu-BTC metal organic framework (MOF) derived Cu-doped TiO₂ nanoparticles with enhanced photocatalytic activity for the degradation of ofloxacin in aqueous phase</u>
11	CHO-	Renuka, Renu Gupta, Ajay Bansal	<u>Degradation of organic pollutant in wastewater</u>



	011		<u>using heterogeneous Photocatalysts</u>
12	CHO-012	Anil Kumar, Avinash Thakur, Parmjit Singh Panesar	<u>Application of green emulsion liquid membrane for lactic acid extraction using Tridodecylamine (TDDA) as an extractant</u>
13	CHO-013	Sai Parmeshwar	<u>Modeling of paraffin wax deposition in pipelines by generating temperature and pressure drop profiles along the length of pipelines: Case study of AB field crude oil pipeline</u>
14	CHO-014	Gurleenjot Kaur	<u>Removal of Ofloxacin antibiotic from wastewater using agri-residue ashes & its solidification</u>
15	CHO-015	Jatinder Singh and Gulshan Kumar Jawa	<u>Equilibrium, thermodynamic and kinetic studies for adsorption of toxic Ni(II) ions from water by chemically modified saw dust (<i>tectona grandis</i>)</u>
16	CHO-016	Parminder Singh, Puja Sharma	<u>Comparative analysis of UNIFAC model with other simplified models</u>
17	CHO-017	Chetan Goyal, Devansh Kaushik, Manjeet Singh, Rajiv Arora	<u>Adsorption of methylene blue from aqueous solution by using de-oiled rice bran as adsorbent</u>
18	CHO-018	Dev K. Mandal, Haripada Bhunia, Pramod K. Bajpai	<u>Optimization, biodegradability and evaluation of ecotoxicological impact of radiation grafted polypropylene films</u>
19	CHO-019	Gulshan Kumar Jawa and Hemant Kumar	<u>Photocatalytic degradation of Naphthol blue black dye by hydrophobic copper Schiff base metal complex under UV irradiation</u>
20	CHO-020	Akhouri Sanjay Kumar Sinha, Rajesh Kamboj	<u>Lignin separation from black liquor of agro based paper industry using hydrochloric acid</u>
21	CHO-021	Dhruva Kumar	<u>Reductive amination using Hantzsch 1,4-Dihydropyridine as organo reducing agent in the presence of Sc(OTf)₃ and acidic silica at room temperature</u>
22	CHO-022	Navneet Bhullar, Kamlesh Kumari, and Dhiraj Sud	<u>Ultrasound assisted synthesis of biopolymer chitosan/acrylic acid/thiourea/hydrogels: Characteristic and swelling kinetics</u>
23	CHO-	Bikramjit Singh and Jatinder Singh	<u>Synthesis of new ligands and their metal</u>



	023	Aulakh	<u>complexes with copper(II) ion</u>
24	CHO-024	Surinder Singh, S. K. Sharma, S. K. Kansal	<u>Removal of toxic pigment gossypol from cottonseed using solvent extraction</u>
25	CHO-025	Nikhil Prakash	<u>Simulation and sensitivity analysis of catalytic gas-phase propene polymerization</u>
26	CHO-026	Gulshan Kumar Jawa, Sandeep Mohan Ahuja	<u>Batch studies on Cadmium(II) removal from aqueous solutions through adsorption on pods of acacia karoo</u>
27	CHO-027	Poonam Rawat, Alok Ranjan, R. N. Singh, Sweta Trivedi, Armeen Siddique and Vikas Baboo	<u>Synthesis, structure evaluation, non-linear optical properties and antimicrobial activity of pyrrole-azole derivatives</u>
28	CHO-028	Himanshu Rani, R. N. Singh and Poonam Rawat	<u>Synthesis, spectroscopic characterization of heterocyclic chalcones containing pyrrole: Experimental and theoretical study</u>
29	CHO-029	Jyoti Rana, Gyanendra Goindi, Navneet Kaur	<u>Neem leaves as adsorbent for dye waste water</u>
30	CHO-030	Preeti Beniwal, Rajiv Arora, Amrit Pal Toor	<u>Extraction & recovery of phytic acid from rice bran</u>
31	CHO-031	Devansh Kaushik, Jatinder Kumar Aggarwal, Rajiv Arora	<u>Biodiesel production from high free fatty acid spent bleach earth oil</u>
32	CHO-032	Pankaj Kalra, Rajeev Garg	<u>Advanced materials & their synthesis techniques for various components of solid oxide fuel cells- A Review</u>
33	CHO-033	Kanupriya Sharma, Tapan Sharma, Praveen Kumar, Gaurav Verma,	<u>Synthesis, Characterization of Zinc Selenide nanoparticles and its effect on photoluminescence properties at different wavelengths</u>



Precipitated silica recovery from rice husk ash

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ABSTRACT

India is one of the world's largest producers of white rice and brown rice. During processing of rice, rice husk is being produced during de-husking operation which finds its application as fuel mainly in industrial boilers being used in dyeing industry, biomass-based power plants, paper mills, rubber industry, par-boiled rice mills etc.

In Punjab, Ludhiana which is known as the hub of Indian hosiery industry is consuming around 4.50 lakh MT of rice husk as fuel in industrial boilers, thus generating around 0.7 – 0.8 lakh MT of Rice Husk Ash (RHA) annually. Presently, this RHA is being disposed off in low lying areas and along road sides which leads to deterioration of ambient air quality due to low bulk density thus posing problems to the nearby residents. The quantum of RHA generation is huge / substantial but did not find any productive use in any of the manufacturing process.

Punjab State Council for Science and Technology (PSCST) had carried out “Techno-Economic Feasibility Study for Silica Recovery from Rice Husk Ash” under the project supported by Punjab Pollution control Board (PPCB). The study is focused at Ludhiana which is the hub of Indian hosiery industry and critically polluted area as notified by Ministry of Environment & Forest, GoI.

The study revealed that silica can be recovered from waste material (RHA) either by carbonation route or acid route. The silica recovery from RHA is in the range of 60-65%. Silica is used in rubber industries as reinforcing agent. It is used as an anti-caking agent in cosmetics, toothpastes, food industries etc.

Keywords: Rice husk ash, Silica recovery, Waste management, Textile dyeing industry.

Methodology Adopted

The major objectives of the study are:

To study the present method of disposal of Rice Husk Ash and its cost economics.

To estimate the quantum of rice husk consumption viz-a-viz rice husk ash generation in Ludhiana.

Techno-economic feasibility study to explore the potential of silica recovery from RHA.

Results and Discussion

During the study, it has been found that there are around 277 industries in Ludhiana using boiler for their process requirement, out of which 11% are large scale units, 5% medium



scale and remaining 84% are small scale units. The total consumption of rice husk in Ludhiana has been estimated as 1498 TPD with RHA generation as 225 – 270 TPD. The small and medium scale units are disposing off their RHA in low lying areas and along road sides within a radius of 15 - 20 km with the help of tractor trolley. After detailed deliberations with the industry, the disposal cost of RHA in moist form was found to be in the range of Rs. 200 - 250/Ton. During study, samples of RHA were collected for analysis from the industries, consuming rice husk in large quantities such as textile dyeing, dyeing with co-generation facility and tyre & tube manufacturers. The silica content in RHA was found to be in the range of 80-84% indicating scope for silica recovery. The typical properties of precipitated silica as shown in table below:

Sr. No.	Parameter	Details
1.	Appearance	White fluffy powder
2.	Purity	≥ 98%
3.	Surface Area	100-350 m ² /g
4.	Bulk density	120 – 400 g/l
5.	Loss on Ignition	3.0 – 6.0 %

The study revealed that silica can be recovered from waste material (RHA) either by carbonation route or acid route. The said routes consist of three stages named as digestion, precipitation and re-generation. The first stage involves the digestion of RHA with caustic soda at specific conditions. In this stage, silica present in the ash gets extracted with caustic soda to form sodium silicate solution. After the completion of the digestion, the solution is filtered for the residual undigested ash present in the solution to get Bio-char. The clear filtrate of sodium silicate solution is taken for precipitation of silica. The silica recovery from RHA is in the range of 60-65%. Silica is used in rubber industries as reinforcing agent. It is used as an anti-caking agent in cosmetics, toothpastes, food industries etc. There is a growing demand for fine amorphous silica in the production of high-performance cement, concrete to be used in bridges etc.

Conclusions

In nutshell, the quantum of RHA produced in the State has been estimated around 500 TPD which is presently being disposed off in low lying areas and along road sides, thereby deteriorating the ambient air quality. The technologies for the recovery of sodium silicate/ silica recovery from RHA have already been identified which needs to be demonstrated in the State for the scientific management and disposal of RHA.

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Investigations on swelling characteristics of chitosan based hydrogels: Effect of pH and crosslinker

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ABSTRACT

Hydrogel is three-dimensional macromolecular polymer gel, synthesized from hydrophilic monomers in the presence of functional crosslinker. The resulting crosslinked networks possess large voids which can retain significant amount of water but does not dissolve in water. Chitosan is a linear amino polysaccharide composed of randomly distributed D-glucosamine (deacetylated unit) and N-acetyl-D-glucosamine (acetylated unit) units linked by β -(1 \rightarrow 4) glycosidic bonds. In the present study, Chitosan based crosslinked hydrogels were synthesized by free radical polymerization of monomer acrylic acid on to the biopolymer chitosan employing two different crosslinkers and potassium persulphate as initiator using ultrasonic waves. Two different chitosan-based hydrogels synthesized were designated as CTA and CGA. FT-IR, SEM-EDX, and Thermal analysis were carried out to characterize the synthesized Hydrogels. Swelling characteristics of CTA and CGA hydrogels were studied by performing the swelling experiments at different pH 2, 7 and 10. The effect of pH and crosslinker on swelling behavior of hydrogels was assessed. Maximum % swelling for CTA hydrogel was found to be 33-87% at pH 10 and for CGA, 393% at pH 2. The swelling response of synthesized hydrogels demonstrated the remarkable sensitivity to change in pH. Effect of crosslinker was evident as higher % swelling was attained in case of CTA. Maximum stability of both hydrogels was observed at pH 10. From the swelling data, swelling kinetics was obtained in order to assess the water transport behavior of hydrogels.

Keywords: *Chitosan, Hydrogels, Acrylic acid Crosslinker, Swelling Kinetics.*

Methodology Proposed

The objectives of present investigation are Synthesis and characterization of chitosan based hydrogels using different crosslinkers. Effect of pH and crosslinker on swelling response of hydrogels. Investigation of swelling kinetics of CTA and CGA hydrogels. To attain the above mentioned objectives, the following procedure was adopted.

Preparation of hydrogels:

For making chitosan solution, chitosan was completely dissolved in acetic acid solution and kept undisturbed for 24hrs. Then another monomer acrylic acid was added dropwise to chitosan solution followed by dropwise addition of potassium persulphate to initiate the reaction and in the last crosslinking reagent was added. The reaction mixture was subjected to ultrasonic waves at 40°C in ultrasonic water bath.

Swelling Experiments:



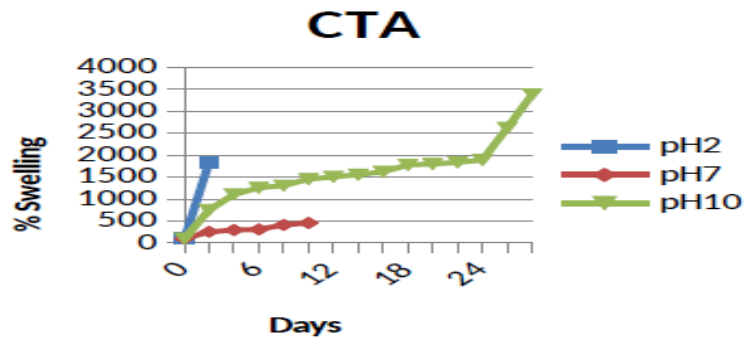
The swelling studies were performed by immersing 0.1g of dried gel in 100ml of Millipore water until the swelling reached at equilibrium. Swollen gels were withdrawn at regular intervals of time and weighed after removing excess surface water with the help of filter paper. The data for swelling studies was fit into equation (1) to assess the transport behaviour of water through polymer network.

$$W_t/W_\infty = kt^n \quad (1)$$

The value of n provides the information about the operative mechanism for water adsorption. If the value of n is less than 0.5, it indicates the applicability of fickian kinetics and if value of n is in the range of 0.5-1.0 then the process is non fickian.

Results and Discussion

The % swelling of polymeric gels (CTA and CGA) was recorded at pH (2, 7, 10). Maximum % swelling of CTA was attained at pH 10 i.e. 3387%. The hydrogel was not stable both in acidic and neutral solutions as it get degraded. In case of CGA, the gel was found to be stable at pH 10, however higher % swelling was observed at pH 2 & pH 7 (393% & 345%).



Graph1: Effect of pH on swelling behavior of CTA

The n values for CTA and CGA were 0.498 and 0.389, thus fickian behavior was noticed in both hydrogels. The calculated diffusion coefficient values were $1.71 \times 10^{-10} \text{ cm}^2\text{s}^{-1}$ & $1.99 \times 10^{-8} \text{ cm}^2\text{s}^{-1}$ for CTA and CGA respectively.

Conclusions

Chitosan based hydrogels with terephthalaldehyde crosslinker were found to be super hydrophilic as % swelling for CTA was 3387% respectively. The swelling response of synthesized chitosan based hydrogels was found to be sensitive to change in pH and crosslinker. Water sorption mechanism is fickian in nature for both hydrogels.

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Effectiveness of as-synthesized N-doped- TiO₂ photo catalyst for photocatalytic treatment of real effluent from paper mill

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ABSTRACT

Semiconductor based TiO₂ photocatalysis has received much more attention because of its properties like non-toxicity, chemical and biological stability, low cost and higher photocatalytic activity. However, to make it more viable technical and commercially, various extensive investigations are in progress for development of modified TiO₂ photocatalyst by modifying its optical properties. The present research paper focuses on synthesis, characterization and photocatalytic activity of the synthesized N-doped TiO₂ photocatalyst. Cavitation induced synthesis of N-doped TiO₂ photocatalyst resulted in formation of anatase phase as main phase with tetragonal structure, having the particle size of approximately 10-20 nm. The effectiveness of the as synthesized modified N-doped TiO₂ photocatalyst (NT-450) for photocatalytic treatment of real effluent obtained from paper mill has been investigated.

Keywords: *Photocatalyst, Ultrasonic irradiation, Photocatalysis, Anatase, Effluent*

Methodology Proposed

N-doped TiO₂ photocatalyst was synthesized by using titanium isopropoxide as titania precursor, hydroxylamine hydrochloride as nitrogen precursor respectively. The N-doped-TiO₂ photocatalyst was synthesized by novel ecofriendly technique i.e. by irradiation with ultrasonic waves. Cavitation assisted synthesis involves the generation of localized hot spots having high temperature (5000°C) and high pressure (1000 atm) which led to the formation of uniformly distributed nanomaterials with high yield in short span of time. Synthesized photocatalyst was characterized by different analytical techniques. The as synthesized photocatalyst was used for photocatalytic treatment of paper mill effluents.

Results and Discussion

The efficacy of the as-synthesized N-doped TiO₂ photocatalyst calcinated at 450°C for photocatalytic treatment of real effluent obtained from paper mill has been investigated. Photodegradation experiments were performed using effluent containing lignin and chlorophenols under optimized conditions (catalyst dose 1g/ L; red light). Paper mill effluent was characterized for physical and chemical parameters. UV-Vis spectra of effluent show broad absorption band in the UV-region at 210- 350 nm. Time dependant



UV-Vis spectra of the effluent during photo-irradiation under red light with NT-450 at 660 nm was shown in **figure 1**.

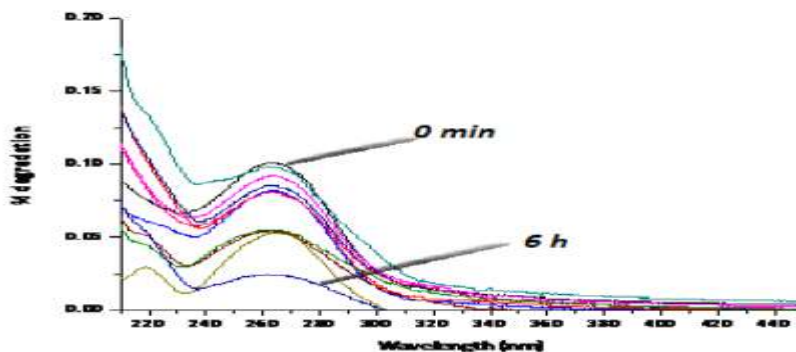


Figure 1: Time dependent UV-Vis spectra of real effluent

The absorption peak diminished gradually with irradiation and 76.2% of the effluent has been degraded after 6 h and the change in the HPLC chromatogram w.r.t. degradation has also been studied.

Conclusions

The synthesized N-doped TiO₂ photocatalyst (NT-450) exhibited anatase phase with tetragonal structure. The morphological studies confirmed the formation of entangled nanoplates, with particle size of approximately 10-20 nm. The photocatalytic activity of the NT-450 evaluated for degrading paper mill effluent was found to be 76.2% after 6h and also confirmed from HPLC chromatogram of the effluent samples.

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Water. Treat. Doi: 10.1080/19443994.2015.1026278.



Studies on persistence of anti-diabetic drug metformin hydrochloride in aqueous medium

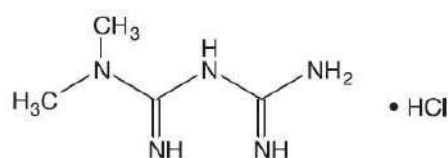
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ABSTRACT

Metformin is one of the most commonly prescribed medication for the patients suffering from Type-II diabetes (NIDDM) all over the world. It is an oral antihyperglycemic drug belonging to biguanide family, chemically known as 1,1-dimethyl biguanide monohydrochloride having the following structure.



Metformin Hydrochloride

This drug effectively treats diabetes by reducing glucose levels and increasing insulin sensitivity. Metformin is highly soluble in water, appreciable soluble in methanol and practically insoluble in non-polar solvents such as acetone, ether and chloroform [1]. Due to its low absorption in body, it is recovered unchanged in urine and feces and contributes to synthetic mass loads in wastewater treatment plants [2]. It is among the pharmaceuticals which are found abundantly in wastewater effluents from hospitals, clinics, pharmaceutical industries and domestic sewage. Due to its high aqueous mobility, it is expected to be present in surface water once released in the environment. Metformin has been considered as emerging micropollutant based on its high consumption and reported exotoxicity [3]. Metformin remains bio-active even at extremely low concentration. Due to the endocrine disrupting effects of metformin, its long-term exposure to fishes causes reduction in fecundity, overall size and intersex behaviour [4]. Keeping into account, its solubility, mobility in water bodies, ecological and health hazard issues associated with metformin, it becomes imperative to investigate its persistence and degradation in aqueous environment.

Keywords: *Metformin Hydrochloride, biguanide, antihyperglycemic, persistence, micro-pollutant.*

Methodology Proposed

In the present investigations, the persistence of metformin was assessed in test solution viz deionised water, tap water and simulated human plasma solution. Experiments were also performed to analyze its degradation in solar light and UV light. The samples were prepared in replicates in transparent and amber colored reagent bottles, each containing 5 mg metformin hydrochloride in 100 ml of test solutions. The residual concentration of pharmaceutical was obtained by spectrophotometric and chromatographic methods using



UV-Vis spectrophotometer and Reverse Phase- High Performance Liquid Chromatography. RP-HPLC was performed on C-18 column by using mixed ACN and buffer solution as mobile phase. hydrochloride.

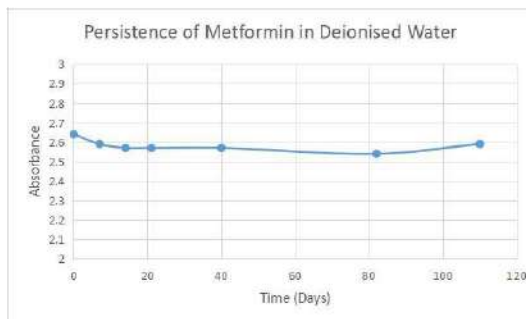


Fig.2 The persistence/degradation study was further confirmed from RP-HPLC chromatogram.

Results and Discussion

Metformin shows a peak at 233nm in UV region and the recorded UV spectrum of 50 ppm metformin solution is shown in Fig1. The UV- Vis spectral data of day 0, 7, 14, 21, 40, 84 and 110 was used to plot the persistence graphs in different test solutions. No peak shift was observed in UV-Vis spectral results even after 100 days. As shown in Fig. 2,3,4. The experimental data as obtained from UV-Vis spectrophotometric measurements clearly reflects the highly persistent nature of metformin hydrochloride in the employed conditions.

Conclusions

The present investigations provides an evidence that despite the gold standard activity of metformin in treatment of NIDDM, It should be considered as an foible due to its persistence in aquatic bodies and due to it's ecological and health perspective further detailed investigations are suggested for this pharmaceutical drug.

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Ultrasonic-assistant one-pot green synthesis of heterostructured Bi₂O₃-TiO₂ nanoparticles: An efficient photocatalyst under solar light

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ABSTRACT

The aim of present research is the development of economical, safe and green synthesis routes that lead to the formation of photocatalyst which overcome the problems related to particle size, significant optical response in visible light, degradation efficiency, etc. Here, we report one-pot synthesis of heterostructured Bi₂O₃-TiO₂ nanoparticles (BTO NPs) using greener- ultrasonication approach. The physicochemical properties of as-synthesized nanoparticles were studied using X-ray diffraction (XRD), Fourier Transform infrared (FTIR) spectroscopy, Scanning electron microscopy (SEM) and UV-visible spectroscopy. The BTO NPs showed porous spherical morphology with particle size 20-25 nm. The photocatalytic degradation efficiency of BTO NPs under solar light was investigated by using Rhodamine 6G (RhG) dye. The results show 98.1% removal of RhG in 100 minutes at 9 pH.

Keywords: *Nanoparticles, heterostructured, Bi₂O₃-TiO₂, photo-catalyst, degradation, Rhodamine 6G, Solar light.*



Elemental chlorine free bleaching of wheat straw pulp using ozone – A sustainable and clean process technology

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ABSTRACT

For making white varieties of paper and paperboard the unbleached pulp is treated with different types of chemicals in different sequences. Chemicals like chlorine, hypochlorite, hydrogen peroxide and chlorine dioxide are being used conventionally for bleaching of chemical pulps. Bleaching of pulp using chlorine and/or chlorine based chemicals generates large amounts of pollutants measured commonly as biochemical oxygen demand (BOD), chemical oxygen demand (COD), and colour. The effluent generated also contains significant amount of highly toxic compounds including organochlorine compounds, measured as adsorbable organic halogens (AOX). Moreover, quality of pulp specifically in terms of optical and strength properties also got deteriorated after using these chlorine and chlorine based compounds during bleaching. Pre-bleaching treatment of pulp with oxygen and ozone reported to reduce the generation of pollutants substantially and improve the quality of pulp. Oxygen delignification stage is applied on unbleached pulp to reduce lignin content. The ozone treatment of pulp is generally carried out just after oxygen delignification stage for further removing the lignin content of pulp before final bleaching stages, which resulted in significant reduction of operating cost and generation of less environmental, hazardous compounds during bleaching. Elemental chlorine free (ECF) bleaching sequences are reported to be cleaner compared to elemental chlorine based sequences. Unfortunately, most of the studies carried out on ECF bleaching using oxygen delignification and ozone pre-treatment are on hardwood and softwood pulps. Very scanty literature is available on ECF bleaching of wheat straw using oxygen delignification and ozone. The reason behind scanty literature may be due to the less utilization of agro residue based raw materials for making pulp by most of the developed countries. In India contribution of agro based raw material (mostly wheat straw and bagasse) in total paper production is about 30%. Wheat straw, bagasse and sarkanda are the major nonwood fiber amongst the variety of agro residue based raw materials used by the paper mills. Wheat straw is the most common non-wood fiber used for making writing and printing paper by the agro based paper mills. Among the different



agro residues based raw material in the world the wheat straw is the most abundantly available raw material. The global availability of wheat straw is reported to be about 600 million metric tonne, sugarcane bagasse about 102 million metric tonne and rice straw about 360 million metric tonne. Presently, the contribution of agro residue based materials in the global paper and board production is about 8% only and rest 92% of production comes from either softwood or hardwood. Studies were carried out on wheat straw pulp using ECF bleaching sequences (D₀E_{OP}D, OD₀E_{OP}D and OZD₀E_{OP}D) with and without using oxygen delignification and ozone pre-treatment and compared with conventional elemental chlorine based bleaching sequence CE_{OP}HH to see their effect on generation of pollutants during bleaching and quality of the pulp produced. Results showed that use of ECF bleaching sequence D₀E_{OP}D reduced the BOD, COD, colour and AOX in the bleaching filtrate by 49.9%, 51.7%, 56.4% and 70.7%, respectively, compared to that generated with use of conventional elemental chlorine based bleaching sequence CE_{OP}HH. The optical properties like brightness and whiteness were improved along with the significant improvement in pulp viscosity by 58.8%. The brightness reversion measured as post colour number was reduced significantly by 66.1%. ECF bleaching of wheat straw pulp improved the double fold by 15.9%, tensile index by 16.2%, burst index by 41.4% and tear index by 73.8% as compared to that obtained using conventional elemental chlorine based bleaching. Incorporation of oxygen prior to ECF bleaching sequence D₀E_{OP}D further reduced the BOD, COD, colour and AOX in the bleaching filtrate by 38.1%, 41.6%, 44.1% and 49.7%, respectively. Introduction of oxygen delignification prior to ECF bleaching further improved the optical properties but marginally reduced the pulp viscosity by 4.6%. The post colour number was further reduced significantly by 22.0%. Incorporation of oxygen delignification stage prior to ECF bleaching improved the tensile index by 4.6%, burst index by 18.9% and double fold by 21.6% but reduced the tear index by 8.4% as compared to that obtained using ECF bleaching without oxygen delignification. ECF bleaching of wheat straw pulp using ozone was found to be the most clean process and able to reduce the BOD, COD, colour and AOX in the bleaching filtrate by 62.6%, 65.6%, 76.4% and 73.2%, respectively, compared to that obtained during ECF bleaching of pulp without using pre-bleaching treatments. ECF bleaching of pulp using ozone significantly improved the optical properties like brightness by 2.5 units and whiteness by 4.1 units but marginally reduced the pulp viscosity by 0.6 units. The post colour number was further reduced significantly by 34.8%. The physical strength properties obtained with ECF bleaching of wheat straw pulp were comparable with those obtained using ECF bleaching without ozone. ECF bleaching of pulp using ozone was found able to reduce the BOD, COD, colour and AOX in effluent by 81.3%, 83.4%, 89.7% and 92.2%, respectively as compared to that obtained with conventional elemental chlorine based bleaching sequence CE_{OP}HH. Similarly tensile index of pulp was improved by 24.2%, double fold by 36.4%, tear index by 61.1% and burst index by 69.7% with the ECF bleaching of pulp using ozone as compared to that obtained with conventional elemental chlorine based bleaching. Quality parameters of the pulp like brightness, whiteness and viscosity were improved by 5.7%, 8.6% and 42.6%, respectively and P.C. number was reduced by 82.8% with the ECF bleaching of



pulp using ozone as compared to that of obtained with conventional elemental chlorine based bleaching. Elemental chlorine free bleaching of pulp using ozone was found to be the cleanest technology for the bleaching of wheat straw pulp among the studied bleaching sequences with respect to reduction in pollutant generation and improvement in quality of pulp.

Keywords: ECF bleaching of pulp, oxygen delignification, ozonation, soda-AQ pulping, environment



Adsorption of crystal violet dye by using carbonized cocos nucifera

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ABSTRACT

The adsorption of Crystal Violet (CV) dye was performed in this study on carbonized coconut fiber (*Cocos nucifera*). The batch experiments were performed to optimize the parameters for the maximum adsorption of the CV dye and the parameters included were - initial dye concentration, amount of adsorbent, contact time, pH of the dye solution and temperature. The maximum adsorption of 93.74% was obtained at 10 ppm initial dye concentration, 1.5 g/L adsorbent, pH 9 and at 40°C. The adsorption kinetics study was carried out within framework of two most important models: pseudo-first order and pseudo-second order. It was found that the adsorption of CV dye on carbonized coconut fibre followed pseudo-second order kinetics. The experimental isotherm data was analyzed using Langmuir and Freundlich models. Both Langmuir and Freundlich isotherm models were found fit in this study, but Freundlich isotherm model gave better results than Langmuir isotherm model. Thus, this study indicates carbonized coconut fiber as effective adsorbent for the removal of crystal violet dye from aqueous solutions.

Keywords Adsorption, Carbonized Coconut fiber, Crystal Violet Dye, Isotherms, Wastewater Treatment

Methodology Proposed

In this work, our target is to study the basic dye Crystal Violet adsorption on Charcoal from Coconut fiber which was obtained from the local market in Ferozepur (India). The dye, Crystal Violet (CV), was purchased from S D Fine Chemicals, India. The Coconut fiber was first cleaned with fresh water to remove the soil, sand and any other undesirable material and then, kept in sunlight for one days. It was further reduced to small size particles through grinding. These particles were paralyzed in a furnace at 400°C temperatures for 4 hours. The produced char was grinded, sieved and stored in an air tight container and labeled as Coconut fiber Char (CFC). The experiments were conducted in 250 mL Erlenmeyer flasks with the working volume of 100 mL of aqueous solution. The initial pH of the solution was adjusted to the desired value by adding 0.1 M NaOH or HCl. The required amount of adsorbent dose was added in the flasks. The flasks were shaken for the specified time period in a temperature -controlled incubation shaker at 120 rpm. The flasks were withdrawn from the shaker after the desired time of operation. The supernatant and the spent adsorbent were separated by using the centrifugation at 5000 rpm for 15 minutes and operation (R24 REMI Centrifuge, Mumbai, India). The residual dye concentration in the supernatant was analyzed by measuring the solution absorbance



at $\lambda = 588$ nm using a UV-visible spectrophotometer (Model - EI-2375, Electronics India). All experiments were carried out in triplicate and the average values are presented. The amount of equilibrium absorption Q_e (mg/g) of the dye was calculated by:

$$Q_e = \frac{c_0 - c_e}{w} V$$

(1)

The percentage removal of dye was calculated as:

$$\% \text{ Dye removal} = \frac{c_0 - c_e}{c_0} \times 100$$

(2)

Results and Discussion

Various experimental parameters analyzed in this study include amount of adsorbent, initial concentration of dye, contact time, pH of solution and temperature. The adsorbed quantity on CFC adsorbent increased by increase in initial concentration of Crystal Violet dye. This can be explained by the presence of a large number of molecules which will diffuse toward sites of the adsorbent surface and consequently partial adsorption depends on the initial concentration [1]. The adsorption percentage increased with adsorbent's dosage rise, but the amount of adsorbed dye per adsorbent unit mass decreased with a rise in adsorbent amount from 1.5 to 6 g/L. It has been observed that the dye removal is increased on increasing the pH of the solution from 5 to 9. Afterward, there is a slight decrease in removal efficiency on further enhancement in pH of the medium. Thus, an optimum pH 9 is selected for further adsorption studies on CV dye. Crystal Violet is a basic dye and has a pKa value of 0.8 [2]. The absorption (%) increases up to 40 °C and thereafter remains constant till 50°C. The adsorption decreased when the temperature was further increased to 60°C from 50°C. The adsorption capacities were calculated using the Langmuir and Freundlich isotherms. The adsorption kinetics of the Crystal Violet dye was studied using the pseudo-first order and the pseudo-second order models.

Conclusions

The present study shows that crystal violet dye could be adsorbed from the aqueous solutions in eco-friendly conditions using carbonized Coconut Fiber. The maximum decolorization percentage of 93.74% was obtained at 10 ppm initial dye concentration, 1.5 g/L adsorbent and at 40°C. Kinetic studies of CV dye on CFC were carried out using pseudo-first order and pseudo-second order reaction kinetics and it was found that pseudo-second order reaction kinetics fit best for the adsorption of CV dye on CFC. Both Langmuir and Freundlich equation could represent the adsorption data well with reasonable and consistent values of parameters but the Freundlich model describes better adsorption on the CFC.

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Velocity profiles of rosin-rammler particle-size distribution during hopper discharge: Discrete Element Method Analysis

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ABSTRACT

In the present work, the discrete element method (DEM) is used to investigate the velocity profile of rosin-rammler particle size distributions (R-R PSDs) during hopper discharge. The velocity profiles inside hopper are measured by tracking each particle in simulation domain. The effect of spread parameter (PSD width) and location parameter on velocity profile is studied systematically. The velocity profiles vary along the different sections of hoppers during whole discharge, but remain invariant in shape and follow a pure parabolic increase from the hopper wall. The velocity profiles for considered PSDs can be expressed by radially distance from hopper wall, which infact help in developing an analytical mass-flow criterion during hopper discharge processes.

Keywords: *Discrete element method, Rosin-rammler particle size distribution, Velocity profiles*

Methodology

Discrete element method

Discrete element method (DEM) is numeric technique in which forces and trajectory on each and every particle in the system are tracked through suitable contact law and Newton's equation of motion. The basic computation scheme for DEM simulation is shown in Fig. 1.

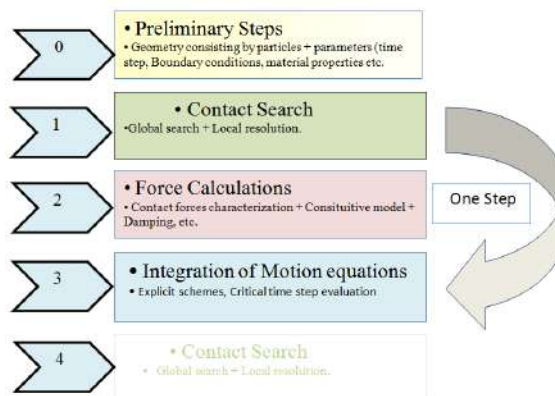


Fig. 1: Basic computational scheme for the DEM.



Different simulation packages and open source softwares available to perform DEM modeling. In this study LIGGGHTS 3.5.0 is used to carry out the DEM simulations. LIGGGHTS is an open source code for modeling granular materials. The implementation of all the models along with their validation within LIGGGHTS is given by Kloss et al. [1]. The contact model based on Hertz's law is used to compute the forces between the interacting particles in all simulations. In the present study, rosin-rammler particle size distributions (R-R PSDs) are considered having cumulative-mass form [2] as follows:

$$R = 1 - \exp \left[- \left(\frac{x}{x'} \right)^n \right]$$

where, R is cumulative undersize distribution function, x is particle size ($x \geq 0$), x' is location parameter of the distribution, i.e., the particle size corresponding to 63.2% cumulative distribution undersize, and n is spread parameter (PSD width) of the distribution ($n > 0$).

Results and Discussion

In this paper, behaviour of Rosin-Rammler particle size distributions (R-R PSDs) during hopper discharge process have been investigated. The effect of PSD width and location parameter on mass discharge rate during hopper discharge process is also examined.

Table 1: Prediction of MDR by DEM and Beverloo correlation.

PSD width (n)	Location parameter (x')	DEM (kg/s)	Beverloo correlation (kg/s)
3	5	1.64	1.69
4	5	1.57	1.61
5	5	1.53	1.56
5	3	1.86	1.82
5	4	1.68	1.69

Results indicate that an increase in PSD width (at constant location parameter) and location parameter (at constant width) plays significant impact on mass discharge rate (MDR). The results are tabulated in Table 1. MFR obtained from DEM is also compared with existing beverloo correlation and shows a good agreement for studied R-R PSDs. On the other hand, the relationship between PSD width and particle velocities is generally non-monotonic with no consistent trends, whereas the particles velocity decreases sharply with increase in location parameter (x'). The velocity decreases with radial positions and is relatively insignificant in the region close to the wall. Such a velocity profile is also observed by Wang et al. [3] in their latest study. The velocity profiles for considered PSDs vary along the different heights of hopper during discharge, but remain invariant in shape and follow pure parabolic increases from the walls of the hopper.

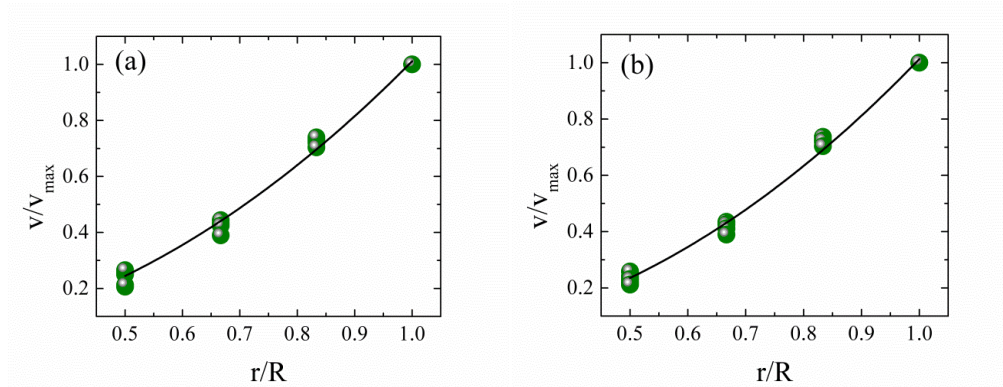


Fig. 2: Rescaled velocity profiles, (a) as a function of PSD width, (b) as a function of location parameter for studied R-R PSDs. The solid lines are the fits of the rescaled velocity profiles to a power law as $v/v_{\max}=(r/R)^2$

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Batch studies for the removal of Cu (II) metal ions from synthetic solutions using activated carbon derived from eucalyptus bark saw dust

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ABSTRACT

The increase in the industrial activity during the recent years has significantly contributed to the increase of heavy metal ions in the environment mainly in the aquatic systems. Heavy metal ions such as cobalt, copper, chromium, nickel, palladium, lead, zinc are detected in the waste streams from the mining operations, tanneries, electronics, electroplating, batteries and petrochemicals industries has major effects on the human and aquatic life. The performance of adsorbate-adsorbent system was studied using activated charcoal prepared from eucalyptus tree bark. Interestingly as the pH increased the impact of hydrogen ions diminished and more ligands were accessible for the adsorption. In this manner at higher pH values the general surface on the adsorbent turned out to be more negative and the rate of adsorption increased. The increasing order of pH was $6 > 4 > 2 > 8$. The effect of initial metal ion concentration at 10 ppm shows that up to 76.6 % removal was adsorbed at the initial metal ion concentration of 10 mg/l within 120 minutes and later got saturated at 120 min of the reaction time. The % removal increases in the order as $10 > 20 > 30 > 40 > 50$ ppm. The parameter adsorbent dose was considered to be significant for effective metal ion removal as it determines sorbent-sorbate equilibrium of the system. The amount of copper adsorbed per unit mass of the adsorbent decreases with an increase in adsorbent dosage from 0.5 to 5 g/L which determines the number of binding sites available for adsorption. The number of adsorption sites or surface area increases with the increase of adsorbent dosage and hence results in a higher percentage removal. The influence of metal adsorption plays a significant role and the % removal increases with increase in adsorbent dosage at the early stages of adsorption and later got saturated at 110 -120 min for Cu (II). The outcomes acquired from the contact time demonstrates that the rate of adsorption increases/raises with the increment of contact time between the adsorbent and metal ion/particle/adsorbate in the solution. After certain amount of time all the active sites of the adsorbent were filled either with metal ions or the solution itself was saturated. So the increase in rate of adsorption ceases and percentage removal becomes constant and approaches a saturation point. It can be concluded that with respect to increase of contact time the % removal increases and the optimized contact time for Cu (II) was 105 to 120 min where (93.615 % removal) was reported at pH 6.

Keywords: *Eucalyptus tree bark, pH, initial metal ion concentration, adsorbent dose, contact time*



Fig 1 Eucalyptus bark tree logs



Fig 2 Activated carbon prepared from eucalyptus bark powder



Fig 3: Remaining part of the adsorbent with Cu (II) ions being adsorbed



Cu-BTC metal organic framework (MOF) derived Cu-doped TiO₂ nanoparticles with enhanced photocatalytic activity for the degradation of ofloxacin in aqueous phase

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ABSTRACT

The application of heterogeneous photocatalysis in wastewater treatment has gained increasing interest on account of its prospective utilization of entire solar spectrum. In this study, Cu-doped TiO₂ nanoparticles were prepared using ultrasonic assisted precipitation method. The synthesized samples were characterized in detail to understand its crystalline, structural and morphological properties using different analytical techniques. The characterization results exhibited that the prepared photocatalyst possessed high crystallinity, purity and nanoparticles like morphology with an average diameter of 15-25 nm. The band gap for Cu-doped TiO₂ nanoparticles has been estimated to be 3.10 eV, which is significant in enhancing the visible light induced photocatalysis. Further, the prepared Cu-doped TiO₂ was used as photocatalyst for the degradation of ofloxacin in aqueous solution. About 72% degradation of ofloxacin (10 mg/L, pH 7) was obtained within 180 minutes under visible light. The role of active radical species for the photocatalytic degradation of ofloxacin was investigated and accordingly probable mechanism was proposed.

Keywords: Photocatalysis, Ofloxacin, Cu-doped TiO₂, Visible light



Degradation of organic pollutant in wastewater using heterogeneous Photocatalysts

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ABSTRACT

Textile industries are major contributors of hazardous organic pollutants like dyes and other chemicals into water bodies. Due to highly toxic and hazardous nature of dyes, it is therefore essential to remove them from water bodies before the discharge. The advanced oxidation processes were used to degrade organic pollutants in water. The photocatalytic systems were effective for degradation of complex azo dyes using heterogeneous photocatalysts. In the present study, degradation of an azo dye, Orange G, was conducted in wastewater with different semiconductor nanomaterials acting as photocatalysts under UV light. The nanotubes of titanium dioxide (TiO₂) and zinc sulfide (ZnS) were synthesized and used in the photocatalytic removal of the dye. The purpose of this investigation was to synthesize the semiconductor nanoparticles as a photocatalyst for degradation of Orange G dye. It has been observed that the degradation efficiency was higher for UV/ZnS as compared to UV/TiO₂.

Keywords: *Photocatalysts, wastewater, organic pollutant, degradation, Orange G.*

Methodology Proposed

All materials in this experiment were prepared in the laboratory and of analytical grade. The stock solution of Orange G dye was prepared in distilled water. The instrument UV-Vis Spectrophotometer-2600 Shimadzu was used in this experiment. The photodegradation study of azo dye (Orange G) was conducted in the presence of UV light. The degradation was analyzed by UV-Vis spectrometer at a maximum absorption wavelength of 478nm. The nanoparticles of TiO₂ and ZnS were prepared as a semiconductor photocatalyst for degradation of Orange G dye. (Jorge et al. 2015, Kashinath et al. 2017). The photocatalytic degradation studies were performed in the photocatalytic batch reactor, which consists of two UV tubes (15 W each) irradiating in the wavelength of 254 nm. Cooling fans were employed inside the reactor for the removal of heat generated by light irradiations. First, the suspension was illuminated under dark for 30 min to reach adsorption-desorption equilibrium without UV light exposure. Then the reaction was initiated by UV light with continuous magnetic stirring. At specific time intervals, 3 ml samples were withdrawn and centrifuged (Cruz et al. 2017). Then, the supernatants were collected and analyzed by using the UV-vis spectrometer. The concentration of the dye was noted before and after the illumination of light. The percentage degradation of the dye was calculated by using equation (Jinshao et al. 2017 and Jorge et al. 2015)

$$\text{Degradation (\%)} = \frac{C_0 - C_t}{C_0} \times 100$$



Where C_0 and C_t are the initial and final dye concentrations in the aqueous phase respectively.

Results and Discussion

Calibration Curve of dye:

The calibration curve of Orange G dye was plotted (i.e. Absorbance Vs concentration) at the corresponding wavelength of 478 nm. The calibration curve is used to calculate the concentration of unknown samples directly. The calibration curve of Orange G dye was plotted by varying the concentration of dye solution as shown in Figure 1.

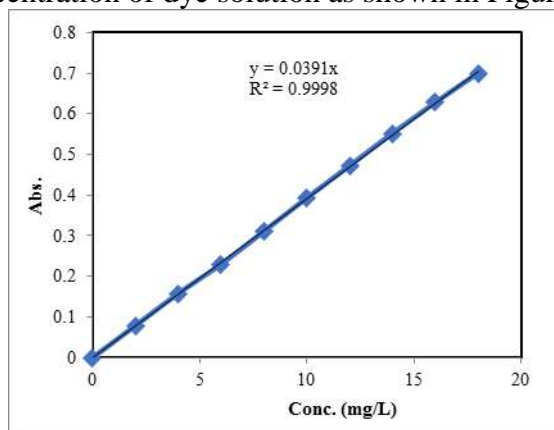


Figure 1: Calibration curve of Orange G, $\lambda_{\max}=478\text{nm}$

Degradation of Orange G under UV light:

It has been observed from Figure 2 that the degradation efficiency of Orange G dye was observed to be 64% and 97% by using TiO_2 and ZnS as Photocatalyst. It was observed that the degradation of dye increased with increase in reaction time.

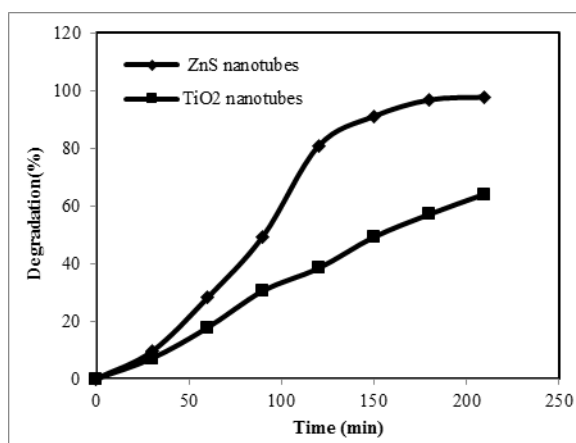


Figure 2: A Comparative study of degradation efficiency using TiO_2 and ZnS

Conclusions

The nanotubes of titanium dioxide, zinc sulfide, were synthesized for the photocatalytic degradation of Orange G dye. It was found that orange G dye has been effectively decolorized in the presence of UV irradiation. The degradation efficiency of orange G



dye was observed to be 64% and 97% by using TiO_2 and ZnS as Photocatalyst. Thus, ZnS found to be more effective photocatalyst for Orange G dye degradation.

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Application of green emulsion liquid membrane for lactic acid extraction using Tridodecylamine (TDDA) as an extractant

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ABSTRACT

This research work elucidates the application of Green Emulsion Liquid Membrane (GELM) based on Rice Bran oil (RBO) for the lactic acid (LA) extraction from aqueous solution. GELM assisted green extraction technique has been confirmed as a promising potential technique in the case of LA separation from aqueous solutions due to its unique and pertinent characteristics/properties. The demand of LA is increasing day by day due to it acts as a platform chemical for several industries such as food, polymer (as PLA), chemical, and biomedical. Previously, various extraction techniques have been successfully applied in the field of LA extraction which are time-consuming, costly, the formation of a by-product, poor extraction efficiency, toxic toward microbes, and large inventory cost. In this present investigation, an environment-friendly separation technique i.e. GELM based on RBO is introduced first time for LA extraction from the aqueous solution. GELM is a fast, effective, and highly selective technique for chemical separation, extraction, and water treatment. GELM is an environment-friendly and economic separation technique.

Keywords: Tridodecylamine, Rice bran oil, Lactic acid, Span 80



Modeling of paraffin wax deposition in pipelines by generating temperature and pressure drop profiles along the length of pipelines: Case study of AB field crude oil pipeline

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ABSTRACT

During transportation of crude oil through a pipeline, when the oil temperature is higher than the pipe wall temperature, there will be a dissolved wax concentration gradient between the bulk oil and pipe wall. Deposition of waxes occurs if the wall temperature falls below the wax appearance temperature (WAT) of oil being transported and as temperature reduces below Pour Point (P.P), the crude oil flow completely ceases. Wax deposition is a major flow assurance issue which affects transportation of crude oil from one point to another point as there will be reduction in production. As remedial costs increase with decreasing production, wax precipitation and deposition significantly influence economy for a field.

The current study deals with an onshore pipeline which transport crude oil. AB field of Asset I was put on production in early 90's. Presently the production from ABC field is almost 400 cubic meter per day. At AB Group Gathering Station (G.G.S) the entire AB crude is heated to 60oC at winter and 50oC in summer and pumped in AB-CD crude dispatch line. Due to high WAT nature of AB crude oil, high precipitation of wax and pressure drop is observed during winters. Due to this production losses are observed and which is more severe during winter season. Chemical treatment has been done in past due to wax content.

Present study helps to analyze the temperature, pressure drop in particular length of pipeline. MATLAB is the software used for modeling and temperature profile of summer and winter season separately and pressure drop along length of pipeline is modeled. As a temperature profile is being created along the length of pipeline, we will be able to locate WAT and Pour Point separately for winter and summer seasons. Pressure drop along the length of pipeline can also be estimated. All the data obtained is compared with field data and an validation is done.

Keywords:



Removal of Ofloxacin antibiotic from wastewater using agri-residue ashes & its solidification

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ABSTRACT

Pharmaceutical compounds are a large group of emerging contaminants (ECs) that are consumed in high quantity all around the world. Recently, many synthetic pharmaceutical compounds such as antibiotics, analgesics, anti-inflammatory, beta-blockers etc. have been detected in various aquatic environments. Worldwide marketing of such compounds is between 1,00000 to 2,00000 tons/year [1]. Therefore, every year a huge amount of antibiotics are introduced into the biosphere. Even at low concentration levels (ng/l), it shows worst effects on human being and ecosystem. Various methods are being used for separation of pharmaceutically active compounds (PhACs) from aquatic system. Many advance processes (chemical treatments, advanced oxidation techniques etc.) are used but these are associated with drawbacks like generation of toxic byproducts, requirement of special equipment's and pre/post treatment and high energy demand [2]. In India huge amount of agri-residues are generated, which are being used as fuel in boilers by various industries. This gives rise to large amount of agri-residue ash that can be used as an adsorbent for separation of PhACs. Adsorption is a favorable separation process because of its well-known advantages. This study presents the removal of PhACs which is a big problem nowadays, treated by using agri-residue ashes as adsorbent. Furthermore, for the safe disposal of exhausted adsorbent, solidification and stabilization (S/S) technique was used to bind the used adsorbent by using Portland cement as solidifying agent in different ratios for controlling the leachate adverse effects into the environment.

Keywords:



Equilibrium, thermodynamic and kinetic studies for adsorption of toxic Ni(II) ions from water by chemically modified saw dust (*tectona grandis*)

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ABSTRACT

Heavy metals are toxic and non-biodegradable and their accumulation in the living tissues can cause various diseases and disorders. Nickel contamination is mainly due to industries related to electroplating, aircraft, pigments, battery, mining and metallurgy of nickel and ceramic industries. Hence there is a need to remove Ni (II) metal ions from the wastewaters from industries before discharging into the environment. In the present paper removal of Ni (II) by thioglycolic acid treated saw dust (*Tectona Grandis*) has been investigated. The dried saw dust was separately treated with 0.1 M thioglycolic acid and continuously stirred for 24 hr at 25°C. The mixture was filtered and thiolated material washed with distilled water and dried. Batch studies suggest that removal is dependent upon contact time, metal ion concentration and pH. Maximum removal by thiolated saw dust at pH 5 due to sulphur-hydryl infused cellulose surfaces which help to take up metals from aqueous solutions in 2.5 hr has been achieved for the concentration range 20 to 200 mgL⁻¹. Removal studies revealed that the majority of metals ions were removed within the initial half hour contact with the adsorbents and increases very slowly later, this may be attributed to the availability of a larger number of adsorption sites in the beginning. The sorption data obtained at optimum conditions have been subjected to various adsorption isotherm models. The value of $1 < n < 10$ indicates the effectiveness of the adsorbent obtained from Freundlich isotherm. The applicability of Langmuir isotherm models and the high values of the correlation coefficients ($r^2 = 0.9897$) suggests - monolayer adsorption. The values of R_L have been found to be between 0 and 1 which suggests favorable adsorption. Thermo dynamical parameters such as free energy change (ΔG^0), enthalpy changes (ΔH^0) and entropy change (ΔS^0) have also been obtained. The negative values of ΔG^0 indicate feasibility and spontaneous nature of adsorption of metal ions on the adsorbent. The positive value of ΔH^0 suggests the endothermic nature of adsorption. The positive value of ΔS^0 suggests the increases randomness at solid solution interface during adsorption. Besides adsorption at the surface, the possibility of intraparticle diffusion has been studied by using the Morris-Weber equation. This shows that decreasing particle size increases the adsorption of Ni(II) on thiolated saw dust. K_p values give an idea about the surface porosity, higher the value of K_p , reveals more porous is the surface. The time course data of Ni(II) adsorption were fitted to pseudo first order and second order Lagergren models to find out the order of reaction. However for thiolated saw dust, the second-order kinetic model, with slightly higher R^2 values, showed a little superiority over the first-order model.

Keywords: Heavy metals, nickel, adsorption, water treatment, *tectona grandis*



Comparative analysis of UNIFAC model with other simplified models

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ABSTRACT

The UNIFAC MODEL is currently the most convenient standardized method for evaluating activity coefficients in liquid mixtures and the estimated activity coefficients can further be used to predict Vapor-Liquid Equilibrium for non-ideal systems. It is based on the concept that in a liquid mixture, the properties of the solution are determined by the properties of the present species not considered as integrated molecular structures but as the relationship and interaction of specific functional groups that structure each molecule in the solution. The activity coefficient is evaluated in terms of Excess Free Energy, that is, the "extra" energy of the solution that makes it non-ideal. It is defined by the following expression:

$$\ln \gamma_i = \left(\frac{d G^E}{d n_i RT} \right)_{P, T, n_i}$$

Where γ_i is activity coefficient

G^E is excess Gibb's free energy

n_i is no. of moles of i^{th} component in solution

R is universal gas constant

T is temperature of the solution

P is pressure of the solution

As we can see, the activity coefficient can be evaluated by changing the free energy in excess of the solution by varying the concentration of the species i keeping the pressure and temperature of the system and the concentrations of the other species constant. The equation to estimate the deviation of ideality in the equilibrium proposed by the UNIFAC model is the following:

$$\frac{G^E}{RT} = G^{comb} + G^{resid}$$

Where G^{comb} corresponds to the Combinatorial Energy due to the molecular shape and size & G^{resid} corresponds to the Residual Energy caused by molecular interactions. Both energies, combinatorial and residual, are evaluated through the use of specific parameters for each present species defined by UNIFAC through a relative molecular volume r_j ; a relative molecular surface area q_j and an interaction parameter $\alpha_{i,j}$ evaluated in binary form between the species. These parameters are obtained by defining the functional units or



sub groups that make up a molecule and interact with each other, confirming the characteristics of each chemical species. Each functional unit is associated with a relative volume (R_v) and a relative surface area (Q_k), which are the properties of the subgroups and is also considered the energy effect of association between them.

Keywords:



Adsorption of methylene blue from aqueous solution by using de-oiled rice bran as adsorbent

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ABSTRACT

Dyes are widely used in many industries, mainly in the textile industries. The effluents containing these dyes are an environmental concern and the disposal of these wastes into receiving water causes damage to the environment and may also be toxic to aquatic life. It is therefore imperative to treat textile effluents due to their toxic and aesthetic impacts on the receiving water bodies. Removal of dyes from wastewater using adsorption process has become one of the most effective and comparable low-cost methods for the decolorization of textile wastewater. Adsorption by using activated carbon is a very effective process, but the high cost of such adsorbents has motivated the search for alternatives and low-cost adsorbents. Agricultural waste is an alternative use for wastewater treatment because they are cheap, simple, sludge free and involve small initial cost and investment. This work explores the feasibility of De-Oiled rice bran, a solid waste, for the absorption of methylene blue (MB). Batch adsorption studies were conducted to evaluate the effects of adsorbent dosage (0.5-2.5 g/L), initial pH (2-10), initial concentration (5-25 mg/L), and time (0-120 min.). A central composite design technique for the design of experiments was used for the adsorption using carbonaceous catalyst prepared from rice bran. The optimum conditions were achieved at 1.5 g/L of adsorbent dosage, pH 6, 15 mg/L initial dye concentration in 60 minutes, with adsorption removal of 93.7%. The results revealed that De-oiled Rice Bran is potentially low-cost adsorbent for adsorption of Methylene Blue.

Keywords: Dyes, Effluent, Adsorption, low cost, Activated Carbon, Methylene Blue, De-oiled Rice Bran



Optimization, biodegradability and evaluation of ecotoxicological impact of radiation grafted polypropylene films

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ABSTRACT

Based on Design of experiment and response surface methodology, simultaneous radiation grafting with Co-60 was optimized in terms of inhibitor concentration, solvent concentration, radiation dose and monomer concentration for 35% degree of grafting. The grafted PP films were characterized by tensile test, scanning electron microscopy and differential scanning calorimetric analysis. Grafted samples were evaluated for biodegradability and ecotoxicological impact on microbes and plants (corn and tomato) as per OECD-208 guidelines. The biodegradation, as per ASTM D 5338-11, achieved was 5.5% at 35% degree of grafting. Ecotoxicological test indicated that biodegradation intermediates were non-toxic in nature.

Keywords: *Polypropylene, Radiation grafting, Response surface methodology, Biodegradability, Ecotoxicological impact*

Methodology Proposed

Grafting of Acrylic acid on the polypropylene films. Design expert software was used to optimize the grafting condition for the targeted degree of grafting. Characterization of grafted films has been performed tensile test, FTIR and SEM. Biodegradation studies have been performed by following the guideline of ASTM D 5338-11. Evaluation of ecotoxicity has been performed by plant growth ecotoxicological test.

Results and Discussion

The suggested optimized conditions for 35% degree of grafting were monomer concentration 12.09 wt%, radiation dose 12.40 kG., inhibitor concentration 0.07 M and solvent concentration 0.12 M, it was also experimentally verified in triplicate and average degree of grafting achieved was 34%, which is almost same as suggested 35% by the response surface methodology (RSM). Grafting of AAc onto PP films was confirmed by FTIR. Tensile strength of PP18 (35% grafted) was 21.1 MPa which is suitable for packaging applications (as against 38.8 MPa of PP). The biodegradation achieved was 5.5% at 35% degree of grafting shown in Fig. 1.

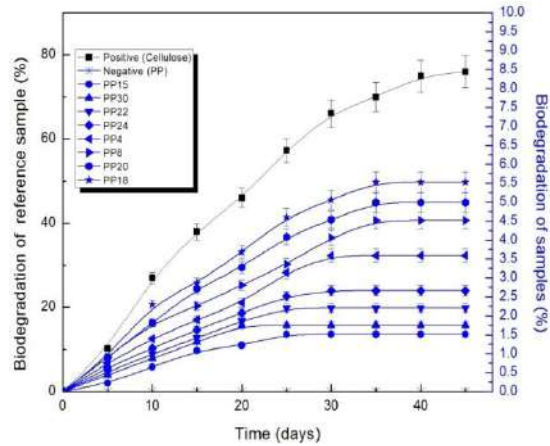


Fig. 1 Biodegradation of all the grafted PP films, PP (negative reference), cellulose (positive reference)

Conclusions

In this work, grafting conditions have been optimized to achieve 35% degree grafting of PP. The presence of AAc confirmed quantitatively by carboxylic group analysis on the surface of the PP. Biodegradability increases with increase in degree of grafting and maximum biodegradation 5.5% is achieved at 35% degree of grafting. Ecotoxicological tests confirmed the non-toxicity of biodegradable intermediates of grafted PP films.



Photocatalytic degradation of Naphthol blue black dye by hydrophobic copper Schiff base metal complex under UV irradiation

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ABSTRACT

The presence of a lone pair of electrons on the nitrogen atom and due to general electron donating character of the double bond in Schiff base found profoundly and have exhaustive applications. Schiff bases are synthesized when any primary amine reacts with an aldehyde or a ketone under categorical conditions. Well-designed Schiff base ligands are considered privileged ligands. Transition metal Schiff base complexes are having important role in medicine, in biological systems and in industries. Heterogeneous photocatalysis has emerged as most promising treatment for the degradation of sundry dyes and industrial effluents at lab scale. Further, sundry heterogeneous degradation processes predicated on metal complexes have been grown because of their unique benefit such as facile catalyst instauration from the solution, consequential decrease of material losses, and physical disseverment of active sites by dispersion on the fortifies and a frugal cost of the wastewater treatment. In the present work, Cu(II) complex of Schiff base ligand have been synthesized and has been studied for photocatalytic degradation of Naphthol blue black (NBB) dye at varied affecting parameters to find its effectiveness. The promising results have been found to justify the application of the material developed.

Keywords: *Schiff base ligand, spectral analysis, photocatalytic degradation, naphthol blue black dye*

Methodology Proposed

In present work metal complexes of Cu(II) have been synthesized with the help of synthesized Schiff base ligand. The ligand and metal complexes were characterized by spectral analysis such as IR, ¹HNMR, ¹³C, GC-MS and UV-Vis. Effect of various parameters have been studied.

Results and Discussion

The results suggest that the mononuclear complexes have a metal to ligand mole ratio of 1:1 and the metal (II) ions are coordinated with the phenolic oxygen and imine nitrogen atoms. The photocatalytic degradation of cationic activity of Naphthol blue black (NBB) dye was completed spectrometrically on illumination of ultra violet light using Cu(II) complex of Schiff base ligand. Photocatalytic degradation of NBB dye was examined under sundry parameters such as concentration of catalyst, dye concentration, additament of H₂O₂, different pH conditions (5, 7 and 10) and effect of time of irradiation. It was



found that the efficiency of decolorization process increases with incrementing the concentration of H_2O_2 .

Conclusions

The results revealed that Cu-Complex of Schiff base ligand is congruous for photocatalytic degradation of NBB dye for treatment of authentic effluents. The outcome uncovers that 30mg/50ml of Cu(II) complex was observed to be ideal dose for most extreme degradation of NBB dye. It was found that catalyst exhibited better catalytic activity for degradation of NBB dye under acidic condition.



Lignin separation from black liquor of agro based paper industry using hydrochloric acid

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ABSTRACT

The pulp and paper industry is one of the most important segments of chemical industry and having more than 400 units in India. About 80% of them are based upon the agriculture residue raw materials. The soda pulping and Kraft pulping processes are mostly used for the separation of fibers from agro based residue materials. Especially in soda pulping process, we solubilize the lignin by reacting with NaOH in liquor form, comprising of degraded organic materials and residual inorganic chemicals. This liquor is called as black liquor in paper industry. Now the problem is that black liquor has very high range of COD (1,25,000-1,50,000ppm), high range of pH (12.5-14) and very dark blackish brown color which is posing a serious threat to the water bodies like rivers, lakes, ponds and even ground water. In paper mills, boilers and recovery furnaces are used for the separation of organic and inorganic chemicals. Most of the organic chemicals are burnt in the recovery furnace to generate the heat energy which is further utilized for steam generation. It is having a lot of financial burden on new paper mill installation due to costly equipment, and about 40% cost of the paper industry is consumed for installation and running this unit. So we need simpler process which requires less labor intensive, less capital cost and lower the pollution load for handling the black liquor. In this direction, present research work has been done to find an innovative process based on treatment of black liquor with hydrochloric acid.

Keywords: *Lignin, Agro based Paper Industry, Hydrochloric Acid*

Methodology Proposed

The black liquor sample was taken from Shriyans paper mills Ltd. which is situated in Ahamedgarh, Punjab. The raw material which is used for the paper making is rice straw. The black liquor sample which comes out from pulp mill contains small amount of hemicelluloses, lignin, caustic and silica which is present in agriculture waste residue. The samples were treated with HCl and effects were studied.

Results and Discussion

By using hydrochloric acid some remarkable results have been revealed which shows that COD, pH and colour reduces significantly. In this direction optimization has been done by taking the different amount of hydrochloric acid, starting from 2% to 14%. The pH was reduced from 12.4 to 2.2 and COD from 1, 46,800 to 34,600 ppm. The visible color



was changed from blackish dark brown to light yellowish. Lignin part of Black Liquor precipitated on top of liquor layer and was separated easily by centrifugation methods. Lignin is used as feed in furnace utilized for steam generation, residual caustic can be reused for pulping operations and effluent can be sent to effluent treatment plant for further

treatments. If COD and other factors are controlled, the water can be reused for agriculture and industrial purposes also.

Conclusions

In the present study, results reveal that the optimum use of hydrochloric acid (8%) will give better results as the whole lignin part is precipitated and separated from the effluent. Steam utilization is reduced during multiple effect evaporators which are used in chemical recovery process. This process is environmentally benign as it conserve the environment. This innovative work will generate less pollutants, give economical process for industry and save energy which is used for evaporation of black liquor operations.

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Reductive amination using Hantzsch 1,4-Dihydropyridine as organo reducing agent in the presence of Sc(OTf)₃ and acidic silica at room temperature

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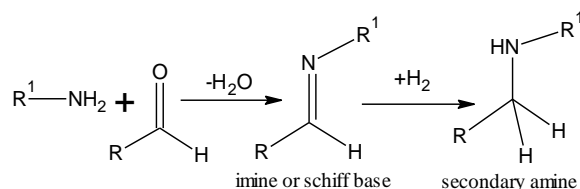
ABSTRACT

Reductive amination¹ of carbonyl compounds is a powerful tool used in the synthesis of structurally diverse amines. Synthesis of amine is an important reaction in drug discovery as well as for synthetic organic chemistry. It can lead to the synthesis of variety of natural products as well as highly biologically active molecules. Present protocol deals with the reductive amination of aldehydes with aryl amines using Scandium triflate [Sc(OTf)₃]-acidic silica as catalyst and Hantzsch-1,4-dihydropyridine (HDHP) as a organo reducing agent in toluene solvent at room temperature. The reaction takes place selectively and obtained yields are very good.

Keywords: Amination, Hantzsch-1,4-dihydropyridine, Scandium triflate, acidic silica, organo reducing agent.

Methodology Proposed

Reductive amination¹ is one of the best methods for the synthesis of secondary or tertiary amines in biological and chemical systems. Generally, it can be done in two steps: synthesis of intermediate (imine) in the first step and reduction of this imine in the second step (Scheme 1). In most of the cases intermediate imine is not stable or isolable, so, the most convenient and preferred way for preparation of saturated amines from carbonyl compounds and amines is, in situ formation and reduction of imines. Reductive amination is also available in nature, pyridoxal phosphate act as a coenzyme in all transamination reactions and the conversion of pyridoxal phosphate into pyridoxamine phosphate in the presence of aminotransferase is natural process.²



Scheme 1: Reductive amination.

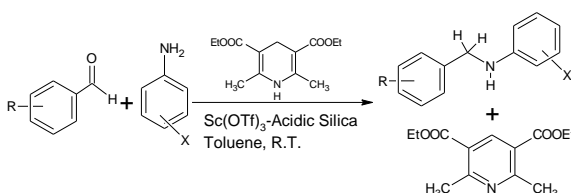
Thus, there are many approaches in literature to carry out this direct process. Several of these already reported methods suffer from drawbacks like catalytic hydrogenation, is incompatible with those compounds having a C=C or C≡C bond and other reducible functional groups. While some already reported procedure need harsh reaction condition and presence of Argon or Nitrogen atmosphere that made the process expensive.³ Thus,



the development of novel and simple catalytic method for a mild direct reductive amination is still an important research objective. In continuation to do so, and considering the mild nature of Hantzsch 1,4-Dihydropyridine (HDHP) as a hydrogen donor has been reported here. Further use of scandium triflate [Sc(OTf)₃] as a Lewis acid catalyst with acidic silica is the another merit of this procedure. As triflate salts are very stable as compared to traditional catalysts and are recoverable and reusable and can also be used in aqueous conditions. Metal triflate catalyzed reductive amination procedures are also well documented in .4 By keeping all these facts in mind present protocol has been developed.

Results and Discussion

First of all we synthesized fresh Hantzsch 1,4-dihydropyridine (HDHP) as per standard procedure reported in literature, after that, we initially examined a direct reductive amination reaction of benzaldehyde with aniline using scandium triflate [Sc(OTf)₃] and acidic silica as catalyst and freshly prepared, well dried, Hantzsch 1,4-dihydropyridine (HDHP) as reducing agent. The reaction was carried out by directly mixing a 1:1:1.2 mixture of benzaldehyde, aniline, HDHP and catalytic amount of Sc(OTf)₃-acidic silica (0.1:0.5) in 20.0 mL of toluene at room temperature. Progress of reaction was monitored via TLC until complete disappearance of benzaldehyde in TLC occurred. It afforded the expected N-benzylaniline 3a in very good yield, without reduction of benzaldehyde and HDHP was oxidized quantitatively to the corresponding pyridine derivative (Scheme 2). The analytical and spectroscopic data fully support the structural assignment for compound (3a).



Scheme 2: Reductive Amination using HDHP and Sc(OTf)₃-Acidic silica at room temperature.

After optimization of reaction condition, the general applicability of this procedure for the synthesis of variety of secondary amines using functionally diverse amines and aldehydes were studied. The presence of electron withdrawing or electron donating substituents on the aromatic ring did not affect the course of reaction. Sensitive functionalities such as -CHO, C=C, OMe, and NO₂ function were tolerated under this mild reaction conditions. Furthermore, the clean reaction conditions, mild nature of HDHP, highly selective and reduced only C=N bond and afford desired amines in high yields without affecting other sensitive functional groups.

Conclusions

Present protocol is mild, wide-ranging, efficient and very selective method for reductive amination of aldehydes and amines under easygoing conditions, mediated by Scandium triflate-acidic silica in toluene at room temperature. Furthermore, this method



has the advantages of inexpensive reagents, simple operation procedure, improved yields and simple experimental work up. It is recommended that Hantzsch dihydropyridine (HDHP) is an efficient, safe and environment friendly reducing agent for the direct reduction of imines. This method is not only of interest from ecological point of view, but also proves to be a clean, mild and very simple procedure in large scale production of secondary amines.

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Ultrasound assisted synthesis of biopolymer chitosan/acrylic acid/thiourea/hydrogels: Characteristic and swelling kinetics

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ABSTRACT

The present work was aimed at synthesizing crosslinked chitosan acrylic acid hydrogels by free radical polymerization under the effect of Sonicator of 40 Hz sound wave frequency. Potassium per sulphate and thiourea were used as initiator and crosslinker respectively. Different feed ratio of acetic acid, acrylic acid, potassium per sulphate and thiourea were used to investigate the effect of solvent, monomer, initiator and degree of cross linking on the grafting and swelling percentage. The percentage grafting (P_g) and percentage swelling (P_s) were calculated using Eq. 1 and Eq. 2, respectively.

$$P_g = \frac{W_2 - w_1}{w_1} \times 100 \quad (1)$$

Where w_1 and w_2 are the weights of chitosan and chitosan based semi-CIPN, respectively.

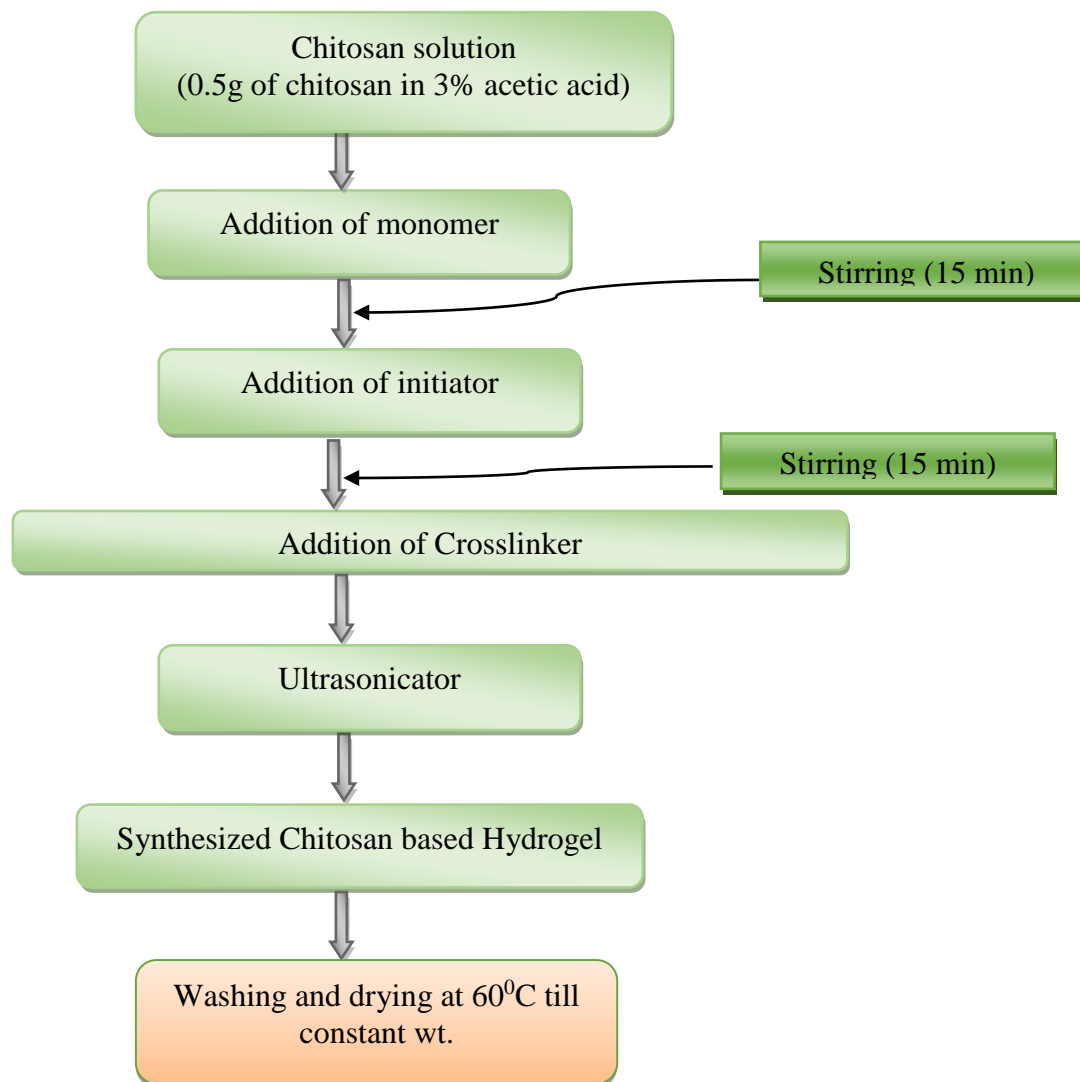
$$P_s = \frac{W_s - w_d}{w_d} \times 100 \quad (2)$$

Where W_s and w_d are the swelled weight and dry weight, respectively.

The swelling behavior of prepared hydrogel samples was studied in millipore water at 25⁰C temperature. The optimized data as percentage swelling was investigated. The different analytical techniques such as Fourier transform infrared spectra analysis (FTIR), X-ray diffraction (XRD), Thermogravimetric analysis (TGA) and Differential Scanning calorimetry (DSC) was employed to characterize the synthesized hydrogel.



Graphical ABSTRACT



Keywords: Sonication, hydrogels, percentage grafting and percentage swelling



Synthesis of new ligands and their metal complexes with copper(II) ion

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ABSTRACT

Some potentially active azomethines and azomethine N-oxides ligands of pharmacological importance have been synthesized from O-nitrocinnamaldehydes and variously substituted aromatic amines and phenylhydroxylamine respectively. Initially their synthesis has been carried out by condensing O-nitrobenzaldehyde with acetaldehyde under base catalyzed reaction conditions. The crude product isolated was characterized by means of derivatization and melting point as O-nitrocinnamaldehyde which was subsequently condensed with variously substituted aromatic amines by taking their equimolar quantities in ethanolic solution. These crude products were recrystallized and were characterized through their spectral studies. While the azomethine-N-oxide was synthesized by condensing O-nitrocinnamaldehyde with phenylhydroxylamines and product azomethine-N-oxide was analyzed like wise. Both the ligands azomethines and azomethine N-oxides showed a great affinity of complexation with Cu(II) and Ni(II) ions. These complexes have been characterized through their spectral studies.

Keywords:



Removal of toxic pigment gossypol from cottonseed using solvent extraction

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ABSTRACT

A modified method for extracting gossypol from defatted cottonseed at low temperature has been described. The gossypol extraction was carried out in acidic medium at a temperature of 348 K to avoid binding of gossypol with protein. The gossypol free protein can be utilized for a large amount of human and animal population as food and feed purposes. The solvent extraction was performed using 2-propanol-water (95:5 v/v) acidified with 0.5 M citric acid to allow hydrolysis of bound gossypol from defatted meal and reduce the total gossypol content of the cottonseed meal. The solvent was capable of extracting more than 90 % gossypol from defatted cottonseed meal at optimum process conditions (348 K, solvent/seed ratio 15 and 180 min). The kinetics of extraction followed pseudo second order rate law.

Keywords: *Cottonseed, Gossypol, Solvent extraction, 2-propanol*

Methodology Proposed

The extraction of gossypol from cottonseed was performed using an environmentally friendly green solvent system comprising of 2-propanol-water (95:5 v/v). Known amount of cottonseed samples (defatted) were kept at required temperature i.e. 318, 328, 338 and 348 K. 2-propanol-water (95:5 v/v) solvent was added with desired solvent to seed ratio for extraction. The total gossypol content was estimated using double beam UV VIS spectrophotometer (IS-4876 method).

Results and Discussion

More than 90% extraction of gossypol was obtained using the solvent system 2-propanol-water. The optimized conditions for gossypol extraction were 0.5 M acid concentration, temperature 348 K, solvent to seed ratio 15 and contact time of 3 hrs. The experimental data was fitted into pseudo first order and pseudo second order kinetic models. The extraction kinetics followed the pseudo second order rate law. Temperature was found to be the most significant and effecting parameter. The kinetic data was fitted into non-linear regression equation. The data was found to be well fitted in the predicted equation.

Conclusions

2 propanol-water was found out to be a potential solvent for extraction of gossypol. The extracted gossypol can be further utilized for medicinal or therapeutic applications.



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Simulation and sensitivity analysis of catalytic gas-phase propene polymerization

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ABSTRACT

Polypropene (PP) is a translucent material with excellent physical and mechanical properties. Polypropene is produced by polymerizing propene with suitable catalysts. Polypropene has demonstrated certain advantages in improved strength, stiffness and higher temperature capability over polyethylene [1]. In the face of existing enormous market for polypropene the global polypropene market is expected to reach \$126.89 billion by 2026 growing at a CAGR of 6.4%, continuing holding a significant portion of the market share of the commodity thermoplastics globally [2]. The polypropene market in India is projected to grow at a CAGR of over 11% during 2017-2030. Surging application areas, rising industrialization and commercialization constitute major factors that are promoting polypropene market in India [3]. Reliance Industries Ltd., Indian Oil Corporation Ltd., HPCL-Mittal Energy Ltd. and Haldia Petrochemicals Ltd. are the leading players operating in India polypropene market. Due to the predictable growth of consumption, there's a yearning to intensify the productivity and yield in existing processes to mollify its demand. Catalysts for use in Ziegler Natta polymerization have been widely researched. They are generally categorized into two groupings on the basis of solubility [4]. Heterogeneous catalysts: Titanium or vanadium-based compounds used in conjunction with organoaluminum complexes, and; Homogeneous catalysts: Complexes are based on Titanium, Zirconium, or Hafnium and include metallocenes and/or multidentate oxygen and nitrogen-based ligands. There are three categories of processes generally employed to produce isotactic polypropene (iPP), homo- and co-polymers, namely, liquid slurry processes, bulk or liquid pool processes, and gas-phase processes. Aspen Plus is a market-leading process modeling tool used for conceptual design, optimization, and performance monitoring for the chemical, polymer, specialty chemical, metals and minerals, and coal power industries. The propene gas-phase polymerization process model illustrates the use of Aspen Polymers Plus to model a gas-phase UNIPOL process for propylene homo-polymerization using a four site Ziegler-Natta kinetic model. Present work deals with the steady state simulation of propene homo-polymerization with a multisite Ziegler-Natta kinetic model in gas phase.

Keywords: *Simulation, Ziegler-Natta, Sensitivity, Propene, Polymerization*

Methodology Proposed

Aspen Polymers is the market-leading technology for accurate and reliable design and optimization of polymer processes. It is fully integrated with industry-standard simulators including Aspen Plus®, Aspen Plus® Dynamics and Aspen Custom Modeler®.5. In the present simulation study, an Aspen Polymers Plus model is developed to simulate a polypropene gas-phase UNIPOL flow sheet. The flow sheet includes the fluidized bed



reactor, the gas recycle/cooling loop, discharge, and purge units. The fluidized bed reactor is modeled using the CSTR reactor in Aspen Plus with two phases: a gas phase and a polymer phase. The POLYPCSF, Perturbed-Chain Statistical Associating Fluid Theory (PCSAFT) thermodynamic model is used to relate the gas phase monomer, hydrogen, etc. composition to their concentrations in the polymer phase. The multisite Ziegler-Natta kinetic model is used to describe the polymerization reactions in the polymer phase. The kinetic model calculates the reaction rates for the components and polymer attributes at each site type. Sensitivity analysis is carried out to investigate the effects of temperature, pressure, catalyst amount, and catalyst/co-catalyst ratio on polypropene properties.

Results and Discussion

On increasing the reactor temperature, the number average and weight average molecular weights are found to decrease whereas polydispersity index (PDI) increased. The opposite effects were observed for the pressure drop across the reactor. The inlet pressure was kept constant whereas the outlet pressure was varied to check the effect of pressure drop. The PDI was found to decrease nonlinearly with the decrease in pressure drop. On increasing mass flow rate of the catalyst, resulted in decreased number average and weight average molecular weights, which defines the greater number of chains initiated and so the less averaged molecular weights of the product for a given feed rate of the propene. Initially, PDI was found to increase sharply for a change in mass flow rate of catalyst and then sluggishly. The effects of catalyst to cocatalyst mass flow rate ratio, on number average & weight average molecular weights and PDI were qualitatively the same for a change of ratio from 0.1 to 1.

Conclusions

Steady state simulation of propene polymerization was carried out using Aspen Polymer Plus and sensitivity analysis was carried out to find the effect of reactor temperature, pressure drop, catalyst flow rate, and catalyst co-catalyst ratio on polypropylene properties. It is concluded that lower reactor temperature and pressure drop with lower catalyst mass flow rate favor high molecular weight polypropene with relatively less PDI. These parameters can be optimized to produce polypropene with the desired product quality.

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Batch studies on Cadmium(II) removal from aqueous solutions through adsorption on pods of acacia karoo

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ABSTRACT

With increase in industrialization, the presence of heavy metals into wastewater streams has turned to the serious concern to the ecosystem. The metals diffuse through the food chains causing various health hazards. Many of the biomaterials have been investigated by researchers for adsorption of heavy metals from water solutions as an alternative technique since last two decades. In this paper, the study on use of pods of *acacia karoo* for adsorption of Cd(II) from aqueous solutions have been reported. Effect of various parameters on removal of metal ion have been made for finding out the optimum parameters through one parameter optimization. Further, the kinetic, equilibrium and thermodynamic studies have been made. The pods of acacia karoo have shown great potential towards adsorption of cadmium (II) from aqueous solutions.

Keywords: *Adsorption, heavy metals, biomaterials, cadmium(II), pods of acacia karoo.*

Methodology Proposed

The characterization of biomaterial (pods of acacia karoo) have been made using proximate analysis, particle size analyzer and FTIR analysis. The effects of various parameters affecting the adsorption of Cd(II) such as pH, adsorbent dose, contact time, stirring speed, initial concentration of metal ions and temperature have been investigated to find the optimum results. Kinetic studies have been made to find the order of adsorption process. Pseudo first order and pseudo second order kinetic models have been applied. For equilibrium studies, most widely used models such as Freundlich isotherm and Langmuir isotherm model have been investigated to study the adsorption behavior. Thermodynamic studies have been made to find the values of ΔH^0 , ΔS^0 and ΔG^0 , such that the exothermic/ endothermic behavior, and the feasibility and spontaneity of the process can be found.

Results and Discussion

The effect of various parameters influencing the adsorption was studied at various pH (2-8), adsorbent dose (100-2000 mg/100mL solution), initial metal ion conc. (10 – 200 mg/L), stirring speed (50-250 rpm), contact time (5–180 min) and temp. (20–500C). Maximum % removal of Cd(II) by pods of Acacia karoo was found to be 82.4% at adsorbent dose of 500mg/100 mL solution. The optimum parameters have been detected through the batch experiments through one parameter optimization i.e. changing one parameter keeping other parameters constant. With increase in pH above 2, percent removal of Cd(II) increases. This may be explained as the metal ions Cd(II), Pb(II) and Cu(II) being positive ions get conflicted with positive H⁺ ions at low pH and so adsorption is found to be better at higher pH values. The kinetic studies on adsorption of metal ions on the biomaterials used in batch modes have resulted in superiority in applicability of pseudo-second order model over the pseudo-first order model. The



parameters found from the kinetic model can be used for design of bioreactor for the process. Good values of model parameters show the potential of biomaterials for adsorption of heavy metals. Equilibrium studies in batch mode have shown the applicability of both Freundlich and Langmuir isotherm models on biosorption of Cd(II) on pods of Acacia karoo. The good values of model parameters depict the effectiveness of the adsorbents. Better values of R^2 in case of Langmuir isotherms show the monolayer adsorption of metal ions. Percent removal of metal ions have been found to be increased by increasing the temperature from 20⁰C to 50⁰C, which suggests that the temperature plays an important role to increase adsorption of Cd(II) on the biomaterial. The negative value of ΔG^0 found suggests feasibility and spontaneous nature of adsorption of cadmium ions on the adsorbent. The positive value of ΔH^0 indicates the endothermic nature of adsorption. The positive value of ΔS^0 explains the increase of randomness at solid solution interface during adsorption.

Conclusion

The pods of acacia karoo has been proved to be a potential adsorbent for removal of Cd(II) from aqueous solutions. The process has been reported as feasible and spontaneous, and endothermic in nature.



Synthesis, structure evaluation, non-linear optical properties and antimicrobial activity of pyrrole-azole derivatives

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ABSTRACT

This work deals with synthesis, spectral analysis and structural clarification of pyrrole azole derivatives. The pyrrole containing different pyrrole-azole biheterocyclic derivatives: pyrrole-pyrazolones (5a-b), pyrrole-pyrazoles (6a-b) and pyrrole-1, 3, 4 oxadiazole (7a-b) have been synthesized using cyclization of pyrrolyl hydrazide-hydrazone intermediates in the presence of selected reagents. The structures of the pyrrole-azole derivatives were confirmed by spectral analysis. All quantum chemical calculations have been performed by density functional theory (DFT), using B3LYP functional and 6-311++G (d,p) as basis set. The calculated data corroborate well with the experimental data. The FT-IR analysis shows red shifts in $\nu\text{N-H}$ and $\nu\text{C=O}$ stretching as result of dimer formation. The binding energies of dimer are found in the range of 12.75 - 11.21 kcal/mol after basis set superposition error correction. The UV-Vis result shows limited absorption in visible section and major transparent over a visible wavelength range enabling them suitable for application in the visible range. The optical energy gaps of these derivatives were found to be less than 3.2 eV. The β_0 values for compounds (5a, 6a, 7a) are calculated as 24.60×10^{-30} , 42.51×10^{-30} , and 19.14×10^{-30} , esu, respectively. The calculated results show that investigated molecule will show better non-linear optical response than para nitro aniline which might be used as non-linear optical (NLO) material. All the synthesized compounds were screened in vitro against four species of microorganisms, Bacillus subtilis, Pseudomonas aeruginosa, Asperigellus niger and Candida albicans. Most of the compounds exhibited significant antimicrobial activity.

Keywords: Pyrrole-azole, DFT, NLO, Antimicrobial activity



Synthesis, spectroscopic characterization of heterocyclic chalcones containing pyrrole: Experimental and theoretical study

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ABSTRACT

Chalcones are valuable compounds because of their proven biological activity and material applications. With the aim of synthesizing new heterocyclic compounds and exploring biological potency, new series of chalcones containing pyrrole were synthesized using different aromatic aldehyde as starting moieties in presence of alkali. The structures of newly synthesized compounds were confirmed using different spectroscopic techniques such as IR, ¹H-NMR, ¹³C-NMR, and mass spectral analysis, and elemental analysis. The synthesized chalcone has been further used as intermediate in the synthesis of various heterocyclic compounds. The theoretical and experimental data corroborate with each other. The newly synthesized derivatives were screened for their antioxidant activities. It was observed that the newly synthesized compounds had shown promising activity. The synthesized compounds will be used as potential candidates for future drug discovery and development.

Keywords: Chalcones, Pyrrole, Spectroscopy, Antioxidant activity



Neem leaves as adsorbent for dye waste water

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ABSTRACT

In the present work, neem leaves are obtained from the agricultural fields and are used as adsorbent for dyes with the model system of methylene blue solutions. The MB has health hazards exposures to the dyes have been known to cause an allergic reaction. The substances are considered as toxic. The adsorption capacity parameter obtained from a batch experiment is useful in providing information about the effectiveness of dye-adsorbent system. The effect of factors such as the initial pH value, adsorbent dose, time of contact were investigated. The results indicate that the percentage removal also increased with the increase in the adsorption capacity (q_e) 82% of colour removal efficiency is achieved at the dose of 100g/l NLP for methylene blue of 10mg/l concentration. The optimal parameters for this experiment were 10mg/l for initial dye concentration, 5gm/50ml adsorbent dosage and pH 8. In the batch system, the adsorption capacity was increased when the parameters were increased until it achieved the equilibrium. Langmuir adsorption isotherm graph is plotted with $1/q_e$ vs $1/C_e$. Trend lines for the adsorption data of different concentration of methylene blue with neem leave as adsorbent is plotted. The linear regression was conducted using plot $1/q_e$ vs $1/C_e$, it was found that R^2 values are closer to 1 indicating that the Langmuir adsorption isotherm is a good fit for the adsorption data. The neem leave could be employed as the effective low-cost adsorbent for removal of Methylene Blue Dye from aqueous solution.

Keywords: Methylene Blue, adsorbent, Neem leave, Langmuir adsorption isotherm.



Extraction & recovery of phytic acid from rice bran

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ABSTRACT

Rice bran, a major by-product of rice milling industry possesses a high nutritional value like protein, fats as well as crude fibre. However, despite its high potential as a raw material for the preparation of functional foods, it is still underused for the production of human food. Moreover, rice bran is also rich in Phytic Acid (also called as Myo-inositol hexakisphosphate) which although being an anti-nutrient has high commercial value. It exhibits protective action in Parkinson's disease and has high medicinal value. Because of these exceptional qualities, Phytic Acid from rice bran can be extracted and analyzed through conductometric titration, ion exchange chromatography, solvent extraction and high-performance liquid chromatography. Solvent extraction is an improved method for extraction and purification of Phytic Acid with high purity and yields. On varying extraction time, concentration of solvent and temperature the yield of Phytic Acid can be increased.

Keywords *Extraction, Food composition, Myo-inositol hexaphosphate, Phytic Acid, Rice Bran*

Methodology Proposed

This work aimed to describe an analytical technique for the efficient extraction and purification of Phytic acid using rice bran as raw material. Raw rice bran was donated by Bhagwati Lacto Vegetarian Pvt Limited, Ferozpur (India). The amount donated was 10 kg and kept under refrigeration throughout the experiment. Phytic Acid (PA) was extracted with 0.8 M HCl at a concentration of 0.1 g mL⁻¹ and quantified according to the procedure described by Latta and Eskin [1] based on the reaction between ferric ion and sulfosalicylic acid. An analytical procedure for the purification of PA was developed after considering the extraction conditions [2] as 1 h at 25°C with continues shaking with 1.0 N HCl and a concentration of rice bran of 0.1 g mL⁻¹. The pH of the extract containing PA was adjusted to 4.5 with a solution of 4 M NaOH, the rice protein's isoelectric point [3], and the extract was centrifuged at 2000 x g for 10 min. A supernatant (S1) and pellet (P1) were obtained. The yield of PA was expressed as a percentage and calculated as the ratio of the initial rice bran PA content (PA_i) to the obtained PA content (PA_o), multiplied by 100.

Results and Discussion

The results indicate that the variables affecting the yield of PA extracted from rice bran are - concentration of HCl, temperature and time. The extraction times of PA of 30 min and 45 min were tested in triplicate and compared with the extraction time of 1 h. It was observed that the extraction time of 1 h differed significantly from the time of 30 min and



45 min. The content of extracted PA in 100 g of rice bran on a dry basis for these three extraction times was 5.92, 4.51 and 2.92 g, respectively. Thus, it was determined that the maximum extraction of PA occurred when the minimum time was 1 h, a concentration of 1 M HCl was used, the concentration of rice bran was maintained of at 0.1 gm L⁻¹ and the temperature was 25^oC.

Conclusions

It was possible to establish an improved method for the extraction and purification of PA with high purity and yields. In the procedure for extracting rice bran PA, the temperature, the HCl concentration and the extraction time were significant, while the concentration of rice bran had no significant effect.

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Biodiesel production from high free fatty acid spent bleach earth oil

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ABSTRACT

Biodiesel may be cost-effective if produced from inexpensive feedstock which usually contains high level of free fatty acids (FFA) as an inhibitor in production of methyl ester. In this study a two-step process is developed for biodiesel production from high FFA spent bleach earth oil in a batch reactor. Oil extracted from spent bleaching earth (SBE) was utilized for biodiesel process. In the first step, FFA of the SBE oil was reduced to 1.15% through sulfuric acid catalyzed esterification. In the second step, the product prepared from the first esterification process was carried out transesterification with an alkaline heterogeneous catalyst. The influence of different variables on conversion efficiency to methyl ester, i.e., methanol/ SBE oil molar ratio, catalyst amount and reaction temperature, was studied in the transesterification stage. The optimum process variables in the transesterification were methanol/oil molar ratio 9:1, heterogeneous catalyst conc. 5.0 wt %, reaction temperature 65° C and reaction time 75 minutes to produce biodiesel. Therefore, an optimized process for production of biodiesel from a low cost high FFA source was accomplished.

Keywords: *Biodiesel, Free Fatty Acids, Residual oil, Spent bleaching earth, Transesterification.*

Methodology Proposed

Waste SBE oil contains about 9 – 15% FFAs normally and a procedure for converting this oil to biodiesel seems extremely promising. This study discusses the findings of experiments carried out to optimize the parameters for the transesterification reaction for maximum biodiesel production. SBE for this study was provided by K C Solvent, Jalalabad (India). In the first step, oil in SBE was obtained by extraction with solvent hexane a soxhlet extractor. The extraction was continued for 3 h. Solid particles in solvent containing oil were removed by paper filters. Finally, solvent was removed from the oil by rotary vacuum evaporation. SBE oil had an initial acid number of 21.0 mg KOH/g corresponding to a FFA level of 10.5 %, which is above the 2% limit for sufficiently transesterification reaction using alkaline catalyst Hence, FFAs were first converted to esters in a pretreatment process using an acid catalyst to reduce the FFA of SBE oil to 1.1%. In the next step, transesterification was carried out in a three-necked glass reactor of 500 ml capacity operating in a batch mode (Figure 1). A reflux condenser was used to avoid the loss of volatile compounds. A temperature controlled magnetic stirrer (REMI make, model 5MLH plus) was used to carry out reaction at particular temperature and stirring speed. In all the experiments, a known amount of SBE oil, methanol and the catalyst were charged into the reactor and heated to the desired temperature. The catalyst used in this study was calcined sodium silicate.



Results and Discussion

With reducing FFAs of SBE oil from 10.5 % to 1.1%, transesterification reaction was carried out. The optimum parameters obtained for this transesterification reaction was 338 K temperature, methanol/oil molar ratio of 9:1 and 5% wt/wt calcined sodium silicate alkaline catalyst. The glycerol was produced as by-product and separated using separating funnel.

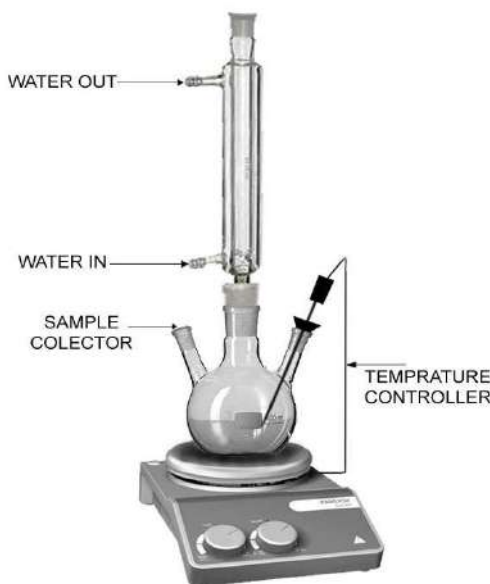


Figure 1: Experimental Setup

Conclusions

The production of biodiesel from low-cost, high FFA raw materials was investigated. Feedstocks with high FFAs could not be an option for biodiesel with heterogeneous alkali catalyst transesterification process. In this study, biodiesel was produced from SBE oil that contained high free fatty acid. In the first step, esterification process was used to reduce FFA value of the recovered oil. The FFA content of the SBE oil was reduced to 1.1% using acid catalyzed (1% v/v H₂SO₄) reaction with methanol to oil molar ratio of 6:1 at 338 K and 45 min reaction time. In second step, calcined sodium silicate catalyzed transesterification process was used to produce biodiesel and glycerol within 75 min at 338 K using methanol to oil molar ratio of 9:1.

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Advanced materials & their synthesis techniques for various components of solid oxide fuel cells- A Review

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ABSTRACT

Solid Oxide Fuel Cells (SOFCs) have suitable perspectives to replace their classical counterparts for the distributed generation of electrical energy with small and medium power sources. They offer an environmentally friendly technology to convert gaseous fuels such as hydrogen, natural gas or gasified coal into electricity at high conversion efficiencies. The main advantages of SOFCs rely on the high conversion efficiency and low environmental impact. They also provide many other advantages like reliability, modularity, fuel flexibility and very low levels of NO_x and SO_x emissions. This review deals with a survey of the current research on advanced materials to be used as Anode, electrolyte and Cathode for solid oxide fuel cells. Materials engineering plays vital role in Solid Oxide Fuel Cell (SOFC) technology.

For example, engineered porous materials are needed to support delicate electrolyte membranes, where mechanical integrity and effective diffusivity to fuel gases is critical; and to construct fuel cell electrodes, where an optimum combination of ionic conductivity, electronic conductivity, porosity and catalyst distribution is critical. Material engineering also underpins selection of cell designs and material systems to minimise failure, particularly during transient operations such as thermal cycling. The paper will address issues related to conventional and advanced futuristic materials for SOFCs. Various chemical routes have recently been developed to synthesize submicro- to nano-sized oxide powders. This paper also provides a comprehensive review on the advanced synthesis of materials for SOFCs such as the cathode, the electrolyte, the anode and the interconnect and their impact on performance of the SOFC. Combustion, co-precipitation, hydrothermal, sol-gel and polymeric-complexing processes are thoroughly reviewed. In addition, the parameters relevant to each synthesis process are compared and discussed.

Keywords: *Solid Oxide Fuel Cells SOFCs, materials engineering, porous materials, cathode, anode, electrolytes, interconnect.*



Synthesis, Characterization of Zinc Selenide nanoparticles and its effect on photoluminescence properties at different wavelengths

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ABSTRACT

Zinc Selenide nanoparticles were prepared by co-precipitation method. The Crystal structure, morphology and optical properties of ZnSe nanoparticles were examined by X-Ray diffraction, TEM, Fourier Transform Infrared. According to X-Ray diffraction study showed the hexagonal crystal structure. Transmission Electron microscopy images were used to examine the surface morphology and confirmed the shape of nanoparticles. FTIR results showed the bonding on the surface of ZnSe nanoparticles. The emission spectra exhibited at different wavelengths showed the variation in intensity.

Keywords: ZnSe nanoparticles, XRD, TEM, optical and fluorescence properties.

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2	ETR3_51	<u>An Automated diagnosis of epileptic EEG: A review</u>	Pallavi Gupta, Birmohan Singh, Manpreet Kaur
3	ETR_52	<u>A comparative study of different ecg signal baseline removal techniques</u>	Anjani Singh, Manpreet Kaur, Birmohan Singh
4	ETR_53	<u>Performance Analysis of feature weighing approach on various machine learning algorithms</u>	Dalwinder Singh, Birmohan Singh
5	ETR_55	<u>Time Series Data Analysis Using R for the analysis and prediction of Stock Market</u>	Richa Arora
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9	ETR_59	<u>An efficient biometric fusion using iris and fingerprnt in digital image processing</u>	Hassandeep Singh, Amit Kamra
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Technical Specification Based Comparison Among Cloud, Fog and Roof Computing

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Abstract

Internet of things has become an essential part of the human life nowadays. In today's world we all need the prime comfort at our finger tips. We want to control everything using our handheld smart devices or wearables. For example, now humans want to control the access of his or her home remotely through the watch he or she wearing or maybe he wanted to keep an eye on the all activities going on in his or her absence at home or at office or maybe he wanted to get pre notified before any disastrous mis-happening like cooking gas leakage, smoke due to fire and any electrical fault any time anywhere. At the backside of all these technical advancement various technologies are implemented. Cloud Computing is one of the most promising technological development in the direction of IoT implementation. Now the term IoT is converting into Internet of Everything all due to more technological and computational advancements in cloud computing techniques. Now we are stepping up with technical advancements like fog computing and roof computing. In Cloud Computing, computing infrastructure and resources are shared and are available as per demand and delivered when needed through internet. Roof Computing is one step ahead to cloud computing, Reducing the load of cloud by gathering services, huge data, workloads, and application to near network edge is the main aim of Roof Computing. Main aim of fog computing is to reduce the burden on cloud by gathering workloads, services, applications and huge data to near network edge. Fog Computing is the extension of cloud computing which is further extended by roof computing. In order to provide Computing resources to edge for IoT devices fog computing provides strong infrastructure and also fulfills all security related essential requirements. In this paper author is trying to analyze and compare among Cloud Computing, Fog Computing and Roof Computing. This comparison is based on different performance metrics like scalability, time complexity, topology constraints, technical complexity, deployment area, distance, security and implementation cost.



An Automated diagnosis of epileptic EEG: A review

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Abstract

Epilepsy is a neurological disorder characterized by the presence of recurring seizures analyzed using electroencephalogram (EEG) signals. Manual inspection of EEG brain signals is a time-consuming process, which puts heavy burden on neurologists and affects its performance. Several automatic techniques have been proposed using traditional approaches to assist neurologists in analyzing binary epilepsy scenarios e.g. seizure vs. non-seizure or normal vs. ictal. However, the EEG signals are nonlinear and non-stationary in nature, which leads to further complexities related to their manual interpretation and detection of normal and abnormal (interictal and ictal) activities. Therefore, it is necessary to develop a Computer Aided Diagnostic (CAD) system to automatically identify the normal and abnormal activities using minimum number of highly discriminating features. This paper includes study of intracranial region of human brain where chances of abnormalities are higher and approaches which possess better results in terms of accuracy, specificity and sensitivity. Here, various feature extraction methods and the results of different automatic epilepsy stage detection techniques is given. Paper also briefly presents the various open-end challenges that needs to be addressed before a CAD based epilepsy detection system can be set-up in a clinical setting.

A COMPARATIVE STUDY OF DIFFERENT ECG SIGNAL BASELINE REMOVAL TECHNIQUES

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Abstract

Baseline drift in ECG signal is the biggest hurdle in visualization of correct waveform and computerized detection of wave complexes based on threshold decision. The baseline drift may be linear, static, nonlinear or wavering. Reducing the baseline drift to a near zero value greatly helps in visually inspecting the morphology of the wave components as well as in computerized detection and delineation of the wave complexes. In this paper various techniques such as Wavelet-Based Baseline Cancellation, Median filter, Butterworth filter and Sovitzky-Golay filter are implemented and compared for best performance. The dataset used in this study is MIT-BIH Arrhythmia database and MIT-BIH Noise Stress test database. Arrhythmia database is annotated database with heart abnormality, which has less baseline drift and Noise Stress test dataset is useful for S-T segment analysis, which has high baseline drift.



Performance Analysis of feature weighing approach on various machine learning algorithms

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Abstract

Feature weighting is a well-known approach for improving the classification performance of the machine learning algorithms. It involves a weight assignment to each feature linearly which changes the feature space. The main goal of weighting the features is to rescale the feature space such that the model of learning algorithms can provide a better fit to a data. In this paper, the performance of different machine learning algorithms is evaluated with the feature weighing approach on the public available datasets. This work intends to analyse the amount of improvements made in terms of accuracy and feature reduction with the feature weighting across different learning algorithms. Wrapper-based approach are employed for searching the best weights for the features. The feature weights are searched with the whale optimization algorithm along with the parameters of classifiers considered in the paper.

Time Series Data Analysis Using R for the analysis and prediction of Stock Market

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Abstract

“The stock market is a device of transferring the money from impatient to patient”, said by Warren Buffet. Earning by investing in stock market has gained tremendous popularity in past one decade; therefore it has almost become financial subject which has gained popularity among researchers. From the past few decades researchers and developers has been working to build appropriate model that can give the precisely forecasted values in stock market. The processing of Stock market quite uncertain and is influenced by many factors, therefore prediction of Stock market has become one of the vital endeavor in business and fiscal. Basically two types of analysis can be done for prediction, one is technical and other is fundamental. In this paper I have tried to implement both technical analysis and fundamental analysis. Technical analysis is done by using past historical data of stock market value by applying various techniques and fundamental analysis is done using by applying Time Series Data Analysis and with the help of ARIMA model in R studio. The method involves collecting bygone stock market data and then finds the correlation between the variables and the stock market values to analyze values. The learned model can then be used to make future predictions about stock values. ARIMA Model is able to predict by using its three variables or parameters which are p, d and q. To make stock market investment safe, powerful tools and techniques are being used nowadays. R is powerful and expanding open source



programming used to compute statistical data and to visualize data. R provides numbers of packages that help in fetching data, packages that help in forecasting the values and packages for graphical representation of analysis done. In this paper, ARIMA model is proposed to forecast the stock market trends of BANKEX by NSEBANK (Nifty Bank) by using historical data from Yahoo-Finance. Also with the help of R programming we can also see the behavior of stock market on daily basis in the form of graphical representations. To build the proposed model, we combine Time Series Data Analysis with ARIMA model polynomial & linear generalization trends.

Number Plate Recognition System-A Survey

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Abstract

NPR system is based on image processing technology, in which we take an image of a vehicle number plate as input to recognize the registered vehicle. Vehicle owner identification is of utmost importance in many situations like rash driving, stolen car detection, over speed and violating traffic rules etc. The only solution to vehicle owner identification problem is to recognize the number plate of the vehicle. So, there is a necessity to develop an NPR system to overcome these types of problems. Many NPR systems are available today but are affected by some factors like high speed, varying width of the number plate, weather conditions, format of the number plate and lighting conditions etc. In this paper, we review existing techniques which are used for recognizing the number plate of the vehicle and used the parameters like image size and processing time etc. In this paper future work in number plate recognition has been proposed for enhancement of effectiveness and reliability of NPR systems.

A review on methods for automated detection of Diabetic Retinopathy in Retinal images

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Abstract

Diabetic retinopathy is a condition that can lead to blindness due to fluctuation in sugar levels causing blockage to the blood vessels and ceasing blood supply. Early screening of diabetic retinopathy is based on features like microaneurysms, hemorrhage, hard exudates, neovascularization and macular oedema which assist ophthalmologist in detecting vitreous hemorrhage, retinal detachment, glaucoma and blindness. In this paper we review various algorithms used to extract these features from retinal images, and portrays a comparison of performance metrics such as Accuracy (Acc), Sensitivity (SN),



Specificity (SP) evaluated on retinal images. Manual detection is a tedious and time consuming task, so automated algorithms are utilized for attainment of task correctly. However, the paper is intended to give user a framework for existing algorithms, discussing current problems and future scope.

Review on Blockchain Technology

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Abstract

Blockchain is a new technology which is a decentralized way to store and manage information and eliminates the role of the middle man. After the internet, the invention of Blockchain was considered as the most significant. Previously blockchain was only used for financial transaction records but in recent year blockchain was adapted into many areas like IOT, healthcare, gaming, voting etc. The purpose of this paper is to explore the importance of Blockchain technology, its application, limitations, risks, and opportunities of this approach.

AN EFFICIENT BIOMETRIC FUSION USING IRIS AND FINGERPRINT IN DIGITAL IMAGE PROCESSING

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Abstract

The Biometric systems are the skill for legalization or arrangement of various individuals using person's physical and behavioral personalities. Though these schemes are more sheltered compared to the conservative processes like key authentications, password, they also experience many limitations like noise in the data, intra-class difference and spoof occurrences. One of the explanations to these glitches is to deal multi-biometric schemes also in these type of systems various foundations of biometric data are used. This paper deals with the fusion approach using extraction of feature vector for biometric traits of human in terms of iris and fingerprints and the performance is evaluated in terms of high recognition rates. The proposed system shows the robustness in the recognitions of the unique individuals using their iris and fingerprints fusion process.



A study on current frauds trends in the Banking Industry and its detection using data mining Algorithms

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Abstract

In the globalized and changed business state of the latest couple of years, we confront an unquestionably growing volume of frauds especially in the financial fragments in India. The Indian cash related organizations division has seen exponential advancement in the latest decade—an improvement that has not been without its snares, as events of distortion have moreover been on the rising. Extortion achieves colossal incidents to the overall public exchequer, as needs be negatively impacting organization transport. Budgetary extortion is huge business, adding to a normal 20 billion USD in organize mishaps yearly. Industry authorities assume that this figure is actually extensively higher, as firms can't unequivocally recognize and measure incidents on account of distortion. The most exceedingly horrendous effect of budgetary frauds is on FDI inflows into India. With Changes in advancement, cheats have taken the shape and modalities of dealt with bad behaviour, passing on logically current procedures for execution. As money related exchanges turn out to be progressively innovation driven, they appear to have turned into the weapon of decision with regards to fraudsters. In this paper, we share our point of view on the patterns in frauds in the money related part, the changing administrative scene and the courses for misrepresentation aversion and control. This paper thus tends to current misrepresentation inclines in money related area and instrument of cheats recognition through the utilization of information mining endless supply of the examples, including a larger amount of check/verification to managing an account procedures can be included.

Proactive Fault Tolerance in Cloud: A Research Perspective Review

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Abstract

Fault tolerance is one of the primarily focused research areas in the field of cloud computing. Most of the existing fault tolerance frameworks are based on reactive approaches. However, due to the advancement in artificial intelligence techniques, there is a wider scope of research in proactive fault tolerance. Therefore, this paper presents a comprehensive review of the proactive fault tolerance frameworks in cloud. In addition, possible research directions are also described.



EEG-based Brain-Computer Interfacing for Non-Muscular Communication

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Abstract

The waves emanate from the human scalp, whenever a motor imagery activity happens in the brain. These signals can be fetched using many methods including that of electroencephalogram (EEG) signals recording. These signals after fetching, are further processed to provide input to the brain-computer interfacing. This area of signal processing has enticed a lot of interest amongst the research community. It can be used in a variety of applications including robotics, mobility devices, environmental control, device communication and for providing assistance to patients suffering from motor disorders. Many developments in recent times have been observed wherein artificial intelligence techniques have been used for various phases of implementation of brain-computer interface. In this paper, we have discussed various phases of brain computer interfacing and its applications including providing of non-muscular communication for patients suffering from severe motor disabilities. framework for existing algorithms, discussing current problems and future scope.

A Survey on Cancer Diagnosis using Deep Learning Techniques

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Abstract

The advancement of technology enhances the computational power which results in effective and fast processing of huge data. Medical diagnosis needs high computational power due to involvement of huge image classification. Deep learning that needs high computational power is the most effective technique for the image classification. Convolutional neural networks (CNN) (algorithm based on deep learning) are used for the image classification which uses large number of hidden layers to process the feature vectors effectively. This paper introduces the deep learning and the CNN algorithm along with a survey on usefulness of CNN in the cancer diagnosis.



A REVIEW OF CLOUD COMPUTING AND ITS DEMONSTRATION TO DETECT SOIL MOISTURE USING ARDUINO CLOUD

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Abstract

This research paper is a description of cloud computing technology in computer science branch of engineering. It is a research work of how cloud computing can be used for the purpose of providing necessary resources and facilities over the internet or a network such that it can be used as a platform for the development of specific working programs. Basically, cloud computing provides us means by which we can access the applications as utilities over the internet. The paper further explores the methodology through which program in arduino cloud is simulated for the detection of moisture present in soil specific output.

Privacy Preservation: An In-sight Approach of Online Social Networks

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Abstract

In the growing era of technology, social networking has evolved to create world as a global village. The main focus has shifted from accessing huge amount of data to enhancing privacy of user's personal details. In social networks, privacy constraint is often mislead as security while privacy parameter includes privacy of users, web links and their attributes. There are multiple components of privacy parameter in a network that includes multiple further problems. In a social network, user privacy includes multiple sub-problems like user location privacy, user interest and user personal information privacy. In this paper, privacy breaches are discussed that leads to proposal of privacy preservation approaches by numerous researchers. This paper laid stress on privacy parameter in social networks which provides a basic introduction and commencing action in the social network's effective deployment. Method of anonymization is also discussed along with various privacy preserving models.



An Exploratory study on Twitter Data

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Abstract

This paper is revolving around the food preferences of Indian people according to what people say on their Twitter accounts. We have collected many sets of tweets on different dates i.e. Oct15, 2018 to Jan10, 2019. The results and graphs show the likings and dislikings of people for different keywords like sea food, potato, bread, chicken etc. The graphs show that there is wide diversity in the likings and disliking of people. People like the veg & non veg food almost equal but their disliking is varied. The graphs are displayed further in the paper.

Emerging Research Trends in IOT

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Abstract

In the current scenario, the Internet of Things (IoT) is one of the most popular research areas. For the new researcher, it is difficult to identify and decide the research scope within the Internet of Things (IoT). This paper provides an overview of the Internet of Things (IoT) with an emphasis on emerging research trends. The Internet of Things (IoT) is so vast that it is hard to collect all information on a single platform. Articles are available about the emerging research trends in IoT but these are lacking in providing the cohesive information at one place. This paper endeavors to provide information about the latest research trends in IOT at one place by suggesting some future directions. However, the paper is intended to give user a framework for existing algorithms, discussing current problems and future scope.



Offline Signature Recognition: State of the art

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Abstract

With the advancements in information and communication technologies, the need to implement reliable authentication techniques is increasing. Thus, the increased security concerns make it essential to develop robust methods of biometrics based authentication systems. Handwritten signature is considered as the most natural way of authenticating the identity of a person. This paper detailed insights into the significant aspects of the state-of-the-art offline signature recognition systems such as feature extraction and classification techniques. The major challenges and key concerns in the development of signature corpora are presented. The paper also presents the key characteristics of some existing benchmark signature databases. In addition, important contributions in the area of signature recognition are exhibited in the tabular form. The key challenges for developing signature datasets are also presented. Deficiencies in this field are identified, e.g. there is lack of standard signature datasets to evaluate the performance of existing techniques used in offline signature systems. At last, the paper concludes with a succinct summary. The key objective of the paper is to present a comprehensive literature survey of the state-of-art knowledge of signature recognition.

Handwriting Analysis For prediction of Human Personality

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Abstract

Handwriting is one of the unique attribute of a human being and consists of useful information related to mental and emotional state of the writer. The science of handwriting analysis is called graphology. Handwriting analysis is an approach to predict personality of a writer using their handwriting. The act of handwriting includes conscious and sub conscious mind nerves, muscles and fingers. The conscious mind controls what writer writes, and sub-conscious mind controls how writer writes, governs writer's mood, feeling and behaviors. Handwriting analysis deals with the recognition of text and pattern that is written on a paper in English language. Handwriting analysis for detection of human stress comprises steps like scanning images, preprocessing, feature extraction and classification. Handwriting analysis reveals writer's health issues, past experiences, hidden talents and mental issues. The major application areas of graphology are personality prediction, writer identification, forged signature and mental diseases. This



paper presents the study of existing techniques and features used for handwriting Analysis. However, the paper is intended to give user a framework for existing algorithms, discussing current problems and future scope.

Review on Image Processing Techniques in Agriculture

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Abstract

Image processing plays a major role in agriculture for enhancing the yield of crops. There are many problems such as weed discrimination, plant diseases detection etc. which reduces the production of crops at a very large extent. To overcome these problems, manual detection methods are used which are very time consuming and expensive. On the other hand, image processing techniques provides automatic detection of pest, weed and plant diseases which is comparatively less time consuming and more accurate. In this paper, we discussed various Image Processing techniques for detection of pest, weed, plant diseases at earlier stages which results in reducing the use of pesticides. It is also beneficial for increasing production and income of farmers.

Role of Digital Technologies in Agriculture

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Abstract

Digital technologies are very useful in every aspect of day to day life. They covers a vast range of smart devices which are using different tools and are being used in different applications. Agriculture is the major source of fulfilling the food need of the peoples all over the world. Agriculture land is limited and population is increasing worldwide day by day. So there is a need of precision farming which must result in higher yield form this limited land and enhance the income of farmers. Digital technologies are now a day's being adopted at a very rapid rate in agriculture for the sake of precision farming. These technologies include Big data, Internet of Things (IoT), Block chain technology, Artificial Intelligence, Robots, Drones, Sensors, 3D printing etc. which are very effective and if used in a systematic manner will help in automation of agriculture work that not only reduces the overall effort and cost of the farmers and but also results in more productivity.



PROJECTIONS BASED TECHNIQUE FOR CHARACTERSEGMENTATION FROM HANDWRITTEN HINDI WORDS

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Abstract

Automatic Handwriting recognition field has been considered as one of the toughest problems in shape identification. The complexity level of this research area is high because of the reasons like the different way of writing followed by the user, structural independence, age factors of persons etc. The input to these kinds of systems can be considered as the scanned images containing handwriting text. This paper presents a novel technique and methodology for the most important step in the recognition process, i.e. segmentation of words and characters. The script under consideration is Devanagari script for writing the Hindi language. Vertical and Horizontal projection techniques have been implemented alternatively for reach to the target of complete word identification.

A Study on Big Data and Cloud Computing

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Abstract

Big data is a data analysis methodology that contribute in the rapid growth of various applications using in daily life like social network analysis, semantic web analysis and bioinformatics network analysis. Cloud computing is a model that is spreading everywhere in order to deliver big data services. This paper presents a brief introduction about the prototype of cloud computing. Cloud service models and deployment models explored in the prototype. Overview of big data along with its technologies is discussed. The basic issues and challenges in delivering big data is mentioned in rest of the paper.



MACHINE LEARNING BASED INVESTIGATIONS FOR OPTIMIZED TEXT DOCUMENT SUMMARIZATION

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Abstract

In this new era of technology, where huge information is available on the Internet, so it is important that one should have a mechanism to get the desired information efficiently in a concise way. Nowadays it is crucial to get the summary of a large document doing it own by the person. Summarization is a technique that extracts sentences from a text document, & then analyzes which text of document is necessary or which are not for summary. Mainly summarization has two techniques i.e. Abstraction & Extraction. Automatic text summarization is the application of NLP which constitutes into Artificial Intelligence. NLP provides interaction between the computer and humans. Automatic summarization is the process in which text is shortened with the help of software and makes the summary of salient point by selecting those from the document. But it retains its original meaning as the original document has. To make the coherent summary some technologies consider parameters such as Syntax, length, and writing style.

ANOMALY DETECTION TECHNIQUES IN VIDEO SEQUENCES EXIST IN LITERATURE & LATEST TRENDS

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Abstract

In these days, visual surveillance in lively scenes, particularly for humans and vehicles, is presently one of the most energetic research topics in the field of computer vision. It has a wide spectrum of capable applications, including admittance control in special areas, human being identification at a distance, crowd instability and overcrowding analysis, detection of anomalous behaviors, and interactive surveillance using numerous cameras, etc. In simple language, the processing structure of visual surveillance in lively scenes includes the following phases: representation of environments, motion detection, moving objects classification, tracking of moving objects, appreciative and explanation of behaviors, identification of human being, and the fusion of data from numerous cameras. So this is paper, we review recent expansions and universal strategies of all these phases. Finally, we consider the possible research directions in field of machine learning and artificial intelligence for the anomaly detection and behavior prediction in real world. By using the machine learning techniques, recognition rate could be maximized which is summarized in this paper behalf of a brief survey on existing anomaly detection mechanisms. We also present a discussion on the computational complexity of the



techniques since it is an imperative concern in real application domains. We expect that this assessment will provide an enhanced understanding of the different directions in which research has been done on this topic.

Content Based Image Retrieval Using Color and Texture Features

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Abstract

Content-based image retrieval is a system which extracts the relevant set of images and matches with query image from large number of dataset. CBIR is used in many important areas such as education, defense, biomedical, crime prevention etc. In CBIR, the images are indexed according to content of image i.e. color, texture and shape that are derived from images. Many features and algorithms can be used to improve retrieval accuracy and to reduce the retrieval time. In this paper, four methods have been used for comparative performance analysis which are CH (color histogram), LBP (local binary pattern), ULBP (uniform local binary pattern), MSLBP (multispectral local binary pattern), to extracts color and texture features of an image and retrieve the relevant images. We evaluate the results of these algorithms using WangSIMPLicity dataset. The WangSIMPLicity image dataset contains 10 categories of objects such as African peoples, beach, antic place, bus, dinosaur, elephant, flower, horse, mountain, and food. Every categories or object contains 100 images. We measure the similarity between two images using four distance measures which are, Euclidean, chi-square, Canberra and square chord distances. The performance of each method has been individually evaluated in terms of precision and average precision.

A brief analysis on resource utilization in cloud computing environment

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Abstract

Cloud computing in the recent years has emerged as the new paradigm of utility computing. It is a platform for providing virtual access to the software and hardware resources through Internet. Rapid increase in the demand of cloud services has necessitated the efficient utilization of datacenter resources in order to minimize the cost of ownership and energy consumption, and to provide quality services. It has become imperative to efficiently utilize the datacenter resources in order to achieve the desired objectives. This article presents a brief analysis on resource utilization in cloud.



A Survey on Cost Optimization Techniques using QoS for Inter-Cloud Computing

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Abstract

Cloud computing is currently the buzzword in the IT industry. It is a computing metaphor of internet technology applied to large, hosted data centers, geographically distributed services on a utility basis. Whence, the data, and software that resides solely in the remote servers. The Cloud Computing can be defined as delivering computing power (CPU, RAM, Network Speeds, Storage, software etc.) services over a network (essentially on the internet) rather than having the computing resources at the customer end physically. The Quality of Service (QoS) is one of the most important issues and challenge(s) posed by Cloud Computing. Quality of Service in Cloud Computing systems is used to achieve better results and giving better services to consumers by the cloud providers with respect to the Service Level Agreement (SLA). Cost is one of the most important parameters of cloud computing which is implemented by price strategies and models. In this paper, we explore the dynamic pricing models by various price strategies in cloud computing. It has been observed that there are various strategies in research on pricing models. But nowadays, customers need better performance and best pricing strategy. For that purpose, we should have to be focused on the cost optimization techniques for improving the Quality of Services. An extended approach is being implemented to enhance the QoS in cloud computing using QoS parameters for cost minimization and better response time.

VM Selection Policy to Optimize VM migration in Cloud Environment

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Abstract

Cloud computing, a metered based technology provides the services using virtualized technology over the internet. In the cloud environment, to improve the performance (such as utilization of the resources, energy minimization) extreme number of virtual machines (VMs) can be installed on the servers as per their resource capacity. In this way, servers can be overloaded. The energy consumption rate of overloaded servers is more in comparison to the server which is in a normal state. VM migration is an efficient technique to become a server in a normal state. VM migration technique is used to consolidate the resources to increase resource utilization (RU) and reduce the energy usage. In the VM migration technique, VM selection which is migrated from one server to another is an important aspect. Appropriate VM selection declines the numeral of VM migrations and increases energy efficiency. In this paper, the VM selection strategy is



presented. CloudSim toolkit is used to verify the strength of the proposed VM selection algorithm. Proposed VM Selection algorithm (MaxMT) performs better than existing MinMT algorithm in terms of total energy consumption, , number of hosts shut down, number of VM migrations, and average Service Level Agreement (SLA) violation rate. MaxMT reduces the energy consumption up to 7.25% and reduces the SLA violation rate up-to 2.6% in comparison to MinMT algorithm.

Cloud service mapping using multi criteria decision making method PROMETHEE

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Abstract

Cloud computing has become a dominant service computing model where resources are provided on the demand basis using pay as you go model. Cloud offers the services in terms of multiple Quality of Service (QoS) attributes. In cloud environment, efficient service mapping between cloud service provider (CSP) and cloud consumer based on multiple QoS attributes within the limited time overhead is a challenging issue. In this paper the multi criteria decision making (MCDM) method PROMETHEE based ranking algorithm is proposed for the service mapping in the cloud environment. Service mapping process is depicted through a case study. The applicability and usefulness of the service mapping process is validated through the experimental results. Results show that the service mapping process is achieved within the limited time overhead.

Framework for Sentiment Analysis of Bilingual Phonetic Text

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Abstract

At present social media is playing a crucial role in the life of human being. Most of the internet users are using social media or social networking websites to keep in touch with their family members, friends and relatives. Also share their suggestions, comments, feedbacks and opinions on these websites. Even many companies are using feedback and opinion of customers to enhance their products and services. To understand or analyze the opinions, sentiment, emotion and feeling of a person from given social media text is a challenging task. Sentiment Analysis (SA) techniques are used to extract the opinion and sentiment of a person from these texts and classify polarity into positive, negative or neutral. Sentiment Analysis is a sub area of Natural Language Processing. In this paper we introduce the basic concept of social media text and a framework for Sentiment Analysis of Bilingual Phonetic Text.



Sentimental Analysis Techniques: A Review

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Abstract

Sentiments of users that are expressed on the social networks, forums and blogs has great influence on the readers, product vendors and politicians. The unstructured form of data from the social media is needed to be analysed and well-structured and for this purpose sentiment analysis has recognized significant attention. Sentiment analysis (opinion mining) is a task of natural language processing to determine that the piece of text contains subjective information and what subjective information it shows, i.e., whether it is positive, negative or neutral. Sentiment analysis is used to read the human mind behind user generated content automatically and later it can be used for commercial use, political use and among others. In this review paper, latest studies regarding the techniques used in sentimental analysis are highlighted.

Medical Image Registration by using Edge Correlative Deviation Index on GPU

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Abstract

Graphics Processing Unit has taken a major role in parallel computing for general purpose applications by using architecture CUDA in order to take advantage of all available cores. The Primary focus of this research work is the implementation of medical image registration process on GPU using NVIDIA's CUDA architecture which computes the medical image registration process parallel. Second goal of this research work is to register the medical images by using edge correlative deviation index which derived from the voxels' positions in edge images. Third goal of the research work is to compare the performance factors speed and CI computed with the help of CPU and GPU. The results evaluated from GPU increase speed 1.5 to 3.5 times as compared to CPU depends on the size of the image.



Security Issues in Wireless Sensor Network: A Review

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Abstract

Wireless Sensor network is combination of small nodes with sensing, computation, and wireless Communication Capabilities i.e. A wireless sensor network is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants at different location. In this paper various security issues and security threats in WSNs are studied.

Survey on Cloud Computing and Security Issues

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Abstract

Cloud computing is the advancement of utility computing, grid computing, parallel and distributed computing which defines the new era. In the recent years cloud computing is adopted by IT companies. Cloud computing enables organizations and individuals to gain computing resources without capital investment. Cloud computing provides users “pay as you go” services on demand. Cloud computing is the technique to store process and manage the data on remote servers rather than personal computer. The cost of data storage on cloud is less as compared to storage on local server. Security of data is one of the main aspect in the cloud computing. Resource sharing in an open environment leading to the various security issues in cloud computing. In this paper architecture of cloud computing, various computing models, characteristics and security issues in cloud computing along with their solution will be explored. Brief description of applications of cloud computing is also given.



Current Trends in Big Data Analytics

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Abstract

Today's world not just include the living creatures but also the most important aspect upon which these living creatures are now more rely is "Information". There is an abundance of information against every aspect available on this planet. So the term "Data" is too concise to encapsulate this "Information". Hence the era of Big Data come into existence. Data is now big enough (in terms of volume, variety, value, veracity, velocity) that without proper techniques and methods it is not possible to frame a definite set of knowledgeable data. A need to mine this deep ocean of information to get knowledgeable data results in the various Data Mining techniques. In this paper, a reflection of all the major data analytical techniques and how the traditional models are replaced by the new emerging technologies based on machine learning or deep learning is presented. In spite of various techniques, there are several challenges come across while dealing with Big Data are also highlighted in this paper.

A Systematic Review of Reactive and Proactive Routing Protocols in MANET

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Abstract

The performance of various routing protocols like Ad hoc On Demand Distance Vector (AODV), Temporally Ordered Routing Protocols (TORA), Wireless Routing Protocol (WRP), Cluster Gateway Switch Routing Protocol (CGSR) and Landmark Ad Hoc Routing (LANMAR) are reviewed by some performance metrics. Routing protocols are the most essential part of any type of networks. Some brief explanation of the above mentioned protocols are given in this paper and after that the various performance metrics are compared.



A Review on Applications of Deep Neural Networks in Microscopic Image Analysis

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Abstract

In recent years, Artificial Intelligent systems have revolutionized many fields by contributing to day to day human life activities. Medical imaging is one of these prominent fields where artificially intelligent systems can be of great value. The success of deep learning based intelligent systems in fields such as computer vision and pattern recognition has grabbed the attention of the medical imaging community. The availability of high-speed internet, cheap storage, high-resolution imaging devices, and vast computation power has made computerized image analysis suitable using machine learning based techniques. Microscopic image analysis is a challenging field as it plays a critical role in disease characterization, computer-based diagnosis and prognosis. In this review, we have briefly discussed the various state of the art deep neural network architectures for the tasks such as disease classification, detection, and segmentation of microscopic images. The review concludes with a critical discussion about open research challenges and future research trends in microscopic image analysis.

Keywords: Microscopic image analysis, Deep neural networks, Classification, Computer-based diagnosis



TRACK IV: Computational Techniques in Renewable Energy Systems (CTRES- 2019)



Sr. No.	Paper ID	Title of Paper	Author(s)
1	CTRES_01	Comparative Analysis of Linear Switched Reluctance Motor for High Speed Rail Propulsion System	Shailendra Jain Nisha Prasad Sushma Gupta
2	CTRES_02	A Three-phase Asymmetric Multilevel Inverter for Standalone PV Systems	Sumit Kumar Yash pal
3	CTRES_03	Performance Analysis of Single-Point and Multi-Point Restricted Crossover Scheme in Design of a Neuro-Genetic Pattern Classifier	Sunil Kumar Vivek Harshey
4	CTRES_04	A Review on Various Hybrid Energy System Methods	Siddhartha Mukherjee Kaustav Bhattacharjee Deepak Sharma Sudhanshu Kumar
5	CTRES_05	Kinematic Analysis of Two-Wheeled Differential Drive Mobile Robot	Mukesh Kumar Sharma K. S. Nagla
6	CTRES_06	Kinematics of Skid-Steer Wheeled Mobile Robot	Sunil Kumar K.S. Nagla
7	CTRES_07	An Overview of Smart-Grid Technology with special emphasis on Distributed Generation	Deepak Sharma Kaustav Bhattacharjee Sumit Kumar Siddhartha Mukherjee
8	CTRES_08	Development of Human Body Finite Element Model for Knee Joint Investigation	Vishwajeet Dilbag Singh K.K Deepak
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10	CTRES_10	Analysis of Heart Rate Variability of Different Body Postures Using Wavelet Transform	Mangi Lal Dilbag Singh
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13	CTRES_14	Simulation & Analysis of Combined Power Generation based on renewable Sources by Using Fuzzy and PI Controller	Hare Krishna Mishra Gaurav Gangil
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CTRES_01

Comparative Analysis of Linear Switched Reluctance Motor for High Speed Rail Propulsion System

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Abstract

Emerging economies worldwide are facing worsening transport crisis because of rising urbanization, increasing traffic congestion, raging fuel prices and environmental distress. High-speed rail (HSR) transport system offers a viable solution to these problems. Propulsion mechanism forms an integral part of any HSR system. Linear motors are immaculate contenders for providing propulsion to such systems. These systems generally prefer linear synchronous motors (LSM) or linear induction motors (LIM) for producing required propulsion force for their movement. Though LIMs possess downsides of low force density, high eddy current losses and low efficiency still LIMs are adopted because of their rugged and simple construction, low manufacturing cost, universal availability and developed control techniques. Linear switched reluctance motors (LSRM) offers lower cost, rugged and simple construction. However, this motor suffers from drawbacks such as higher torque ripples. But still LSRM has grabbed the attention of researchers due to its robustness, high temperature endurance and inherited fault tolerant capability. Because of these inherent advantages, linear switched reluctance motors are widely researched for obtaining a suitable alternative to these commonly used motors.

This paper presents a comparative study of two different linear motors. The linear motors considered in this study are linear induction motor and linear switched reluctance motor. To provide the common basis for comparison, motors are designed for the same stack dimensions. These motors have been designed and analyzed using the finite element method (FEM). The merits and limitations of these motors are quantified comprehensively and summarized on the basis of their propulsion force performance.

Keywords- Linear Motor, LIM, LSRM, High speed rail, FEM

Methodology Proposed

As mentioned above, the calculation method used for the analysis is 3D-FEM. The design and analysis of linear motors requires analytical models for their proper performance assessment using simulation. As the linear motors have complex magnetic circuit and non-symmetrical structure, therefore 3D designing and analysis software is chosen. In 3D-FEM analysis the given problem is solved by dividing it into a number of elements.



Reason for popularity of 3D-FEM method lies in the fact that its elements can easily adapt to any boundary shape those results in comparatively faster solution time.

The motors under study work on different operating principles. They have different structures and follow different design procedures. To overcome this difficulty, these motors have been designed for same stack dimensions. Concentrated windings have been used in the motor structures.

Results and Discussion

The linear induction motor considered in this study is of the short-stator type because the simple and cost effective structure of the translator which forms the track as shown in Fig.1.

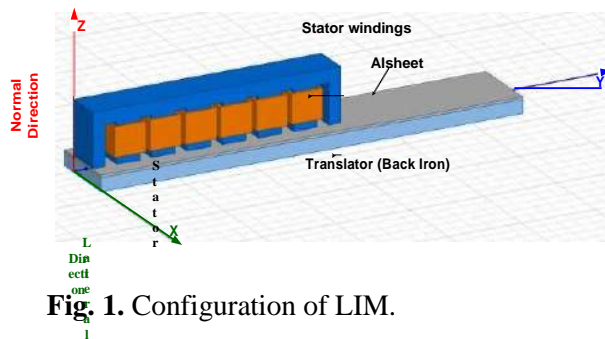


Fig. 1. Configuration of LIM.

In this study short stator longitudinal LSRM has been chosen as shown in Fig.2 due to its feasibility for traction applications.

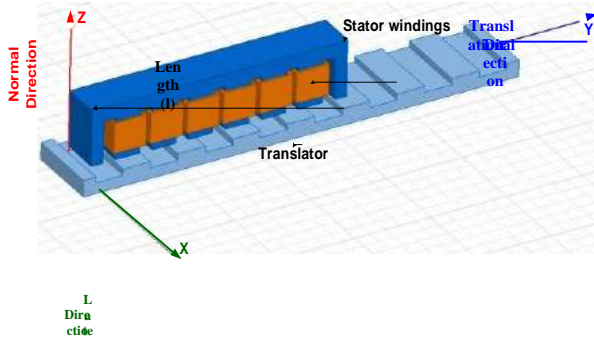


Fig. 2. Configuration of LSRM

The calculations and analysis is done using 3D- FEM. The comparison presented was based on the structural difference and force performances of the three motors. For a better performance, linear motor should possess high propulsion force with lower force ripples. The propulsion force produced by the LSRM is higher than the LIM. Force performance LIM decreases with the increase in the thickness of aluminum metal sheet due to the increase in losses in the sheet.

Conclusions



A comparative study of two linear motors has been done for high speed propulsion application for the same stack dimensions. The two designs are FEM evaluated, and all main aspects of analysis are taken into consideration. Based on the FEM analysis, it can be concluded that LIM has serious limitations in terms of propulsion performance. It produces less amount of force as compared to LSRM. Thus, LSRM can be seen as an alternative to LIM and LSM.

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CTRES_02

A Three-phase Asymmetric Multilevel Inverter for Standalone PV Systems

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Abstract

This paper presents an asymmetric cascaded H-bridge multilevel inverter for photovoltaic system. The asymmetric multilevel inverter is perfect solution for photovoltaic system because it enhances power quality and enables transformer less operation. In an asymmetric cascaded H-bridge multilevel inverter, different levels of voltage are applied which enhance output voltage levels and reduces Total Harmonic Distortion (THD) as compared to symmetrical multilevel inverter. Two different carrier-based modulation techniques are used for providing gate pulses to cascaded H-bridge multilevel inverter. A comparative analysis of two modulation techniques is also carried out in terms of THD. To validate the performance of an asymmetric cascaded H-bridge multilevel inverter for a photovoltaic system, the modeling is carried out using MATLAB/simulink. The result verifies the advantages and reliability of asymmetric cascaded H-bridge multilevel inverter for a PV system.

Keywords: Multilevel inverter (MLI), Total harmonic distortion (THD), Photovoltaic (PV) system, cascaded H-bridge (CHB), Maximum power point tracking (MPPT).

Methodology Proposed

This paper mainly focuses on DC to AC converter used for high voltage photovoltaic system. Multilevel inverter is the most popular inverter due to its application in high power medium voltage operation. It is used instead of CSI and two level VSI. MLI has the benefit of better voltage profile and low dv/dt [4]. Mainly, there are three multilevel topologies namely diode clamped MLI, flying capacitor MLI and cascaded H –bridge MLI. Among all of these cascaded H-bridge MLI is the most efficient because of its modular structure. It comprises of multiple units of single phase inverter generally connected in cascade. The number of power cells is decided according to operating voltage. Cascaded H-bridge converter requires separate DC supply for each cell. The converter operates in symmetrical mode when a common DC voltage supply is given to each cell while it operates in asymmetrical mode when a floating DC supply is given to each cell. In reference [1-3], the authors propose cascaded H- bridge inverter with equal voltage for each individual H-bridge

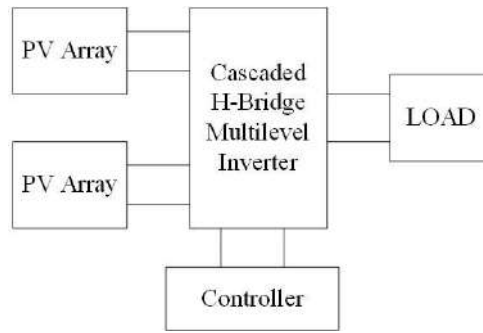
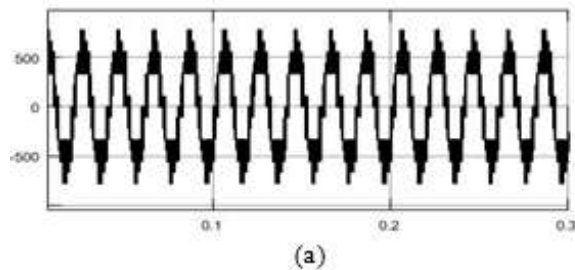


Fig.1. PV system with cascaded multilevel inverter

Results and Discussion

To validate theoretical results, the proposed topology is simulated using MATLAB/simulink software to test performance of asymmetric CHB inverter with solar panel as a source. Solar irradiation and temperature for all PV strings are 1000 w/m² and 25°C respectively. The simulation model of CHB inverter generated using IGBT switches is given in fig 5. PV array connected to upper cell has two parallel strings and three series connected modules per string and PV array connected to lower cell of CHB inverter has four parallel strings and six series connected modules per string. All the PV arrays have open circuit voltage of 36.9 V and short circuit current of 8.09 A. At MPP voltage is 18 V and current is 3 A. The output voltage of PV cell is 75 V which is connected to upper cell of CHB inverter while output voltage of solar cell which is connected to lower cell is 150 V. RL load is connected at the output of CHB inverter.

Fig 2(a) describes the output voltage versus time plot and Fig 2(b) describes the THD spectrum under phase modulation technique. In this case THD came out to be 5.22%. Fig 3(a) describes the output voltage versus time plot and Fig 3(b) shows the THD spectrum under level shifted modulation technique. In this case THD equals to 3.84%.



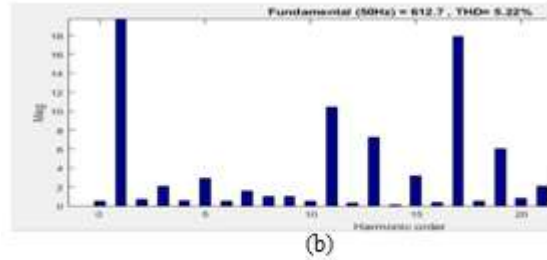


Fig 2 In case of phase shifted modulation (a) Output voltage versus time plot (b) Harmonic spectrum

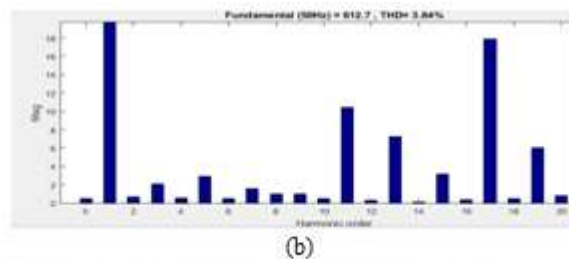
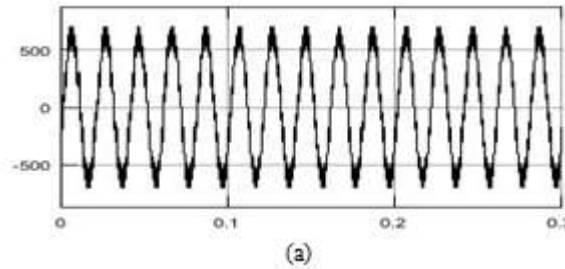


Fig 3 In case of level shifted modulation (a) Output voltage versus time plot (b) Harmonic spectrum

Conclusions

In this paper, three-phase asymmetric CHB inverter with different photovoltaic panels as DC source is presented. A suitable MPPT algorithm has been discussed. For providing gating signals two PWM schemes and their comparison has been discussed. Both the schemes can be used for modulation but level shifted scheme is better than phase shifted scheme. The simulation results verify the feasibility of this topology with separate photovoltaic sources.

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CTRES_03

Performance Analysis of Single-Point and Multi-Point Restricted Crossover Scheme in Design of a Neuro-Genetic Pattern Classifier.Sunil Kumar¹, Vivek Harshey²^{1,2}*Electrical & Instrumentation Engineering Department, SLIET Longowal, India,*¹*skbansal@sliet.ac.in, ²vivekharshey2000@gmail.com***Abstract**

Optimizing weights of Artificial Neural Networks (ANNs) by genetic algorithm (GA) is computationally more efficient when training is done by the back propagation algorithm. Conventionally, papers report better performance of multipoint crossover scheme when a Neuro-Genetic classifier is designed. However, in the absence of a mutation operator, the multipoint crossover is likely to give poor results, since computational complexity increases. This paper demonstrates the superior performance of single point crossover scheme for generating potential candidate. In applications where, low computational complexity is desired, single point crossover results minimized MSE performance of the weight vectors. Simulations performed on IRIS data confirm that for a simplistic Neuro-Genetic processor with no mutation mechanism, crossover scheme should be as simple as possible and hence single point crossover should be a preferred choice.

Keywords: *Genetic Algorithm (GA), Multipoint Restricted Crossover (MRX), Artificial Neural Networks (ANN), Mean Square Error (MSE).*



CTRES_04

A Review on Various Hybrid Energy System Methods

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Abstract

The modern era with all its boon has brought along with it the curse of pollution and its subsequent ill effects on the environment such as global warming and issues such as S and N (sulphur oxides and nitrogen oxides). The fast depletion of natural traditional resources from which extraction of energy takes place has forced the inclusion of new concepts like Hybrid Energy Systems (HES) in the current power generation scenario [1]. This review paper puts light on some of the feasible ways in which the hybridization of various energy systems can be done in order to decrease the ever increasing load on the conventional power generating techniques.

CTRES_05

Kinematic Analysis of Two-Wheeled Differential Drive Mobile Robot

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Abstract

In mobile robot applications, kinematics is the most basic requirement to design control strategies based upon the structural configuration of the robot. The kinematic analysis also allows understanding the mechanical behavior of mobile robots. Robot wheels are characterized by generic structures of the model equations. Based on the geometrical constraints of the wheels a kinematic model has been proposed. Kinematic analysis of differential drive and demonstration of path constraints for a mobile robot is presented in this paper. Simulation results show that the kinematic equation solutions are very near to the true value.



CTRES_06

Kinematics of Skid-Steer Wheeled Mobile Robot

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Abstract

Skid-steered robots, with their robust structure and maneuverability, are generally used for outdoor applications such as cleaning, transportation, and surveillance etc. For precision control on the mobility of such robots, it is required to compute the kinematic constraints. This paper presents kinematic modeling of a skid-steered mobile robot by using geometric relations. Based on the analysis of the kinematics of the skid-steered mobile robot, the underlying geometric and kinematic relationships between path parameters and locations of the instantaneous rotation centers are also revealed and motion of Pioneer 3AT is estimated utilizing them.

CTRES_07

**An Overview of Smart-Grid Technology with special emphasis on
Distributed Generation**

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Abstract

In the past few years India has been able to strengthen its power grid system, but loopholes still exist. It is unable to meet the ever-increasing energy demands of the country. To tackle this situation, adoption of new technologies is necessary that will form the basis of smart-grid (SG) and distributed generation (DG). In the recent years the penetration of DG has been on the rise in the developed countries. This paper presents the key aspects of SG and DG in a brief manner.



CTRES_08

Development of Human Body Finite Element Model for Knee Joint Investigation

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Abstract

Finite element method (FEM) is a method of answer of the boundary value problems. Finite element analysis (FEA) is the applied application of FEM. The obtained results are important in understanding the knee stiffness. Stiffness results in outward movement of knee which can create poor locomotion.

Keywords: Finite Element Method, Boundary Value Problems, Knee Stiffness, Poor Locomotion, ABAQUS.

Methodology Proposed

The finite element method (FEM) has an in-built algorithm which splits very big problems (in terms of complexity) into smaller elements which can be resolved in relative to each other [1]. In the present work ABAQUS is used for modelling and simulation. It is a significant tool in the biomechanics ground which is used to study the mechanism and kinematics of various body parts and joints. A normal human body design was created in ABAQUS software with the average dimension of a human body [2]. Human found it difficult to work if their knee got stiffed or stop working. Joint stiffness can be start at any age, which can lead to poor lifestyle and skeleton problems. In the present analysis, knee joints will be freezes and loading will be given from shoulders, which will give a reaction force from foot and travels to knee. Material properties of human body vary between subjects therefore and it is difficult to assign any particular material properties. The young's modulus of the leg bone varies from 10 to 20 GPa and for the analysis it was taken to be 12 GPa. Poisson's ratio and density used were 0.3 and 3000 Kg/m³ respectively. Linear elastic material model was selected for analysis and role of muscles in sharing the load were neglected and density used were 0.3 and 3000 Kg/m³ respectively. Linear elastic material model was selected for analysis and role of muscles in sharing the load were neglected.

Results and Discussion

FEA analysis is performed on full body model by applying the load on shoulders of 200N. Load leads to deformed human legs are shown in Figure 3 and Figure 5. The



reaction force generated in foot sole as the effect of load applied on shoulders is shown in Figure 2 and Figure 4.

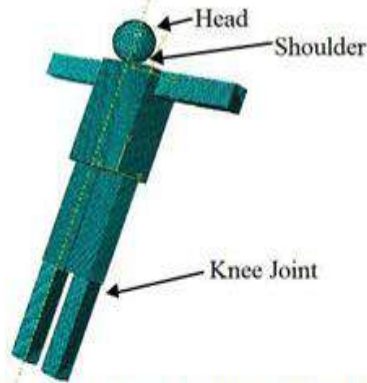


Figure 1. ABAQUS finite element model of human body.

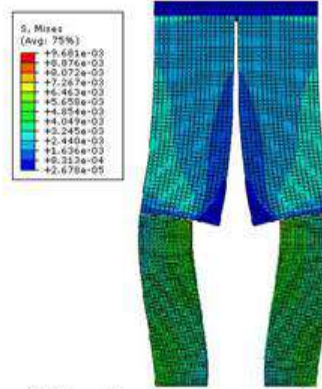


Figure 3. Reaction force generated in knee region

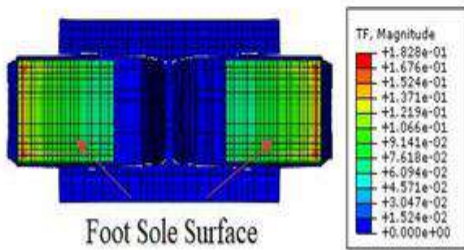


Figure 2. Reaction force generated on foot.

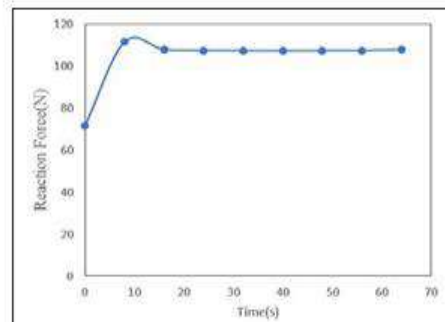


Figure 4. Reaction force generated on one-foot sole surface.

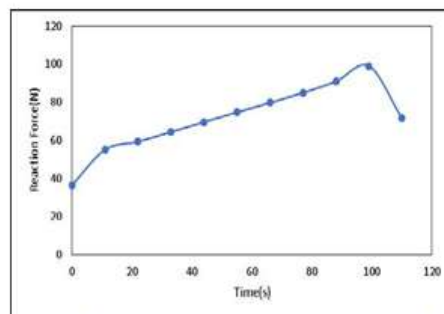


Figure 5. Reaction force generated in knee joint surface



Conclusions

The results indicate the failure of knee joint movement leads to the static force on foot sole which can cause bending of legs outwards. This outward bending can create dislocation of patella bone under high loading condition.

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CTRES_09

Analysis of Multiple and Multistage Power Quality Disturbances using S-Transform

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Abstract

Due to the involvement of several power electronic converters in the interfacing of renewable energy sources with the grid, power quality (PQ) issues have been increased. Meanwhile, these PQ disturbances need to be analyzed with an effective signal processing technique. PQ disturbances such as harmonics which almost remain present in the power system network are multiplied with the single stage PQ disturbances like sag, swell, and interruption to generate multiple PQ disturbances like sag with harmonics, swell with harmonics and interruption with harmonics. In contrast, multistage PQ disturbances are basically the single stage PQ disturbance followed by another PQ disturbance before the recovery of the first disturbance. This paper proposes S-Transform based analysis of multiple and multistage PQ disturbances. For the simulation purpose, the synthetic data of these PQ disturbances have been generated in MATLAB based on IEEE-1159 standard. Effective and satisfactory results have been obtained using the proposed algorithm.

Index Terms- Power quality, Multiple and multistage power quality (PQ) disturbances, S-Transform.



CTRES_10

**Analysis of Heart Rate Variability of Different Body Postures Using
Wavelet Transform**

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Abstract

Electrocardiograph provides information regarding the electrical activity of the heart by altering the shape of its constituent waves which is utilized to detect Heart Rate Variability (HRV). HRV is a most important characteristic for diagnosing various ailments of the heart. HRV is a measure of variations of successive heartbeats. In this paper, a new technique is proposed to detect linear as well as non-linear characteristics of HRV of different body postures using Wavelet Transform. An investigation of relationship between different body postures and HRV is given in the paper.

Keywords: Electrocardiograph, Heart Rate Variability, Wavelet Transform, Body Posture.

CTRES_11

Neural Network Predictive Controller for Coupled Tank System

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Abstract

In this paper, a neural network based predictive controller is investigated for controlling the level of a coupled tank system which is a non-linear process. The neural network based predictive controller (NNPC) uses a neural network and the mathematical model of the process plant to predict the future plant performance. The MATLAB Simulink toolbox has been used to simulate the controlled system with the proposed controller. Responses of the coupled tanks of the proposed method and model reference adaptive control (MRAC) method also have been presented.



CTRES_13

Interior Image Reconstruction Using EIT Technique

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Abstract

Electrical impedance tomography is a recently established technique by which impedance of an object is measured data from the surface of the object, and a numerically simulated reconstruction of the phantom image can be obtained. The EIT experiment presented here used a phantom with 16 electrodes attached to the surface. When different current pulse applied across the phantom and potential are measured over all the electrode pairs. This imaging technique based on boundary or surface voltage is measured when the different current pattern is injected into it. For current pulse, we are creating a voltage controlled current source. It is a combination of wave generator and voltage to current converter and current position and measuring voltage is calculating using the created Control Unit. After that image reconstructing of the cross-sectional image of resistivity requires sufficient data collection by (Finite element method) FEM method and the EIDORS toolkit package of MATLAB. The objective of the EIDORS toolkit was to produce an image from electrical impedance data and finally in the last phase 2-Dimensional image is obtained.



CTRES_14

Simulation & Analysis of Combined Power Generation based on renewable Sources by Using Fuzzy and PI Controller

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Abstract

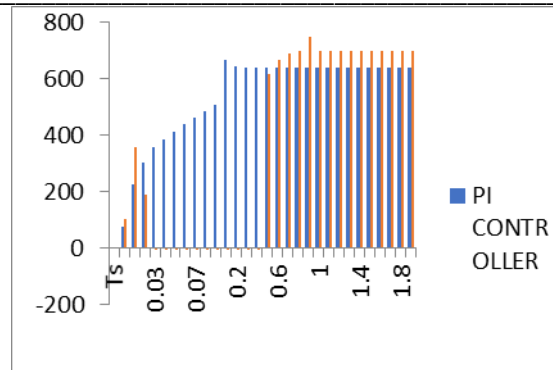
This paper is mainly focused on the idea of smart grid to build in the future. To implement smart grid we have to manage the smart resources that are, solar, wind and fuel cell. So firstly we have to design the generation system which uses the solar, wind and fuel cell. To make the generation system in a effective way we have to utilize some controller which gives fruitful results as simulation model in MATLAB and take the outputs of solar and wind. After getting the outputs of solar and wind we manage the output as per our requirements. In this work our system is mainly based on wind, solar and also fuel cell. To make a combined system for desired outputs power, controlling parameter is planned for individual system that is for wind power generation, Fuzzy Logic controller (FLC) is used to minimize the variations in to change in wind speed any time. Likewise in solar system an array of seventy two Photo-Voltaic cells is utilized and to enhance the power outputs Super conducting Magnetic Energy Storage (SMES) coil is used. After the outputs obtained from the designed model of combined power generation system indicate that the output power is high and for solar power system due to SMES results in power enhances exponentially.

Keywords: Renewable source Smart power grid, Fuel cell, PI controller, FLC controller, wind turbine, solar energy.

Methodology Proposed

In this work we are using two types of controllers first one is proportional-integral controller and other one is fuzzy logic controller. Fuzzy logic controller is one of the artificial intelligence techniques used for accuracy of work in particular areas. For simulation of hybrid system we are using fuzzy logic controller as an effective tool. Controllers are necessary for generation of electrical energy because with the varying in wind speed and PV potential oscillation occurs and it can be controlled by controllers only. The simulation & designing of hybrid electrical generation system is made in MATLAB SOFTWARE using different block used in this software.

Results and Discussion



The simulation outputs obtain out from wind solar combination model to produce power generation along with settling time explain that when fuzzy logic controller and SMES are applied with photovoltaic and wind model correspondingly. Now the results recognized is more stable and profitable as evaluated to the model with regular situations.

Conclusions

This research shows a model of renewable energy by combination of photovoltaic, wind with fuel cell power managing system. The given model and work of combination power system is completed by taking suitable power generation controllers. The combination power generation system is more impressive and potential generation system.

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CTRES_15

Analysis of liquid level control of couple tank system using PD, PI, PID Controller: A Review

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Abstract

Four commonly measured and encountered process variables are level, flow, Pressure, and Temperature, which generally affect physical and chemical processes industries. Controlling the level of coupled tanks is common encountered problem in many industries. Liquid level control is a typical representation of process control and is widely used in petroleum, iron, steel, chemical, and other industries. The liquid level control system is a nonlinear, complex, time-varying and involves large lag and is very difficult to control and regulate. This review paper presents and compares different types of PD, PI & PID Controllers for Coupled Tank System to Control liquid Level. The simulink Toolbox in MATLAB has been used for modeling and testing of the couple tank system. The experimental results of the non-interacting tank water level process can be satisfyingly illustrated the transient response and the steady state response.

Keywords: *PID controller, coupled tank, simulation.*



CTRES_16

A Novel Approach of Stability Problem in Wind Generator by using STATCOM

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Abstract

This paper presents a method to enhance the stability of a grid-connected wind generator composed of a fixed speed wind turbine generator system (WTGS) using a FACTS device of static synchronous compensator (STATCOM). Fault create at $t=1.0$ to 1.02 sec and observe simulation waveform. Finally observe Simulation base comparison of system without STATCOM and system with STATCOM and Analyses transient voltage stability of wind generator. This paper research work in simulation base Analysis of transient voltage Stability of grid connected generator using STATCOM.

Index Terms- Stability, grid, Induction generator, STATCOM

CTRES_17

A Review: Comparative analysis on various generations of Solar Cell

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Abstract

Solar electric power generated via the direct conversion of solar radiation into electricity. Photovoltaic's enables humanity to make use of sunlight in a clean, everlasting, and highly versatile way. PV gets its name from the process of converting light (photons) to electricity (voltage), which is called the PV effect. The enormous growth in the world economy, reflecting both increases in population and rising affluence, is occurring on a planet that is no larger today than it was when we evolved some 4 million years ago. In recent years solar cell technology has achieved tremendous growth as sustainable source of energy. The timeline of solar cells begins in the 19th century when it is observed that the presence of sunlight is capable of generating usable electrical energy. Solar cells have gone on to be used in many applications. For the developments of renewable energy technology invention of solar cell played an important role. Solar cells give us the easier way to utilize the enormous source of renewable energy. From the beginning of solar cell history its reliability, durability and price is a highly considering issue. In these studies, we showed a statistical comparison among the solar cell generation of different era. The comparative study is done by the material used in different generation solar cell, shape of the cell, durability, reliability and price variation of different era.



CTRES_18

Design and Analysis of Solar Power Fed Permanent Magnet BLDC Motor For Automotive Water Pump

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Abstract

In order to save our environment from various effects such as global warming, acid rain etc. and to save the resource, there has been desperate need to replace the conventional energy sources to renewable energy sources. In current scenario there are some changes in the automotive application i.e. to reduce volume and weight and to improve efficiency of the system. The conventional mechanical water pump is directly connected by the engine belt which is attached to an engine. Hence to increase the efficiency and to reduce the complexity, the conventional water pump should be replaced from electronic controlled electrical water pump. A permanent magnet BLDC motor is used for automotive water pump application. In this paper Permanent Magnet BLDC motor has been designed using ANSYS Maxwell software, which is based upon Finite Element Method (FEM). The efficiency, rated torque, speed and other electrical performance parameters are analyzed by RMxpert tool.

Keywords -Solar Energy; Permanent Magnet BLDC motor; Finite Element Method

CTRES_19

Development of wind energy conversion system and modern challenges in grid integration: A review

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Abstract

The global demand for electrical energy is growing twice as quick as the demand for primary energy. Highly reliable and fine quality power are demanded in the present-day power system development. Distributed generation including wind turbines and solar photo voltaic systems are significant in the awareness of green energy. Electricity generation with renewable power generators like wind and solar are preferred to avoid CO₂ emissions. In the sustainable alternatives, wind energy is considered as one among the fastest evolving energy resources. The percentage of renewable energy in the worldwide generation increases day by day. In this paper, evolution of various wind energy conversion systems (WECSs) with their benefits and demerits are discussed. The increasing entry of power electronic converter (PEC) based renewable energy is transforming power system dynamics with new stability concerns. Several challenges like power quality issues, low voltage ride through (LVRT) capability, fault ride through (FRT) capability, power oscillations, primary frequency regulation (PFR), virtual inertia support etc in power system with the inclusion of wind energy are also discussed.



CTRES_20

**A Review of Recent Advances of Muscle Fatigue Analysis Using Surface
EMG Signals**

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Abstract

In this paper an attempt has been made to review recent advances in the techniques used for muscle fatigue detection and analysis using surface EMG signals. Muscle fatigue occurs due to repetitive movement of a particular muscle or a group of muscle in our day to day activity. Fatigue detection at early stage is quite vital to decrease the risk of injury in the muscle. We begin our discussion with introduction to the time domain techniques generally used for fatigue detection i.e. RMS and IEMG and then focusing our attention to more complex frequency domain techniques such as Wavelet Transform Analysis, EMG Median Frequency Analysis, Averaged Instantaneous Frequency Analysis and last but not the least The Time Frequency based Medium to Low Power Band Ratio.

Keywords -Muscle Fatigue, EMG, AIF, Band Power ratio and Wavelet transform.

CTRES_21

**A Comparison on Renewable Energy and Non Renewable Energy
Power Development in India**

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Abstract

This Paper presents a comparative description of power development due to renewable and nonrenewable energy resources in India. In the present scenario fossil fuels and nonrenewable energy resources are playing lead role to fulfill the energy demand in India. Serious environmental problems associated with the use of nonrenewable energy resources. To overcome these problems the renewable energy power development has good potential to meet global energy demand. The energy requirement is one of the basic needs in present time. Factors associated with these resources are explained briefly along with maximum demand of energy.

Keywords -Coal and lignite, crude oil, Solar energy, Wind energy



CTRES_23

An Industrial Energy Auditing Efficiency Improvement of Furnace

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Abstract

This paper presents the process, field measurements, scope of improvement, suggestions for energy efficiency improvement on basis of observations and field values of various parameters related to Aluminum melting and holding furnace and benefits achieved after implementation. All the measurements and observations were made for four no of Furnaces in the plant. Out of four the modifications were made in one furnace only and will be replicated in other three furnaces later on. The modifications involved zero investment for implementation. Different software like RS logix5000, Factory talk view and Drive Executive were used while implementation. The modification resulted in energy saving of 1.93 Lacs Units and 122 Tonnes of HFO (Heavy Fuel Oil) per annum. The study for total of four furnaces will result in energy saving of 7.72 Lacs Units and 244 Tonnes of HFO (Heavy Fuel Oil) per annum.

Keywords -Energy Audit, Energy Audit Report, Energy Saving.

CTRES_24

Short-Range Fixed-Head Hydrothermal Generation Scheduling using Water Cycle Algorithm

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Abstract

This paper presents a solution to short-term hydrothermal generation scheduling (STHTS) using water cycle algorithm (WCA). The day to day schedule of power system operation is STHTS scheduling. Major objective of STHTS is to minimize the overall operating cost by utilizing the hydro energy while satisfying the constraints. Fixed-head reservoirs are considered. For solving STHTS problem, WCA is applied. WCA is a nature inspired algorithm based on the natural flow of water towards the sea (best solution). WCA has been successfully employed on unimodal and multimodal standard functions. From the results it is observed that WCA gives the best results in comparison with existing approaches, while solving STHTS problem.

Keywords -Short-term hydrothermal generation scheduling, water cycle algorithm.



CTRES_25

Hybrid Power Systems Based on Renewable Energies

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Abstract

Recently, in most of countries the increase of generating capacity happens in small units within the frame work of so called distributed power industry (distributed generation)-DG, embedded generation) and among them is hybrid power systems (HPS). Reaching the non electrified rural population is now not realistic through the extension of the grid, since the connection is neither economically possible, nor inspired by the main factors. Further, the increases in oil prices and the intolerable effects of this energy source on the users and on the environment, are slowly eliminating conventional energy solutions, for example fuel genset based systems, from the rural development agendas. Hence, infrastructure investments in rural areas have to be approached with cost competitive, reliable and effective tools in order to give a sustainable access to electricity and to stimulate development. This paper provides an informative instrument to raise awareness among the international community, relevant stakeholders & decision makers, of the existence of a compelling solution to provide cost-competitive & environmentally friendly electricity service to rural communities.



CTRES_26

Multi-objective optimization techniques to solve power dispatch problems: A Review

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Abstract

This paper gives a review to various techniques used to optimize the multi-objective ELD problems considering various renewable energy generation sources. There are varieties of techniques available to optimize the Economic Load Dispatch problem. A number of algorithms are there to solve the various optimization problems. Each algorithm has its advantages as well as disadvantages. Some of the algorithms are good in exploration and other in exploitation. There is no such algorithm which is capable to give the best results on each optimization problem, so it is needed to modify or hybridize the algorithms according to the optimization problem.

As per literature, improved hybrid optimization techniques give better performance than the conventional techniques. They have advantages in terms of accuracy, time required, convergence characteristics and fitness evaluation etc. These features are tested for a set of complicated problems and it is found that they outperformed conventional techniques.

Keywords -Economic load dispatch, gravitational search algorithm, Newton-raphson, gradient search, particle swarm optimization etc.



CTRES_27

Multi objective Heuristic Optimization in Economic emission Dispatch: A Review

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Abstract

Economic emission dispatch (EED) problems are having the importance of most central problems in power systems. Constantly growing energy demand, limitation of natural resources, rise in cost of power generation and environmental concern has become more and more demanding complex problems which force the decision maker to take decisions in an optimal way. Economic load dispatch is the catalog for the planning of generation output to handle load demand with minimum possible operating costs while fulfilling all the constraints. Availability of such sources is not continuous in nature. Moreover, various types of discontinuities in the involved apparatus characteristics makes the various conventional optimization algorithms fail to solve these discontinuous problems. They tend to settle for premature convergence. Here, heuristic techniques have played their role. This paper gives idea of contributions of various authors regarding the solution of EED employing heuristic search algorithms.



CTRES_28

Non-Conventional Way of Power Generation By Using Smart Solar Window Blind

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Abstract

World is expanding in every field from manufacturing to design. This is creating too much electrical load on our power grid system and hence looking for non-conventional ways of power generation and its new applications. Smart solar window blind is the future of solar panels and solution to the problem of power load. Corporate offices are using glass walls so that more amount of sunlight enters in their offices. They use office window blinds to stop excess sunlight and therefore can also be use window blinds for power generation by putting solar chips or thin-film solar cells on the side of window blind or solar slats or films which are exposed to sunlight. Automation techniques are also used to make it automated like using app controlling movement of window slats and how much power is generated by the office window blind.

Keywords- Solar cells, Microcontroller, Servomotors, RFID, and Sensors.



CTRES_29

A review on “Canal Top PV System Installation”

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Abstract

Out of all renewable energy sources, solar energy is most abundantly available in India. To extract this energy PV system is normally used. There are various methods to install the PV system like Roof Top PV system, Floating PV, Dam Top PV system and Canal Top PV system etc. During the installation/execution of these projects on ground level, various hurdles like land availability, substation capacity, opposition offered by land owners etc. are faced by project owners. Canal Top PV system installation is used to optimize the installation area also reduces the losses due to water evaporation. This paper gives a review regarding canal top PV system installation.



CTRES_30

Reduced Order Modelling of Concrete Bridge under Load

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Abstract

For determining new bridge structures and evaluating the existing designs, it is very important to perform structural analysis that determines the behaviour of the bridge under different load conditions. Modelling of such problems leads to a large order system that is computationally heavy and creates storage problems too. The reduced order models obtained after applying a model order reduction techniques, make the simulation easy and their control practically feasible. This paper shows reduction of a concrete bridge under load that forms a large order system.

Keywords: Concrete Bridge, Load, Finite Element Modelling, Model Order Reduction, Krylov subspace

Methodology Proposed

A bridge placed over equispaced supports is modelled as a beam as shown in Fig. 1. The load here represents vehicles on the bridge. The displacement of a beam when subject to load is governed by the Euler-Bernoulli beam equation. Since, the beam is homogenous and the Young's Modulus (E) and area moment of inertia of the cross section (I) are fixed along the length of the beam, so the beam equation is given as,

$$EI \frac{\partial^4 w}{\partial t^4} = p \quad (1)$$

where, w is displacement of the beam and p is the distributed load. The material of the beam is assumed to be isotropic and homogenous that holds linear elastic property.

A 2D model of a concrete bridge is modelled using COMSOL Multiphysics and further reduce by applying model order reduction (MOR) algorithm [1]. COMSOL Multiphysics is finite element method based software. Here finite element modelling (FEM) [2] results into a large order system and gives the study of structural response of the concrete bridge under load. Krylov subspace based model order reduction technique, is used for reducing the order of the system [3].

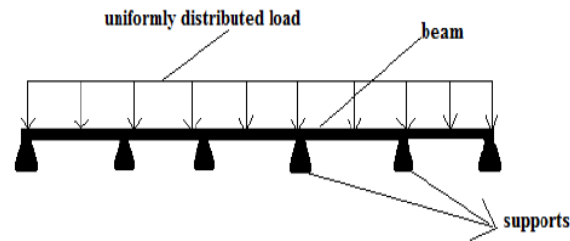


Fig. 1 Concrete beam on equispaced supports.

Results and Discussion

A concrete bridge 50m long and 0.5m wide is subjected to a load of 0.1MPa. The beam is placed over equispaced supports. The distance between two consecutive supports is called a span and each span is equal to 10m. Material of the bridge is taken to be concrete with Young's modulus 25GPa, Poisson's ratio 0.33 and mass density 2300kg/m³. A time varying study is carried out on the bridge using COMSOL Multiphysics. The system used for this work had 16GB RAM and an Intel core i7 processor.

After defining the geometry and applying the loading conditions, meshing is done using triangular elements. The meshing results in 2408 nodes. Thus the order of the system becomes 2408. This FEM simulation results in the transient response of the bridge under load. The simulation time is reported to be 48s approximately. This large order system is reduced using Krylov subspace such that the order is reduced to only 10 states. The reduction time to obtain reduced system is only 0.3s.

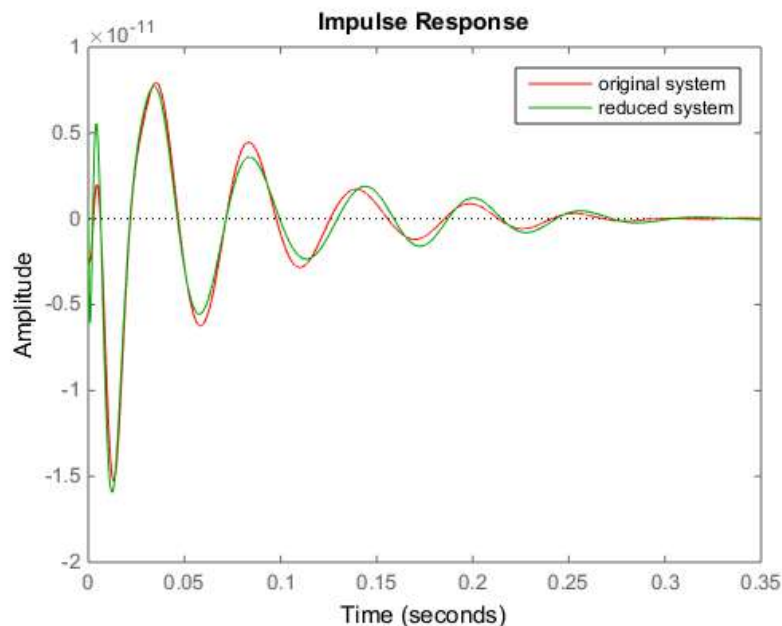


Fig 2. Plot showing impulse responses. Red for full order original system and green for the reduced system.

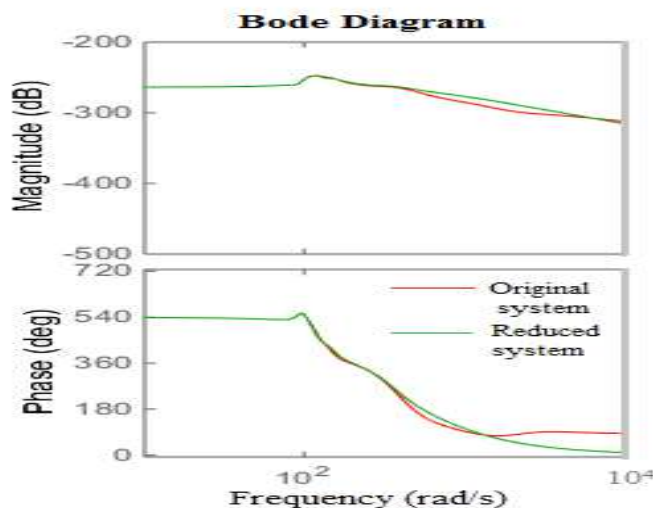


Fig. 3 Plot showing bode responses. Red for full order original system and green for the reduced system.

The accuracy of the reduced system is checked by comparing the responses of the unreduced and the reduced systems for an impulse input. The overall behavior of the system is obtained with an impulse response. Figure 2 shows the impulse response of the unreduced system and the reduced system. The vertical axis of the plot shows the displacement of the bridge in meters. From the plots in Fig. 2 it is clearly visible that the impulse response of the full order original system and the reduced system are matching. The mean error between these two responses is as small as 2.95×10^{-14} . A comparison of frequency domain behavior of unreduced and the reduced systems is also shown using bode plots in Fig. 3 which shows that both the gain and the phase plots of the unreduced and the reduced systems matches very well. The mean error between the bode plot of the two systems is only 3.41×10^{-14} .

Conclusions

This paper presents the scope of model order reduction in the structural dynamics by considering the problem that involves a bridge subjected to load. The utility of this simulation was to simulate the structural response of a bridge under vehicle load. 2D simulation of the bridge using finite element method resulted in a very large order dynamical system. Model order reduction using Krylov subspace based method resulted in a reduced model with significantly less number of states. Responses of the reduced system were obtained and compared with the responses of the original system.

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CTRES_32

Effect of Pole Embrace Factor on the Design of Switched Reluctance Motor for Electric Vehicles

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Abstract

This paper presents the design and analysis of Switched Reluctance Motor for Electric Vehicles. Electric vehicles are said to be the best alternative solution for replacing IC engine vehicles. It is very important and prime objective to estimate the dimensional parameters and also to analyze the operational behavior at each and every condition of the machine before manufacturing it to a physical model. For this reason, simulation method is approached. Switched Reluctance Motors (SRMs) have a lot of advantages such as they do not contain brushes, collectors and magnets. There is no maintenance requirement. Hence the production cost is low. The efficiency of SRM is over 95%. Thus, it is seen that SRM is an appropriate motor type for Electric Vehicle application. In this work, it has been shown that stator and rotor pole embrace factor have a considerable effect on the performance of SRM. The presented work has been done with the help of Finite Element Method (FEM) based simulation software Ansoft Maxwell RMXpert version 15.0.

Keywords—Switched Reluctance Motor, Pole Embrace Factor, Finite Element Method,, Torque Speed Characteristics

Methodology Proposed

Electrical machine design software developed by ANSYS i.e. ANSOFT Maxwell 15.0 has been employed for the proposed work. Finite Element Method (FEM) based design simulation of Switched Reluctance Motor for use in Electric Vehicle has been done using electromagnetic field simulation software ANSOFT Maxwell RMXpert, available with ANSYS Maxwell package [4]. The motor design has been carried out to test whether the performance of the prototype motor matches the user requirements.

I. Design Requirements

The design process starts from the requirements that must be established prior to initiating the design. To increase the robustness of the propulsion system, each wheel on the back side (i.e., two motors particularly for two wheels) has been equipped with a driving motor [3]. Some important parameters leading to the motor design requirements are listed below:

Battery voltage requirement: 300 volts
Rated Speed: 500 RPM



Power rating of the machine: 1500 W

The principal design parameters of the specified SRM have been decided [1] and are listed in Table I.

Table I

Parameters	Symbols	Value(Units)
Stator Outer Diameter	D	246.2 mm
Stator Inner Diameter	D_{si}	156.3 mm
Stator Poles	N_s	8
Stator Yoke Thickness	Y_s	16 mm
Rotor Outer Diameter	D_r	156 mm
Rotor Inner Diameter	D_{ri}	40.53 mm
Rotor Poles	N_r	6
Rotor Yoke Thickness	Y_r	20.26 mm
Stack Length	L_{stk}	159.1 mm
Stacking Factor	K_{stk}	0.95

RMxpert design i.e., Rotating Machine expert design is a template-based design tool of the ANSYS – Maxwell suite used to create a customized machine design flow to meet demand for higher efficiency [6]. ANSYS Maxwell includes a variety of Electrical Rotating Machine’s models which makes the research scholars to design and analyze their machine easily and more conveniently [2]. A modeled design of Switched Reluctance Motor appears on the right side of the main working window [5]. The window contains the separate designs for Stator, Rotor and also the combined machine design as in figure 1.

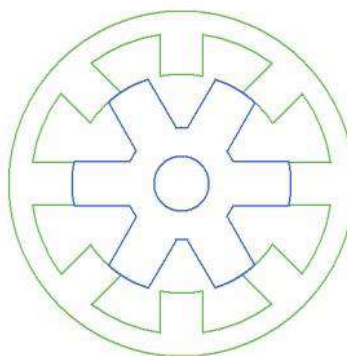


Figure 1: SRM Model in RMxpert

II. Pole Embrace Factor

Generally, embrace coefficient of SRM will influence the rotor and stator tooth width. Pole Embrace Factor is defined as the ratio of pole arc to pole pitch. The changes in pole embrace will affect the output performance of motor in terms of Efficiency, Torque at rated speed, Starting Torque and Rated Speed.



For selecting the appropriate values of pole embrace factor of stator and rotor, the embrace factor has been varied gradually taking the step size 0.05. The embrace factor of stator has been selected to be varied from 0.4 to 0.7 taking total of seven values including intermediate values of step size 0.05 starting from 0.4 to 0.7. Similarly for the rotor, the embrace factor has been selected to be varied from 0.2 to 0.5 taking total of seven values including intermediate values of step size 0.05 starting from 0.2 to 0.5. The selection of pole embrace factor of stator and rotor is obtained depending upon these optimum values of Efficiency and Rated Torque. The various curves and results obtained by RMxpert analysis for the different values of pole embrace factor have been obtained. A model based on appropriate pair of stator pole embrace factor = 0.7 and rotor pole embrace factor = 0.35 which offers improved torque as compared to previous model has been suggested.

Results and Discussion

The solution data and curves obtained by RMxpert analysis of Suggested SRM Model having stator pole embrace factor = 0.7 and rotor pole embrace = 0.35 have been tabulated in Table II.

Table II

Parameters	Value (Units)
Output Power	1476.23 W
Input Power	1521.98 W
Total Loss	45.7529 W
Efficiency	96.9939 %
Rated Torque	31.9133 Nm
Total Net Weight	105.911 Kg

The Efficiency Vs Speed Curve and Output Torque Vs Speed Curve obtained by RMxpert analysis have been shown in Figure 2 and Figure 3 respectively.

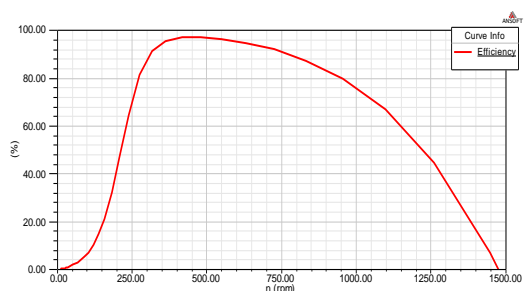


Figure 2

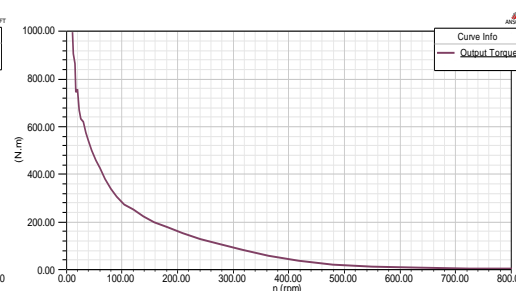


Figure 3

Figure 2: Efficiency Vs Speed Curve
Figure 3: Output Torque Vs Speed Curve

Conclusions



This paper presents the FEM based design and analysis of SRM using ANSYS Maxwell software package. The motor has been designed initially by referring the dimensional data available with one of the research papers reviewed in our study in ANSYS Maxwell RMxpert. In this study, it has been found that the Stator pole embrace factor and the Rotor pole embrace factor have considerable effect on the efficiency, rated torque and weight of the motor. On the basis of the comparative study, it has been found that the SRM design made on setting the Stator pole embrace factor equal to 0.7 and Rotor pole embrace factor equal to 0.35 may be commented as a reliable design. The results obtained by RMxpert solution data have been provided. The motor offers efficiency of 96.9939 % (almost equal to 97 %), rated torque equal to 31.9133 Nm (almost equal to 32 Nm).

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CTRES_33

Hybrid Wind-Solar PV Energy Based Microgrid

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Abstract

An analysis and control of wind turbine driven synchronous generator (SG) interfaced to the grid for variable speed wind energy system (WES) is presented in this work. This system also consists of solar photovoltaic (PV) array and a battery and has the capability to attain maximum power point (MPP) both from wind and solar resources. It uses the control algorithms that are able to reduce the power fluctuations on the grid due to variable speed WES under different loading conditions. It consists of two back to back connected synchronous generator side converter and load side inverter (LSI) through a battery across the DC link capacitor. This system provides controlled power to the grid irrespective of the uncertain nature of wind speeds and solar insolation level. Both the voltage source converters (VSCs) are incorporated with effective control strategies to improve system performance. The MPP for wind and solar resources are tracked and the voltage and frequency are maintained across the load within the required range. This system is tested at steady state and dynamic conditions including variation in wind speed, changing solar insolation level and different loading conditions. The performance of the system is demonstrated for harmonics elimination, load leveling and the control of voltage and frequency of load voltage.



CTRES_35

ROI Based Contrast Enhancement Algorithm for Medical Thermography

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Abstract

Infrared (IR) thermography is a non-contact type approach for measuring the temperature distribution on the object's surface. It has been successfully used for various clinical applications. Normally, the medical thermograms have poor contrast which leads to false diagnosis of medical diseases. However, various contrast enhancement approaches are available, but further research is still required for better visualization of medical thermograms. In this study, the proposed approach employs some standard contrast enhancement techniques with region of interest (ROI) information which provides better outcomes. In brief, the proposed approach is comprised of: (i) extraction of ROI using optimal temperature thresholding, (ii) pseudo-colouring the extracted region, (iii) non-linear contrast stretching, and (iv) edge marking the distinct regions. The performance of methodology has been evaluated by visual analysis which indicates that the results of proposed approach are better than the standard approaches.

Keywords- IR Thermography, Contrast Enhancement, Decorrelation Stretching, Optimal Thresholding, Edge Detection



CTRES_36

Improved Power Quality Buck-Boost Converter fed PMSM Drive

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Abstract

Permanent Magnet Synchronous Motors (PMSMs) are good alternatives to be used as electric drive over other electric motors because of numerous advantages. PMSM requires controlled AC supply as per the rotor position which is usually obtained through diode bridge rectifier (DBR) voltage source inverter (VSI) combination. The DBR based supply consists of high total harmonic distortion (THD) and poor power factor (PF). Therefore, control of THD and PF within specified limits are essential for these drives. This paper presents a buck-boost converter for the improvement of power quality of PMSM Drive.

Keywords- Buck Boost Converter, Inverting Regulator, Permanent Magnet Synchronous Motor, Power Quality, Voltage Follower Control.



CTRES_37

An SVPWM based Induction Motor Drive for Solar Water Pumping System

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Abstract

This paper deals with the design and implementation of a space vector modulated scalar control (V/f) scheme for an induction motor drive driving solar PV based water pumping. The V/F control scheme eliminates the speed sensor and thus curtails the cost. The single stage control scheme for maximum power tracking eliminates the boost converter and thus checks the losses incurred in it. Therefore, the overall system incorporating the single-stage SPV powered SVM based induction motor driven water pump, is modelled and its performance is simulated in MATLAB/Simulink environment and the suitability of the system is verified experimentally on a laboratory prototype under various conditions.

Keywords-V/f control, Space vector modulation technique, SPV array, INC algorithm, Induction motor drive (IMD), Water pump.



CTRES_38

A Novel Fault-Tolerant T-type Single-Phase Five-Level Inverter

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Abstract

This paper proposes a novel fault-tolerant T-type single-phase five-level inverter configuration. Conventional two-level inverters are usually employed in applications like electric vehicle and grid integration, but the output voltage has significant amount of harmonic content. To minimize the total harmonic distortion and the requirement of filters multi-level inverters (MLI) are employed for high as well as medium power applications. The proposed inverter topology can endure the system faults which either occurs due to the failure of the source or due to the failure of any single switch in the system. In contrary to the conventional five-level multilevel inverters this configuration utilizes a smaller number of switching devices. In this paper the novel T-type structure, this fault would have caused a complete shutdown, but this fault-tolerant T-type structure, the power conversion continues with a three-level load voltage waveform. To validate the proposed system simulation results have been discussed under normal and faulty condition in MATLAB/Simulink environment.

Keywords- Multi-level inverters, Fault-tolerant, Reduced count, Cascaded H-Bridge, T-type, Total harmonic distortion (THD), Phase opposition disposition (POD).

Methodology Proposed

The circuit diagram of the proposed fault-tolerant single-phase five-level inverter circuit is shown in Fig.1. Moreover, the proposed topology due to the high frequency cycle-by-cycle voltage balance between C_P and C_N . This paper mainly focuses on the inverter topology and energy balancing method applied between source and the load. The proposed five-level inverter configuration consists of a three-level cascaded H-bridge inverter and a two-level inverter. On one side of the load cascaded H-bridge is connected and on the other two-level inverter is connected. The cascaded H-bridge generates the following voltage levels i.e. $+V_{dc1}$, 0 and $-V_{dc2}$; and in similar fashion the two-level half bridge inverter generates two voltage levels i.e. $+V_{dc1}$ and $-V_{dc2}$.

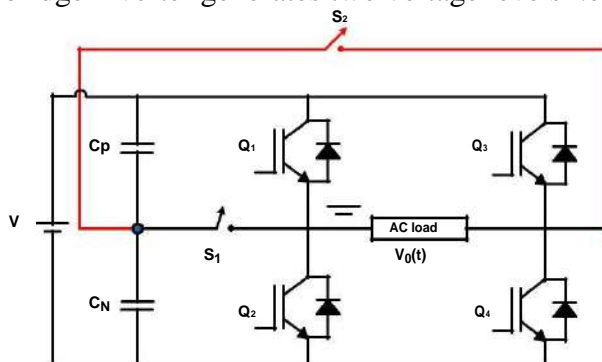


Fig.1 Proposed fault-tolerant single-phase five-level inverter.



The most effectual energy-balancing technique is to balance the charging/discharging of the batteries in case of uneven state of charges (SOCs). This approach is attained with the help of redundant switching states of middle voltage levels of the ($+V_{dc}$ and $-V_{dc}$). To produce the desired voltage levels both the sources are connected in series and then from the aggregated signal actual gate signals are extricated. Comparators are employed for the levels in aggregated signal and a look-up table for the topology being modulated. With the help of this method, the schematic representation of modulation of five-level inverter is exhibited in Fig. 2. In this paper, to generate a five-level voltage phase opposition disposition carrier PWM is utilized and accordingly the gating pulses are generated as shown in Fig. 3. When the fault occurs, the modulating wave becomes half and then compared with the two inner carriers (V_{cr2} and V_{cr3}) as shown in Fig.4 and the corresponding three-level voltage are generated accordingly.

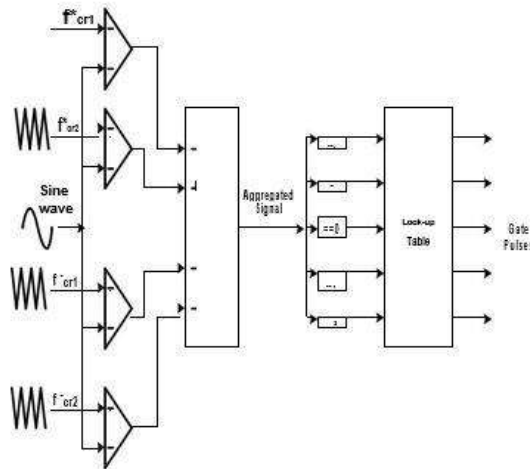


Fig. 2 The schematic diagram of modulation strategy

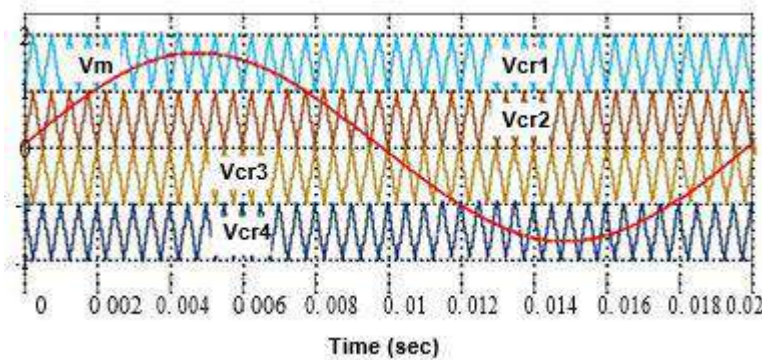


Fig. 3 POD-PWM technique with $m_a=0.85$

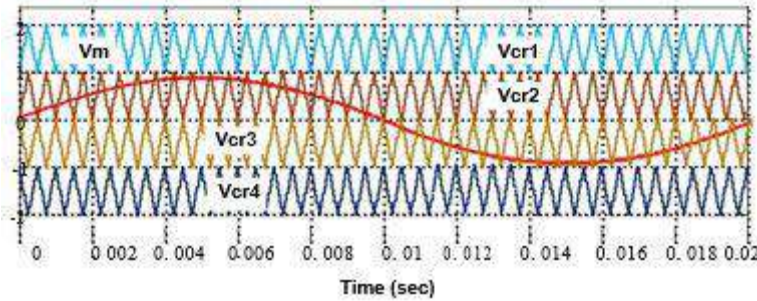


Fig. 4 POD-PWM technique during source or switch failure with $m_a=0.85$

Table I Parameters for the Simulation

Rated battery voltage	$V_{dc} = 100 \text{ V}$
Rated output voltage before fault	100 V
Rated output voltage after fault	50 V
Modulation index	$m_a = 0.85$
Switching frequency	$f_s = 1 \text{ kHz}$
Modulating wave frequency	$f_m = 50 \text{ Hz}$
Load Resistance, inductance value	$R = 25 \Omega, L = 4 \text{ mH}$

Results and Discussion

The proposed fault-tolerant three-phase five-level inverter is simulated using MATLAB/Simulink and demonstrated for an RL load at a rated output voltage of 100 V rms. The five-level output voltage waveforms across the load and current through the load for the modulation index of 0.85 is depicted in Fig.5 and Fig.6 clearly shows the five voltage levels and nearly sinusoidal load current waveform. After 1 sec, the fault is initiated after 1sec and the transformation of the voltage from five-level to three-level are shown and it also exhibits the reduction in the voltage and current magnitudes.

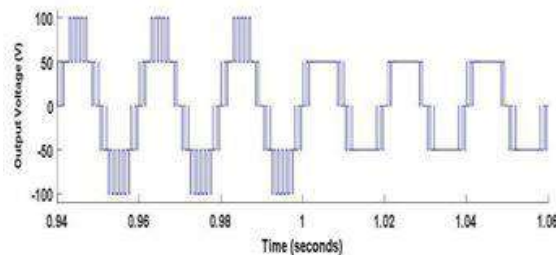


Fig. 5 Output voltage of proposed inverter

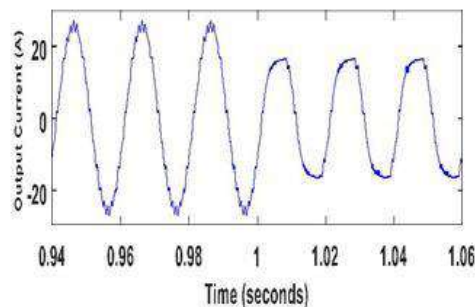


Fig. 6 Output current of proposed inverter

Conclusions

This paper introduces a fault-tolerant single-phase five-level inverter. The proposed topology is simulated in MATLAB/Simulink. With the help of one leg of the three-level five-level output voltage can be obtained. In order to produce the five-level output voltage phase opposition disposition carrier based PWM technique is adopted and the redundant switching combination is utilized to balance the energy between sources. In case of fault i.e. when any one of the source and /or switch fails, the proposed topology can be operated as a three-level inverter with the help of a bidirectional switch which reduces the magnitude of output voltage to half.

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CTRES_39

EMG Signal Features and Classification of Forearm Movements

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Abstract

Electromyogram (EMG) has always been significant for recording muscular movements. Hence, it is clinically applied, especially in Prosthesis hand and electric power wheelchair. Common type of EMG used these days is the Surface Electromyogram (sEMG). Our proposed work recording of real time EMG signal for 10 healthy subjects aged between 20-30 years using two channels MP 100A Biopac systems Inc. Six different motions were recorded using two active surface electrodes that were placed on the surface of skin covering the 'Flexor Carpi Ulnaris' and 'Brachioradialis' muscle in the forearm. Wavelet decomposition-based feature extraction and Artificial Neural Network (ANN) classifier using Back propagation algorithm has been used to classify 6 forearm movements. Results for binary class were between 92% and 98%. This work not only improves the classification accuracy but also increases robustness while decreasing the complexity.

Keywords- Electromyogram (EMG), Wavelet Transform, Prosthesis, Artificial Neural Network (ANN)



CTRES_40

Telemedicine Impacts on Rural Healthcare: A Review

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Abstract

Since our independence the Indian economy is continuously based on agriculture and the large part of our population comes from the rural areas which are somehow connected with agricultural activities. The cities where the agriculture products are used as a raw material for market products. Therefore, the urban population is also connected with the rural activities which is nothing but the agriculture, so that the health and education for rural population should be the prime concern for economic and social growth for any country. In this article we are focusing our attention on rural health and suggests why and how telemedicine is the great deal in this regard. In most of the developing countries not only in rural areas but in urban also the patient to doctor ratio is very low. Therefore, telemedicine would be the good option for this lack of good clinical treatment in the absence of physician.

Keywords-ISRO, telemedicine, network, communication, wireless devices.



CTRES_42

Evolutionary computing techniques for Distributed Generation: Survey

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Abstract

Distributed Generation is the generation of electricity from many small energy sources and is located closer to the user, or customer. In recently there has been large interest in the assimilation of distributed generation units at the distribution systems. The main purpose of using distributed generation is to improve voltage profile, voltage stability and to minimize power losses. Distributed generation (DG) is carried out to reduce losses, to improve voltage profile and to maximize voltage stability in a power system. In recent years, several evolutionary computing-based optimization techniques have been proposed to solve the optimization problem of distributed generation. These techniques include Genetic Algorithm, Artificial Bee Colony, Particle Swarm Optimization and Differential Evolution etc. DG problem has been solved as a single objective as well as multi-objective optimization problem using these techniques. This paper presents an overview of research and development work carried out in the field of Distributed Generation. This paper presents a review of research work carried out for solving problem using evolutionary computing techniques. Types of distributed generation, technology used for distributed generation and related terms are also discussed.

Keywords: Distributed generation (DG); types and technology; Single objective optimization problem and Multi objective optimization problem.



CTRES_43

Evolution of Electric Vehicles- A review on historical development and present status

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Abstract

Nowadays, the utilization of vehicles is drastically increased due to urbanization, industrialization and change of living standard. Basically, fuel-based and hybrid electric vehicles are often used in routinely activities which rely on the non-renewable resources, such as petrol, diesel, LPG and CNG. Consequently, these vehicles adversely affect our environment by emitting the harmful gaseous content. To reduce these contents and to make environment eco-friendly, there is need to move towards the emission-free vehicles, where electric vehicle is one of an alternative. These vehicles are also called Zero Emission Vehicles (ZEVs). With this consideration, the present paper targeted on the basics of electric vehicles, historical development, challenges and issues faced in present scenario. Besides, the comparison among various vehicles in terms of the efficiency, range, speed, acceleration, mileage, cost etc., has also been discussed.

Keywords: Electric Vehicle, Internal Combustion Engine, Hybrid Electric Vehicle, Plug-In Hybrid Electric Vehicle.



CTRES_45

Recommendation of parking lot based on approximation dynamic analysis

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Abstract

In the experiment of counting vehicles arrival and charging time prediction we are now able to predict the number of vehicles in every parking lot system using python programming language, which is based on Poisson's theorem. This experiment proposes a system that predicts the EV going to arrive and leave in a time interval as well as the state of charge and the charging time for the same. This prediction is later used in a map based android application. The android application uses the prediction mechanism and proposes a suitable parking lot for the user. The app stores all the data of the location of the parking lots. Data sheet of London's parking lots providing the coordinates has been taken as reference for the ease of getting started with the experiment. This lets the user to locate the nearby parking space. The availability of parking is measured and shown to the user. This algorithm will help locating the nearby parking space for charging spot country wide.



CTRES_49

Economic Power Dispatch Considering Renewable Energy Using Differential Evolution Algorithm

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Abstract

This paper presents forecasting for performing in the real time in every 5 to 15 minute time span. Participation factor is taken as a base from the previous economic dispatch. Generators are used to participate in power imbalance between the two consecutive schedules. Differential evolution method, minute to minute variability is used to evaluate best fit participation factors. The voltage, reactive power limit and line flow constraints are comprised for all minute to minute sub-intervals. Since 'best-fit' participation factors are evaluated only once, i.e., at the start of the scheduling interval, the dimensionality of the optimization problem remains the same as that of the conventional approach. The proposed approach is suggested for sequential and dynamic variants.

Keywords: Electric Vehicle, Internal Combustion Engine, Hybrid Electric Vehicle, Plug-In Hybrid Electric Vehicle.



CTRES_50

Fuel Production from Waste Tyre Rubber

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Abstract

The increasing fuel prices are the burning issue in India. In the year 2017-2018 India imported about 256.32 metric million tonnes of crude oil and petroleum product which is approximately equal to 6,52,896 lakh crore. The Indian import of crude oil contain sour grade (Oman and Dubai average) and sweet grade (Brent Dated) of crude oil which is processed in Indian refineries in the ratio of 72.38:27.62 in the year 2016-17. As the demand for petroleum products increasing day by day and level of crude oil decreasing. Also, the main thing is that these fuels are not renewable. Everyone is worried about the issue what would we do when the day will come that all the petroleum reservoirs will end up. Hence, it has become necessary to determine a new methods or solutions to fulfil the increasing demand. Researchers are engage in finding out the new alternate fuels for the petroleum. The alternate fuel should be such that it should minimise the air pollution as much as possible. It will be more beneficial if the alternate fuel is produce from the waste which will also reduce the problems of waste management. Keeping the all these point in view present experimental investigation was carried out at G.B. Pant University, Pant nagar for the production of alternate fuel from the waste rubber tyre oil for engine use. The selection of waste tyre also minimizes the problems waste tyre management which reduces soil & air pollution causes by burring and burning them respectively. The oil from the waste tyre was prepared by pyrolysis processes which contain large amount of contamination and impurities which were removed by the distillation and some other processes. The refined oil further used in CI Engine for testing which shows the positive results up to 40% blends with diesel fuel.

Keywords: Pyrolysis, Prices, Blends.



CTRES_51

Finite element method based design and analysis of BLDC motor for renewable energy applications

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Abstract

The need for sustainable development requires the utilization of renewable energy sources. As the awareness and production increase, applications of renewable energy will increase too. Since, energy produced from renewable sources is not that reliable and the power output is lower than nonrenewable energy sources, hence, BLDC motor is better suited for application point of view. Ansys Maxwell (version 15.0) is used for designing and simulation of this BLDC motor which is based on Finite Element Method. RMxpert is used for analysis of various parameters of motor such as efficiency, torque, speed etc.

Keywords: Renewable Energy, BLDC Motor, Ansys Maxwell, Finite Element Method



CTRES_52

Ant Colony Algorithm For A Two Tank Liquid Level System –An Experimental Study

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Abstract

In process control for efficient control of liquid level in two tank process, good controller required to control the controlled variable. The PID controller is commonly used to control liquid level in tanks. The best tuning of PID controller still a challenging problem in all process control application. The PID controller parameters are conventionally tuned using by hit and trial method, Ziegler Nicholas method, Cohen Coon method etc. These tuning methods can minimize the error and can provide satisfactory transient response, but required large settling time. Optimization techniques are used for minimizing the system steady state error and overshoot of transient response with least settling time. The Ant colony optimization technique is used to computer K_p , K_i and K_d value of the PID controller. The performance matrices taken are rise time, settling time, peak time, peak overshoot, Integral square error (ISE) and Integral absolute error (IAE).

Keywords: Ant colony Optimization, PID controller, Ziegler Nicholas method, Cohen Coon method, Integral square error and Integral absolute error.

Methodology Proposed

The control dynamics of CTS system is non-linear due to control valve characteristics. The non-linearity characteristics make the control problem more challenging. These PID controllers exploit several tuning methods for obtaining appropriate control parameters. The conventional method fails to provide desired system response and sometimes do not deal with non-linear systems. To overcome this problem, modified Ant Colony Optimization tuned PID controller is designed to obtain desired response of the proposed system as the original. ACO is applicable only for discrete optimization where one variable changes its position in discrete manner, but here the three parameters of the PID controller vary continuously in the search space.

AOC is a advance optimization technique which is used to find the optimal solution of K_p , K_i and K_d value of the PID controller [1].

ACO is one of the evolutionary meta-heuristic approach for solving Optimization Problems which is introduced in 1992 by Marco Dorigo. ACO algorithm is inspired by laid pheromone trail and the following motion of real ants where communication medium between ants is pheromone [2]. In the physical world, ants move randomly in search of food and when they reach the food return to their ant colony laying pheromone trails. If remaining ants find such a route, they follow the pheromone trail laid by



previous ants rather travelling randomly. With time, there is evaporation of pheromone trail as a result its attractive strength reduces. Pheromone evaporation avoids the convergence of optimum solution. If there is no pheromone evaporation the path taken by initial ant would tend to be attractive to the remaining ants. Therefore, when any one ant finds the shortest path from ant colony to the destination (food source) remaining ants more likely follows that path and in this way positive feedback leaves the ants to follow single path [3]. There are the following ACO algorithm steps:

- a. Deploy ants initially
- b. Objective function Evaluation
- c. Pheromone content computation at each ant locations.
- d. Evaluation of movement probability of ants.
- e. Ant Dispatch
- f. End the algorithm if termination is reached otherwise go to step b.

Results and Discussion

The ACO parameters which are used to analyze the performance of the ACO tuned PID controller with population size of 100, dimension 3 and number of iterations 200. The evaporation constant, ρ is equal to 0.6 and the threshold probability is 0.5. The minimum value of K_P is taken as 0.05 and maximum value is taken as 2.5. The minimum value of K_I is assumed as 0.0001 and maximum value as 0.01. The minimum value of K_D is taken as 2 and maximum value is taken as 51. controller (K_P , K_I and K_D) are taken as the dimensions of the variable space. The ACO tuned PID algorithm is tested for thirty mutually exclusive runs and result we get optimal tuning parameters as:

$K_P=1.7384$, $K_I=0.01$ and $K_D=4.98923$

The step response of the proposed system with ACO tuned ID controller. By using this controller, the peak overshoot is 0.0% and the rise time is 10.579sec.

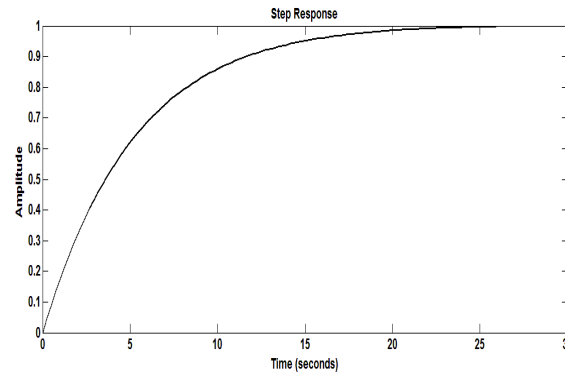


Fig. 1 Step Response of the proposed system

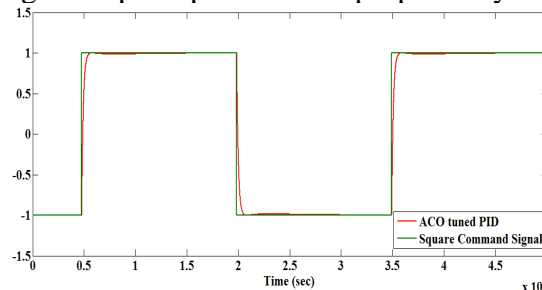




Fig. 2 Tracking performance of Square Command Signal for ACO tuned PID controller

Conclusions

This paper represents the coupled tank system is implemented using Ziegler-Nicholas, Cohen coon and ACO tuned PID controllers and real time application and analysis of ACO tuned PID controller. Also the comparison of differently tuned controllers such as ZN tuned PID controller, Cohen coon tuned PID controller, GA-PID and ACO tuned PID controller is done on the basis of transient performances, ISE and IAE.. At last the effectiveness of ACO tuned PID controller in tracking set point and disturbance rejection is also seen. It was found that the proposed ACO method proved to be superior with the confirmatory to the real time system.

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CTRES_53

Fabrication of Low Cost Solar Drying System Using Locally Available Materials for Preserving Agriculture and Horticulture Commodities

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Abstract

Solar energy has a major contribution to the generation of heat and electricity by mean of solar thermal and solar photovoltaic technologies. Solar dryer is one of the popular solar thermal technologies that use solar energy in the form of heat energy. For the agriculture and horticulture commodities; the lots of postharvest losses are observed in particular regions. Solar dryer expected to be one of the possible solutions for the local farmers to minimize these losses. Moreover, preservation of the dried fruits and vegetables for off-seasons through solar drying is simple and cost-efficient. In the present work, an indirect natural convection solar dryer is designed and developed using locally available low-cost materials such as wood, pine needles and other scrap materials for remote area application. There are three major components of a solar drying system i.e. air heater, drying cabinet and chimney. Further, the air dryer has two main components i.e. heat absorber and insulation. The skeleton of the air dryer is manufactured by plywood; black painted corrugated metal sheet with the shading of toughened glass are works as a heat absorber. For insulation, pine needles are used. The plywood and PVC pipe with elbow are procured for the fabrication of drying cabinet and chimney respectively. The thermal conductivity of pine needles and rice husk is of the same order of the glass wool that is being conventionally used for insulation in the solar dryer for minimizing heat losses. Glass wool is costly as well as associated with health issues. Therefore, in Himalayan regions, abundantly available Pine needles and in plain areas; rice husk can be a better option to be used as insulation. In the initial phase, apple slices of the same thickness (i.e. 2 mm) were dried with different chimney heights (i.e. 3.0, 4.5 and 6.0 feet). Best results were obtained with the 4.5 feet of chimney height. Further, the efficiency of the dryer was also measured in different climatic conditions. At the chimney height of 4.5 feet; the efficiency of the solar dryer was maximum of 10.38, 9.39 and 8.98% whereas drying rate observed was 3.76, 2.84 and 2.26 gm/min during the sunny day, partially cloudy and cloudy day respectively. During the experiment, the average air velocity was 0.25 m/s. There are three trays among which in the middle and bottom tray weight reduction percentage of apple slices was observed 85.33 and 79.33% respectively which was smaller than the weight reduction percentage of 87.33% of the top tray for the same chimney height. For the better performance of solar dryer, the drying conditions can be optimized by repeating these experiments. Moreover, to maintain the product quality the qualitative and quantitative analysis of microbial population must be required before and after drying.

Keywords: Chimney height, Drying rate, Solar thermal, Solar dryer



CTRES_54

OPTIMAL PLACEMENT OF FACTS DEVICE IN IEEE 14 BUS SYSTEM USING GENETIC ALGORITHM (GA)

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Asst Prof. SGNDT Dalewal

Abstract

With the increasing size of power system, there is a thrust on finding the solution to maximize the utilization of existing system and to provide adequate voltage support. For this the flexibility of power is needed. Flexible AC transmission system (FACTS) if placed optimally can be effective in providing voltage support, controlling power flow and in turn resulting into lower losses. The algorithm to find the optimal location of UPFC based on genetic algorithm has been developed. The effect of these devices on line flows and bus voltage profile has been studied by placing at random location and placing them optimally with optimal ratings dictated by genetic algorithm. The effectiveness of developed algorithm has been tested on 14-bus systems. In this work, a comparison of the effects of compensation of a Simplified multi-machine (two-machine system) power system by shunt/series connected FACTS controllers at optimal location using GA. The model procedure of enhance voltage stability and power flows capability of systems is illustrated. The study system is a simple example of multi-machine system, which is simulated in MATLAB/PSAT.



CTRES_55

An Efficient and Cost-Effective Synchronous Reluctance Driven Solar Water Pumping System

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Abstract

This study presents an efficient and cost-effective single stage solar photovoltaic (PV) array powered reluctance synchronous motor (RELSyM) driving water pumping system for irrigation as well as industrial prospective. In this work only one power converter, i.e. voltage source inverter (VSI) is used for controlling the RELSyM and for the maximization of PV array output power. In the proposed system a RELSyM is selected for driving the pump because of its robustness, reliability and cost effectiveness. There is no magnet, winding or bars in the rotor of RELSyM, which results in the reduction of losses and improvement in the efficiency of overall system. A novel deviation free perturb and observe maximum power point tracking (P & O MPPT) algorithm is developed for extracting the peak available power from the PV array. A Fast torque response-based vector control algorithm is used for controlling the RELSyM. A PV feed forward term is used to improve the dynamic response of the proposed system. Moreover, it makes the system immune to the deterioration in the pump constant. MATLAB/Simulink is used for modelling the proposed system and the performance of the proposed system is verified through the simulation studied for steady state and changing weather conditions.

Keywords: Fast torque response, Solar photovoltaic array, reluctance synchronous motor, P&O MPPT, VSI.



CTRES_56

Ocean Wave Energy as an alternate source of energy

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Abstract

In the recent years, the demand of electricity is increasing rapidly because of population growth and advance technology that needs the electric energy. To fulfill demand of electric energy we need more electric power plants i.e. thermal power plants, nuclear power plants, hydro power plants. Thermal power plants increase the consumption of nonrenewable energy resources which are already limited on earth and also have bad impact on environment because burning of fossil fuels produce CO₂ which leads to global warming. Hydro power plants need new dams which leads to bad impact on marine life. Nuclear power plants waste is very dangerous for environment. So, new kind of energy resources that are renewable are need of hour. In this paper a new kind of renewable energy which is ocean wave energy is presented, which has greater demand in future. The oceans of the earth represent a vast source of renewable energy. The potential of electric power generation from oceans renewable energy is enormous. This paper presents a brief overview about ocean wave energy, different techniques available for converting wave energy into electric energy, its benefits, challenges in wave energy conversion and environmental impact.



Track-V: Electronics Communication and Networking Technologies (ECNT-2019)



Abstract ID	Author	Topic
ECO-001	Ashish Kumar ¹ , Amar Partap Singh ²	<u>Design of Slotted E-shaped Micro-Machined Patch Antenna Array for X-band and Ku-Band Applications</u>
ECO-002	Ashwini Kumar ^{1*} , Amar Partap Singh Pharwaha ²	<u>On the Design of Tri-Band Hilbert Fractal Antenna for Fixed Satellite Services</u>
ECO-003	Gurmeet Singh ¹ , A.P. Singh ²	<u>Modified Sierpinski Fractal Antenna with Improved Impedance Matching for public safety WLAN</u>
ECO-004	Monika Aggarwal, Amar Partap Singh Pharwaha	<u>Design of Dual Band Fractal Antenna for Spectrum Sensing in Cognitive Radio Applications</u>
ECO-005	Rajeev Kumar ¹ , Lakhvinder Singh Solanki ² , Surinder Singh ³	<u>Parametric Analysis of Implantable Spiral PIFA Antenna for Biotelemetry Application</u>
ECO-006	Beant Kaur ¹ , Gurmeet Kaur ²	<u>Inspection of Defective Printed Circuit Boards: A Survey</u>
ECO-007	Baljinder Kaur ¹ , Anupma Marwaha ²	<u>Investigation of mutual coupling effect over interference suppression in non-isotropic antenna arrays</u>
ECO-008	Manvinder Sharma ¹ , Harjinder Singh ²	<u>Design and analysis of Semi C shaped SIW based Leaky Wave Antenna for high frequency applications</u>
ECO-009	Amandeep Kaur ¹ , Ajay Pal Singh Chauhan ² , Ashwani Kumar ³	<u>A Review on Deep Learning for Genomic Data Analysis</u>
ECO-010	Mohit Kumar ¹ , V.K Bhardwaj ²	<u>Solar Light Transmission Using Optical Fiber</u>
ECO-011	Vishu Goyal ¹ , Harshita Sharma ² , Mukesh Kumar ³ , Jagpal Singh Ubhi ⁴	<u>Analysis of Body bias impact on the performance parameters of CMOS Inverter</u>
ECO-012	Rajdevinder Kaur Sidhu ¹ , Jagpal	<u>RF Energy Harvesting: An Approach Towards</u>



	Singh Ubhi ² , Alpana Agarwal ³	<u>Green Technology</u>
ECO-013	Amit Kumar Shakya ¹ , Surinder Singh ¹ , Veerpal kaur ²	<u>Investigation of Urban Expansion of New Delhi through Landsat 5 TM and Landsat 8 OLI Sensor Data</u>
ECO-014	Sudhir kumar ¹ , Dr. A.K. Jain ²	<u>Performance Evaluation of QoS In IEEE 802.11 Wireless Adhoc Networks with Mobile Nodes for FTP Applications</u>
ECO-015	Anoop Kumar Singh ¹ , Deepti Kakkar ² , Tanu ^{3*}	<u>Fuzzy logic- a model to diagnose ADHD</u>
ECO-016	Sushil Kakkar ¹ , Shweta Rani ²	<u>Performance Analysis of Microstrip Patch Antenna with Defected Ground Structure</u>
ECO-017	Shweta Rani ¹ , Sushil Kakkar ²	<u>Small Size Multiband Fractal Antenna for Wireless Applications</u>
ECO-018	Ashwani Kumar ¹ , Amar Partap Singh ²	<u>Fuzzy Logic Based System for Soft Fault Diagnosis in Analog Circuits</u>
ECO-019	Simarjeet Kaur ¹ , Gurwinder Kaur ² , Gagandeep Kaur ³	<u>Comparative analysis of orthogonal space time block code (OSTBC) for MIMO Rayleigh channel</u>
ECO-020	Gagandeep Kaur ¹ , Amandeep Kaur ² , Gurwinder Kaur ³	<u>Analysis of bit error rate performance with linear block codes in wireless communication system</u>
ECO-021	Kanica ¹ , Manpreet Kaur ² , Jagtar Singh Sivia ³	<u>Design of Dual h Shape Microstrip Patch Antenna for Multiband Applications</u>
ECO-022	Vaneet Kumar ¹ , Balkrishan ²	<u>Energy Efficient Virtual Machine Migration Approach With Sla Conservation In Cloud Computing: A Review</u>
ECO-023	Aarti Jain	<u>LEACH based Clustering Methods: Recent Developments</u>
ECO-024	Neeraj Julka, A.P.Singh	<u>Recognition of Foreign Material in Wheat Kernels Using Machine Vision</u>



(ECO-001)

Design of Slotted E-shaped Micro-Machined Patch Antenna Array for X-band and Ku-Band Applications

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Abstract

E-shaped slotted micro-machined patch antenna array design for X-band and Ku-Band applications has been presented in this work. Single patch antenna has been designed on the high resistive (8KΩ-cm) silicon substrate having thickness 675 μm with the quarter wave transformer matching network. Single unit cell of design has been modified into the 1×2 micro-machined antenna array to enhance the performance parameters. The maximum gain of 9 dBi is achieved with the proposed design. The proposed antenna designs can be used for the various X-band and Ku-Band applications including satellite communications.

Keywords: Slotted, Micro-Machining, Array

Methodology Proposed

Concept of micro-machining process is used to design the patch antenna on high index substrate. Some portion of the silicon substrate has been etched underneath the patches while remaining the high index substrate on the other circuitry as shown in figure 1. This process is done to reduce the surface wave excitation thus improve the performance parameters because surface wave excitation is the major problem in the high index substrate which leads to the degradation of the performance parameters mainly gain and bandwidth.

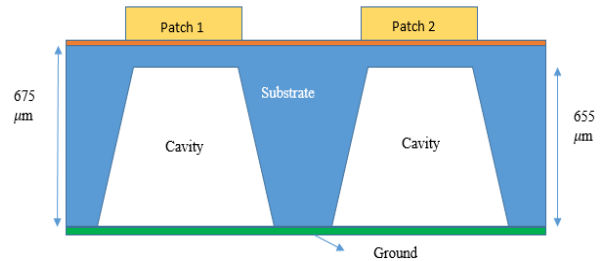


Fig 1: Micro-Machined Patch Antenna Array
 ϵ_{reff} is estimated from following equations [1-

$$(1) \epsilon_{\text{cavity}} = \frac{\epsilon_{\text{air}} \epsilon_{\text{sub}}}{\epsilon_{\text{air}} + (\epsilon_{\text{sub}} - \epsilon_{\text{air}}) X_{\text{air}}}$$

$$(1) \frac{\epsilon_{\text{fringe}}}{\epsilon_{\text{cavity}}} = \frac{\epsilon_{\text{air}} + (\epsilon_{\text{sub}} - \epsilon_{\text{air}}) X_{\text{air}}}{\epsilon_{\text{air}} + (\epsilon_{\text{sub}} - \epsilon_{\text{air}}) X_{\text{fringe}}}$$

$$(2) \epsilon_{\text{reff}} = \epsilon_{\text{cavity}} \left(\frac{L + 2\Delta L \frac{\epsilon_{\text{fringe}}}{\epsilon_{\text{cavity}}}}{L + 2\Delta L} \right)$$

(3)

In the above formula, ϵ_{sub} is dielectric constant of substrate. ϵ_{air} is dielectric constant of air X_{air} the ratio of the air to full substrate thickness in the mixed field region and X_{fringe} the ratio of the air to full substrate thickness in the fringing field regions. The proposed design is shown in figure 2.

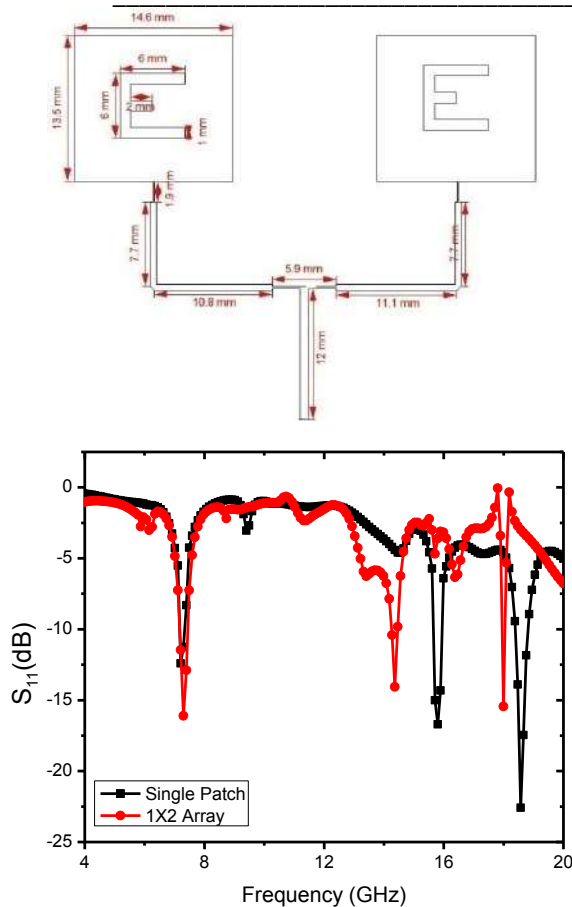


Fig 3: Reflection Coefficient Variations

Fig 2: 1x2 E-shape slot Micro-Machined Patch Antenna Array

Results and Discussions

The Return Loss and voltage standing wave ratio of the proposed design is shown in figure 3 & 4 respectively. All the performance parameters of the proposed design are shown in table I.

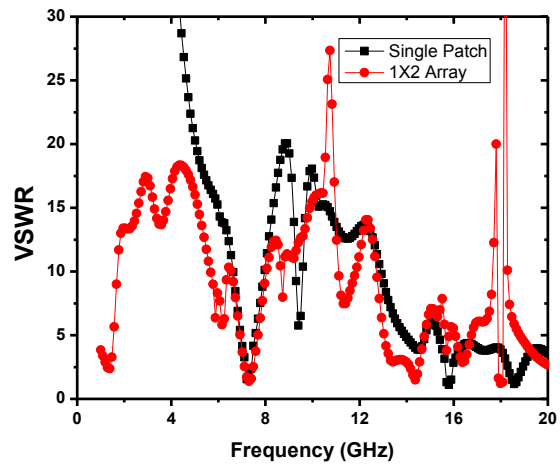


Fig 4: VSWR v/s frequency Plot

Table I: Performance Parameters of the proposed design

Design	Resonating Frequency (GHz)	Reflection Coefficient (dB)	Maximum Gain(dBi)	Efficiency (%)
1x2 Slotted Patch Antenna Array	7.3	-16.11	7.5	76
	14.3	-14	9	84
	17.9	-15.4	8	90

Conclusions

Micro-Machined E-shaped slotted patch antenna has been discussed in this article. Single patch and 1x2 array has been designed on high resistive silicon substrate. The performance parameters of the proposed design have been improved with the Micro-Machining process. The patch antenna design exhibits multiband characteristics in X-band and Ku-Band. The design resonates at 7 GHz, 15 GHz and 18 GHz with a

maximum gain of 9dB. The proposed antenna shows the compatibility with Monolithic Microwave Integrated Circuit (MMIC) and can be used for Satellite Communication, Earth Exploration satellite Services etc.

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(ECO-002)

On the Design of Tri-Band Hilbert Fractal Antenna for Fixed Satellite Services

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Abstract

In this report, Tri band Hilbert fractal antenna is reported for fixed satellite services, which is designed on dual layer substrate, consisted of FR4 and Rogers RT/duroid™ dielectric material, each having a size of 39.7 mm × 30 mm × 1.5 mm. The proposed antenna resonates at 3.82 GHz (3.78-3.85 GHz), 5.05 GHz (5- 5.10 GHz), and at 6.87 GHz (6.68- 7.2 GHz) with a bandwidth 70 MHz, 100 MHz and 520 MHz respectively. Proposed antenna is characterized on the basis of various performance parameters like reflection coefficient, radiation pattern, gain and bandwidth. The proposed antenna covers Fixed Satellite Services (FSS) in C-Band.

Keywords: Hilbert fractal, Multiband, wideband, FSS

Antenna Design

The proposed antenna is designed on two layer substrate consisting of FR4 and Roger 5880 dielectric material, each having having a size of 39.7 mm × 30 mm × 1.5 mm. Hilbert fractal is selected for designing the antenna in this work which is used in many reported work in literature [11][12][13], which shows that there is still a huge possibility of designing antenna using Hilbert fractal. Figure 1(a) to 1(c) show transformation of the antenna design from basic square patch to 2nd iteration of Hilbert fractal structure. Figure 2 shows the S11 values for 0th to 2nd iterations. For 0th

iteration the antenna resonates at 5.9 GHz (5.69-6.09 GHz). For 1st iteration the resonance shifts towards lower frequency and it shows resonance at 5.34 GHz

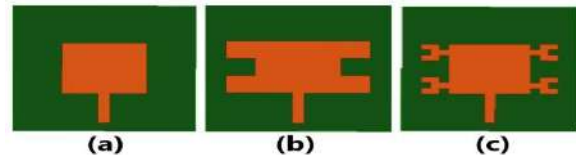


Fig. 1. Transformation of the proposed antenna (a) 0th Iteration (b) 1st Iteration (c) 2nd Iteration

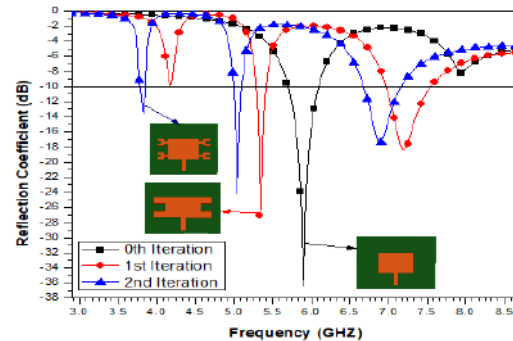


Fig. 2. Reflection coefficient (S11) values of the proposed antenna

(5.28- 5.41 GHz) and at 7.21 GHz (6.97- 7.55 GHz). For 2nd iteration antenna resonates at 3.82 GHz (3.78-3.85 GHz), 5.05 GHz (5- 5.10 GHz), and at 6.87 GHz (6.68- 7.2 GHz).

Results and Discussion

Reflection coefficient (S11) characteristics

Figure 3 shows the reflection coefficient of the proposed antenna.

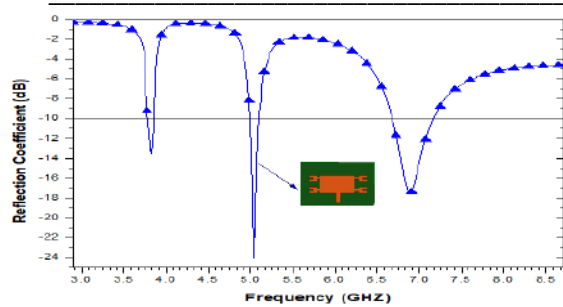


Fig. 3. Simulated Reflection coefficient of proposed antenna

Gain

Figure 4 shows the 3D-polar plot of gain in dB of the proposed antenna.

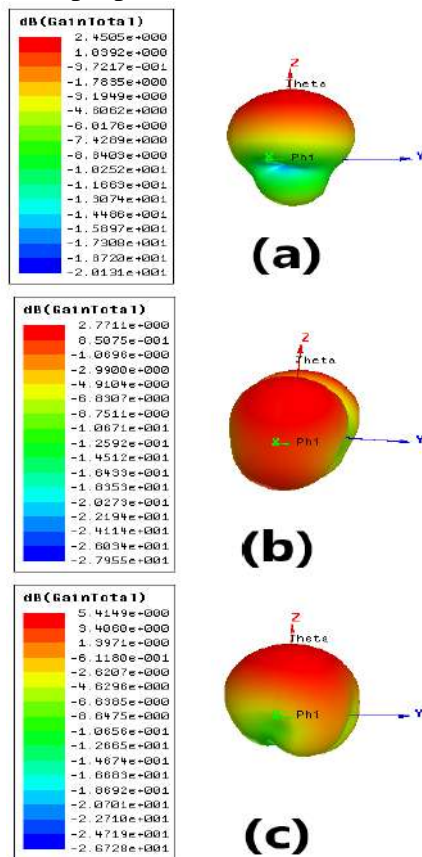


Fig. 4. 3D-polar plot of gain of the proposed antenna (a) at 3.82GHz (b) 5.04GHz (c) 6.87 GHz

Conclusions

In this report, a Hilbert fractal antenna is proposed which is designed on dual layer substrate, consisted of FR4 and Rogers RT/duroid™ dielectric material, each having a size of 39.7 mm × 30 mm × 1.5 mm. The proposed antenna resonates at 3.82 GHz (3.78-3.85 GHz), 5.05 GHz (5- 5.10 GHz), and at 6.87 GHz (6.68- 7.2 GHz) with a

maximum bandwidth of 520 MHz in the required frequency band for the desired applications. Proposed antenna covers following frequency bands (5.0-5.10 GHz), and (6.7- 7.145 GHz) for RNS and FSS.

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(ECO-003)

Modified Sierpinski Fractal Antenna with Improved Impedance Matching for public safety WLAN

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Abstract

A Sierpinski fractal antenna with a modification in the shape of the radiator is presented. Antennas are simulated on RT Duriod substrate ($\epsilon_r = 2.2$) having dimensions of $40 \times 40 \times 1.6$ mm³ shows that resonating frequency is changing as iteration changes. To make it resonate at 4.96 GHz, antenna size is decreased by 9.1% and miniaturization is achieved. Representative results show the effectiveness of antenna design technique.

Keywords: Sierpinski, Fractal, Resonating frequency, Miniaturization

Introduction

In recent years there is a need to develop a system which can support multiple applications in a single system, antenna is the most important component of the overall system. For commercial applications usually small, cost effective and high performance antenna is required. Microstrip patch antenna becomes very popular due to its advantage like low profile, easy to design and fabricate [1]. Now compact antennas are required for different applications at different frequencies. So fractal are most promising technique in compact antenna design with multiband characteristics [2],[3]. In this paper

already known fractal antenna is modified in terms of its rectangular slot.

Methodology Proposed

Modified fractal is designed on low loss substrate RT duriod (5880) with edge feed using finite element method based high frequency structure simulator (HFSS) as shown in Fig.1. In the initial design a basic patch antenna is designed on the basis of following equations (1),(2),(3),(4) and (5) [1].

$$W_p = \frac{v_0}{2f_r \sqrt{\epsilon_r + 1}} \quad (1)$$

where v_0 is velocity of light, f_r is resonant frequency and ϵ_r is relative dielectric constant of substrate.

$$\epsilon_{\text{reff}} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2} \left[1 + 12 \frac{h}{W_p} \right]^{-\frac{1}{2}} \quad (2)$$

ϵ_{reff} is effective dielectric constant.

$$L_{\text{eff}} = \frac{v_0}{2f_r \sqrt{\epsilon_{\text{reff}}}} \quad (3)$$

L_{eff} is effective dielectric constant.

$$L_p = \frac{v_0}{2f_r \sqrt{\epsilon_{\text{reff}}}} - 2\Delta L_p \quad (4)$$

L_p is the length of patch.



$$L_{qw} = \frac{\lambda_g}{4}$$

(5)

L_{qw} is length of quarter wave transformer.

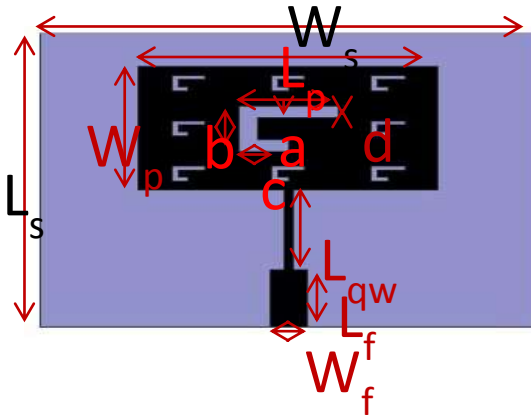


Fig.1. Proposed fractal Antenna

Table 1-Dimensional detail of proposed antenna

S.No.	Edge Name	Value in (mm)
1.	L_s	40
2.	W_s	40
3.	L_p	16.8
4.	W_p	24.2
5.	L_{qw}	10.34
6.	L_f	8.2
7.	W_f	3
8.	a	5.6
9.	b	8.067
10.	c	4.03
11.	d	1.54

Results and Discussion

Basic patch resonates at 4.96 GHz and shows a reflection coefficient of -16 dB. Similarly In first iteration modified sierpinski antenna resonates at 4.96 GHz with miniaturized dimensions, better impedance matching and shows

reflection coefficient of -24.4 dB. Finally proposed antenna resonates at 4.96 with more miniaturized dimensions and has value of reflection coefficient improved up to -27.5 dB as shown in Fig. 2.

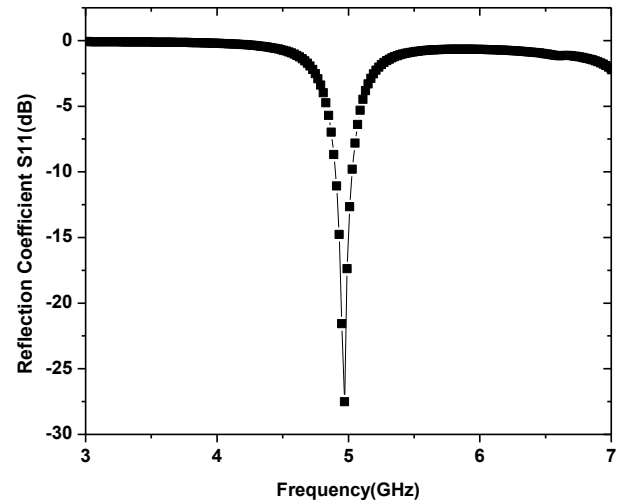


Fig.2. Reflection Coefficient of final Proposed

Conclusions

This method provide simple and easy technique to improve matching by modifying shape of antenna. Antenna size is miniaturized by 9.1% than initial basic design and got better impedance matching. Proposed antenna has acceptable bandwidth, gain and high efficiency which makes it suitable for public safety WLAN application.

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(ECO-004)

Design of Dual Band Fractal Antenna for Spectrum Sensing in Cognitive Radio Applications

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Abstract

In this paper microstrip fractal antenna is presented for spectrum sensing in cognitive radio applications. A square shaped fractal antenna with CPW(Coplanar Waveguide) feed having broadband characteristic in two bands, band I (2.455 - 4.455 GHz, 57 %) and band II (6.818 - 8.455 GHz, 21%) with omnidirectional radiation pattern is obtained.

Keywords: CPW, cognitive radios, fractals, microstrip antenna

Methodology Proposed

The objective of the proposed work is to design a compact shape of fractal antenna for spectrum sensing in cognitive radio applications. Then used different dielectric material to compare their return loss and bandwidth and further the effect of varying substrate height has been compared. MOM based IE3D software is used for the design of proposed shape.

Results and Discussion

Fig. 1. Illustrates that in the basic shape cut off frequency of band I is 3.09 GHz, in 1st iteration it is shifted to 2.8 GHz, in 2nd iteration it is further shifted to 2.7 GHz and after miniaturization it is shifted to 2.45 GHz.

Conclusion

In this paper a square shape of the fractal antenna with dual band characteristics is presented for spectrum sensing in Cognitive Radios. Peak gain of the antenna at 8.27 GHz frequency of band II is 5.71 dBi. This antenna is having omnidirectional radiation pattern and good impedance matching at all frequencies in both bands.

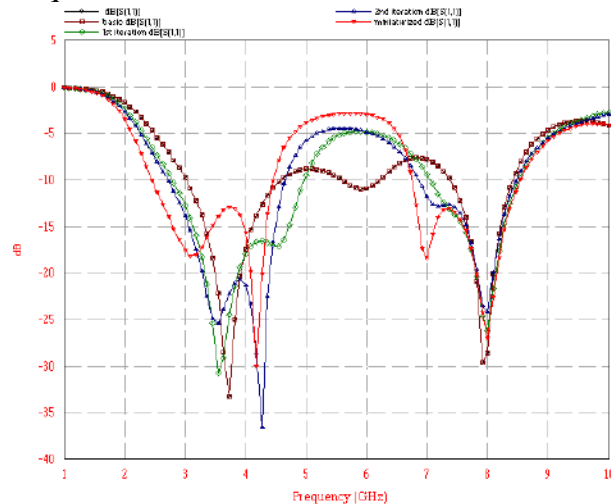


Fig.1. Simulated return loss of proposed antenna in different iterations.

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(ECO-005)

Parametric Analysis of Implantable Spiral PIFA Antenna for Biotelemetry Application

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Abstract

In this paper, parametric analysis of co-planer spiral PIFA is carried out for implantable medical devices. The effect of antenna spiral size, PIFA and feed location has been analyzed on the resonance frequency. The antenna design is proposed to work at 2.45GHz ISM band inside the human muscle. The antenna performance is investigated in terms of reflection coefficient, gain and radiation pattern. The proposed antenna design can also achieve UWB performance by selecting the appropriate feed location. The max gain achieved is -10.52 dB with the bandwidth of 1GHz.

Introduction

Bio telemetry is a branch of study that deals with data communication over a distance for medical purpose. It involves remote health care monitoring of any vital sign of patients or a person under study and send the biological information to doctor or health care unit. A wireless telemetry system can monitor real time physiological parameters such as ECG, EEG, heartbeat, glucose level, and temperature of body part, breast cancer detection[1] etc. of ambulatory patient to provide information such as consultation, diagnosis, observation, and treatment etc [2]. Wireless medical device implanted inside the human body for diagnosis and controlling consist of bio sensor, signal processing circuit and miniature microstrip antenna.

This paper is focusing on the development of microstrip antenna for

implantable medical devices constrained to perform inside the human body. The electromagnetic behavior of the human body is categories with high diversity in terms of its electrical characteristics. Every part of human tissues has different electrical parameter in terms of permittivity and conductivity [3]. This diversity is depending upon the amount of moisture content in the tissues. So it is quit challenging to design antenna to work inside such medium. The prime design requirement of implantable antenna is miniaturization, biocompatibility and specific absorption rate (SAR) [4]. Too many researchers have suggested the miniature antennas using Meander line [5], serpentine line, multi layering of patch in the literature. These shapes help to increase the effective current path of antenna in a small space. Planer inverted F antenna (PIFA) can also used to reduce the antenna size by 50% [6]. On behalf of literature survey, this paper is proposing a miniature sized co planer spiral PIFA with dual shorting post antenna to resonate at 2.45GHz ISM band frequency. A parametric study is carried out on the basis of reflection coefficient, impedance, radiation pattern and the gain.

Methodology

The antenna is designed on 15 x 15 mm Rogers RT/ Duriod 5880 ($\epsilon_r = 2.2$ and $\tan\delta = 0.0023$) with the thickness of 20mil. Fig 1 shows the top view of



antenna design structure and the measurements are shown in Table 1.

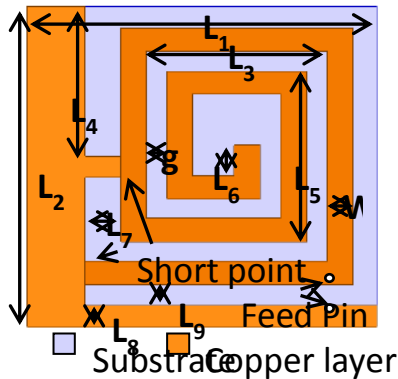


Figure 1: Geometrical layout of proposed antenna design.

A square spiral shape is used to increase the current path. Shortening post further reduce the resonance frequency. A coplanar ground plane helps to achieve ultra wide band characteristics. Finally the proposed design is forced to resonate at 2.45GHz ISM band with good bandwidth by introducing the additional shortening post that suppressed the additional bands.

Table 1. Dimension of the Proposed antenna design

Symbol	Length (mm)	Symbol	Length (mm)
L ₁	15	L ₇	1.5
L ₂	15	L ₈	1
L ₃	8.2	L ₉	1
L ₄	7	W	0.9
L ₅	8	g	1.1
L ₆	1.6		

The antenna is implanted in homogeneous human muscle tissue. The dimension of the tissue is taken as 40 x 40 x 20 mm. Frequency dependent human tissue model is presented here is expressed by using inbuilt piece wise linear model. The relative permittivity and conductivity of human muscle tissue at 2.45GHz is taken as 52.7 and 0.8 S/m respectively [3].

Results and Discussion

The proposed antenna is designed and simulated in HFSS software tool. The parametric analysis is carried out by varying the spiral length, spiral width, gap between the elements, feed position. Fig 2 shows the reflection coefficient of proposed antenna at different short location and Fig 3 shows the 3D radiation pattern at 6mm feed location.

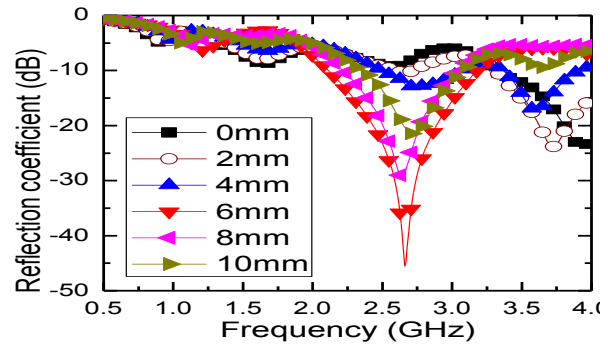


Figure 2: Reflection coefficient of antenna design at different shorting point location.

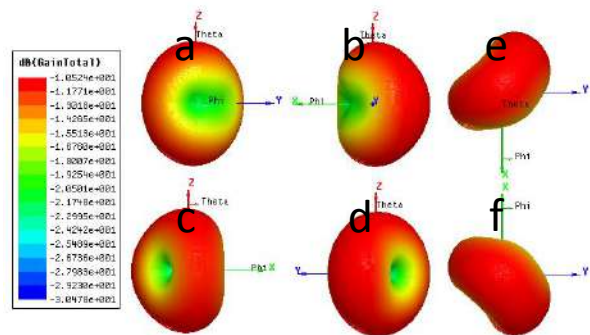


Figure 3: 3D radiation pattern of spiral PIFA antenna a) $\phi = 0$, b) $\phi = 90$, c) $\phi = -90$, d) $\phi = 180$, e) $\theta = 0$ and f) $\theta = 90$.

The reflection coefficient of antenna design is observed to analyze the circuit parameter of antenna by varying different parameters. The effect of length of spiral, width and gap of spiral on antenna performance is analyzed. Antenna width and gap helps to achieve better impedance while implication of



additional shortening post achieved very high bandwidth with quite good gain. The max gain achieved is -10.52 dB with the bandwidth of 1GHz.

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(ECO-006)

Inspection of Defective Printed Circuit Boards: A Survey

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Abstract

Manufacturers want 100% quality rate of their product. Therefore the product must be defect free. In manufacturing industries of electronic devices, inspection of printed circuit boards at the initial stage is an important task. As due to many reasons number of defects occur on printed circuit boards during their production and some defects occur after placing components on it. This paper presents a broad survey on different techniques used for inspection of printed circuit boards.

Keywords: Printed circuit boards, inspection, defects, fatal, potential.

Methodology Proposed

The main objective of this paper is to present the types of defects on printed circuit boards and the existed techniques to inspect them. The methods used to inspect are broadly classified as referential and non-referential method. In referential method, the image is first scanned and then compared with standard image. In nonreferential method, some general rules are followed to inspect the printed circuit boards. The methodology adopted to implement these methods have been described briefly in this paper.

Results and Discussion

Different existed techniques for inspection of printed circuit board will be discussed and compared on the basis of different parameters.

Conclusions

It has been concluded from the literature survey of the existed techniques that inspection of printed circuit board is an essential step in manufacturing industries. The performance of electronic products also depend on the quality of printed circuit boards. As compared to automated inspection, human inspection is subject to make mistakes and slow. The major drawback of most of the existing techniques for inspection of printed circuit boards is that they require the special hardware platform, which makes them expensive. To improve the flexibility in the field of visual inspection systems, many efforts are underway.

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(ECO-007)

Investigation of mutual coupling effect over interference suppression in non-isotropic antenna arrays

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Abstract

In antenna arrays with isotropic elements, individual element pattern remains omnidirectional, whereas, for antenna arrays designed with non-isotropic elements, the coupling among the elementary radiators of an antenna array, effects the array characteristics. There has been a lot of research work being carried out on null steering of antenna array of isotropic elements. In the present paper, null steering is implemented by varying element excitations based on Schelkunoff polynomial method (SPM), in 4-element rectangular patch antenna array with main emphasis on position and depth of nulls, and the symmetry of the pattern. The variations of radiation characteristics due to mutual coupling effect for different inter element spacings have been analyzed to find out the optimum spacing.

Keywords — antenna array, non-isotropic, null steering, Schelkunoff polynomial method, mutual coupling.

Methodology Proposed

In the present work 4-element rectangular patch antenna array as shown in Fig.1 has been designed and simulated using IE3D software for different inter element spacings. The nulls are imposed on direction of

interference by using Schelkunoff polynomial method for controlling the excitation amplitudes of array elements.

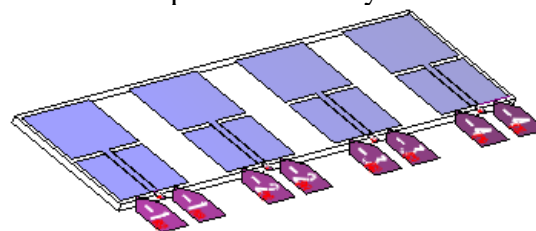


Fig. 1. IE3D model of CPW fed 4-element rectangular patch antenna array

Results and Discussion

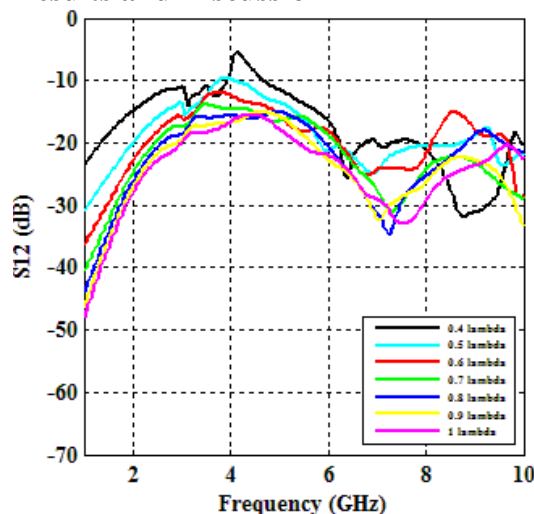


Fig. 2. S_{12} variations of 4-element rectangular patch antenna array for different inter-element spacings.

S_{12} is evaluated for different values of inter-element spacing, and Fig. 2 presents the plot depicting variation of



S_{12} with frequency for different inter-element spacings for the designed array. The increase in inter-element spacing beyond 0.5λ reduces mutual coupling but at a slower rate with increase in sidelobe levels causing degradation of array pattern with distorted symmetry, thus indicating half wavelength distance to be the optimum one. Though the performance of antenna array has increased with a substantial improvement in SLL and NDL but the desired position of nulls is not achieved exactly for the designed rectangular patch antenna array.

Conclusions

The geometry of the elementary radiator of an antenna array is also an important design criterion for null implementation apart from the array properties. The excitation errors resulting from coupling effect produced due to elements interaction while all the elements in array are excited causes radiation pattern alter from the desired pattern. The directional characteristics of the non-isotropic element need to be taken into account by including element factor for effective null steering.

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(ECO-008)

Design and analysis of Semi C shaped SIW based Leaky Wave Antenna for high frequency applications

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Abstract

In spite of the fact that traditional waveguide structures are having favorable circumstances of providing high quality factor and carrying high power capacity, they are bulky and heavy. This prompt Substrate Integrated Waveguide which is promising innovation which highlights both high power capacity and compact in size. Leaky wave antenna can be easily integrated on Substrate Integrated Waveguide Structure. In this paper, SIW based Semi C shaped Leaky wave Antenna is modeled and analyzed for frequency ranging from 7.5 GHz to 11 GHz. Polymethyl methacrylate (PMMA) is taken as dielectric substrate. the results obtained from simulation showed electric field generated, gain, return loss and transmission loss of modeled antenna. at frequency equal to 8.5 GHz, the modeled structure is having maximum gain than other frequencies i.e 1.45 with maximum electric field intensity i.e. 71.4 V/m

Keywords: *Substrate Integrated Waveguide; Vias; EHF or VHF; design SIW; Transmissionloss*

Methodology Proposed

The design was modeled for Substrate Integrated Waveguide Leaky Wave Antenna with longitudinal and transverse slot. The longitudinal slots cut at transverse current J_x and its leakage constant decreases as frequency increases. The transverse cut the longitudinal current J_z and the leakage constant increases with increase in

frequency. The geometry made is having both type of slots in which both longitudinal and transverse currents are cut.

The cut off frequency is expressed as

$$f_c = \frac{c}{2\pi} \sqrt{\left(\frac{m\pi}{a}\right)^2 + \left(\frac{n\pi}{b}\right)^2}$$

(1)

where c is speed of light and is given as 3×10^8 m/sec, m and n are modes, a and b are the dimensions of the waveguide. For TE₁₀ mode the cutoff frequency is

$$f_c = \frac{c}{\lambda_c} = \frac{c}{2a\sqrt{\epsilon_r}}$$

(2)

λ_c is can be found as

$$\lambda_c = \frac{2}{\sqrt{\epsilon_r}} \times ad$$

(3)

Results and Discussion

The design is simulated and analyzed for

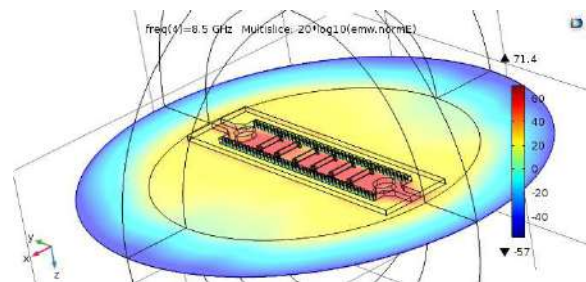


Figure 1. electric field generated frequency ranging from 7 GHz to 11 GHz. The result is analyzed in form of electric field generated, radiation pattern (far field), return loss and insertion loss (s-parameters). The design showed maximum electric field 71.4 V/m as shown in fig 1 and radiation pattern 1.45 shown in fig 2.

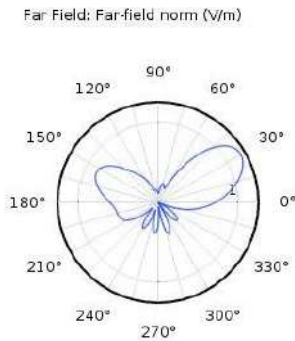


Fig2. Far field radiation plot

Conclusions

Various pros over the microstrip and DFW, SIW is low loss waveguide for the transmission of higher frequency ranges. However the leakage loss can be substantial. SIW based Leaky Wave Antenna was modeled and simulated using combination of longitudinal and transverse slots to make semi C shaped slots. Modeling and simulated experiment work was carried out to analyze and investigate the effects for Mica taken as dielectric substrate for SIW Leaky Wave Antenna structure for frequency ranging from 7GHz to 11 GHz. The Electric field intensity, Radiation far Filed Plot and S-Parameter were calculated for given frequency range. It showed better results for the frequency 8.5 GHz. Proposed waveguide antenna is compact in size and can be used for high frequency applications.

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(ECO-009)

A Review on Deep Learning for Genomic Data Analysis

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Abstract

Increasing innovations in bioinformatics has created a space for genomic data analysis in big data protocols. Erupting data is timely challenging basic methods of data analysis for genomic data. In analogous with exigent requirement of sturdy procedures, deep learning has flourished in diverse meadow in handling the text data, data from voice message, digital data, biological data and astronomical data. However despite of robust development, deep learning is yet trying to congregate its extraor-dinary astuteness in deciphering and handling genomic data. This paper encloses concise aspects of genomic data and deep learning. We have briefly examined deep learning architecture for genomic data and a brief of budding prospects of deep learning in genomic data

Introduction

With the increasing comfort and dwindling expenditure of gathering genomic data has progressively highlighted on restricted capabilities to understand attributes of traits associated with data specifically in the field of medical. Genomic is a derived from Greek word gene which means biological. Genomic data signifies to DNA statistics about a living creature. Despite of colossal exploration in understanding genomic data, 98 percent of data is yet to be understood. Hefty amount of storage and specifically designed software is necessary to examine genomic data. Hence to obtain useful knowledge from the big genomic data, machine learning and dominantly

deep learning is used commonly. Machine learning algorithms disclose fundamental configurations or patterns in data, form models, and create prediction based on the finest fit model [1]. Term learning refers to increase in performance with regard to a certain task is related to increase in experience that is more the experience better the performance. Data provides the learning in machine learning algorithm.

Conclusion

Deep learning an intellectual herculean, which has com-petence of exploring beyond the available knowledge. Ge-nomics has come up as an exciting application in expanse of deep learning involving inimitable confronts. Hitherto deep learning is irrefutably a propitious direction that has revived and enthused frontward the research in genomics in these contemporary years. A mutiny in deep learning applications for genomics has outdone former computational approaches concerning prognostic implementation. Further the discussion the restraints in using deep learning for analysis of genomic data and its encouraging future prospects.

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(ECO-010)

Solar Light Transmission Using Optical Fiber

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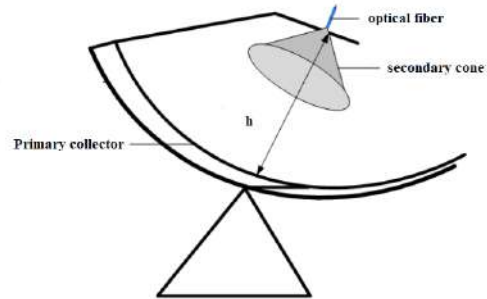
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Abstract

By 2035 the energy consumption will be increased by four folds as compared to the year 2010. Out of which around 24% of the energy will be consumed by the living premises. It is also been estimated that one-third energy consumed in the living premises belongs to lighting purpose only. Thus, it is very much important to conserve this energy through the use of renewable energy. In this line, researchers develop a transmission mechanism to transmit solar light via fiber as a lighting system in daylight. This system consists of two major subsystems. One to collect sunlight and another one the optical fibers. The role of the collector is to focus the sunlight and having different shapes like parabolic, parabolic with flat mirrors or with pyramid/cone. While fiber is used as a transmission line and can be transmitted light up to 50 meters. In this paper, we design a collector that improves the efficiency of light collection by 3% that of the existing system.

Keywords: Sunlight, collector design, renewal energy, optical fiber, solar transmission

Methodology Proposed



The light intensity depends on the following parameters of the system [1]-[3].

1. The extent of the parabolic curve
2. The loss in the optical fiber
3. Coupling between the optical fiber and solar collector

In the proposed design we improve the intensity of light which is given by:

$$I_o = \frac{\left[\frac{I_i A_s R r_f^2}{\left(\frac{(f-h)d}{2f} \right)^2} \right]}{10^{l_f/10}}$$

Where, I_o = intensity of fiber output (lux), I_i = intensity of solar light (lux), A_s = area of a collector surface (m^2), R = reflectance value, r_f = radius of the optical fiber (m), f = focal length of reflector (m), h = height of the tip of the optical fiber (m), d = diameter of the collector shape (m), l_f = loss optical fiber (dB).

To improve the efficiency we proposed a parabolic collector system as a major collector and collector cone as secondary. Cone is designed in accordance with the acceptance angle of



an optical fiber and the height is calibrated as per the place of setup.

Results and Discussion

The results of the proposed design give the highest intensity of 206 lux at $h = 46$ cm. While varying the height from 10 to 46 cm, a standard deviation of 4.68 lux is also measured.

Conclusions

The proposed model having a parabolic collector system with a secondary collector cone produces the highest output of 206 lux at a height of 46 cm. Moreover, if we paint the primary collector by gray and silver color the reflectance is improved by 0.225% and 0.475%, respectively. It is also observed

that the light intensity per unit area is inversely proportional to the square of the distance from the source during transmission.

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(ECO-011)

Analysis of Body bias impact on the performance parameters of CMOS Inverter

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Abstract

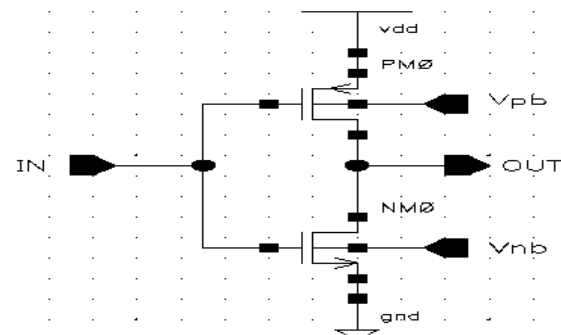
Leakage and dynamic power is the most important part of total power dissipation of integrated circuits. Some of the techniques used for reduction of leakage power are multiple configurations of V_t cells, power gating, oxide thickness reduction. Applying body biasing is also another reliable power reduction technique. This paper shows the effect of body biasing of CMOS inverter in reduction of power dissipation, delay and power delay product. Cadence virtuoso 6.1.5 environment is used for schematic and simulation work at 45 nm technology. Compare to zero source to body bias, when only PMOS reverse body bias voltage applied to CMOS inverter circuit then about 97% reduction of PDP is achieved, with decrease in delay time. While when only NMOS reverse body bias voltage applied to circuit, PDP is increased by 16.38% with increased delay time variation. When both PMOS and NMOS reverse body bias voltage applied to circuit then about 57% reduction in PDP is achieved with increase of delay as compare to zero source body bias inverter. The technique is significant and leads to improved performance calculated in terms of dynamic power, leakage power, propagation delay and power-delay product (PDP) and it can be a reference configuration of higher digital circuit performance.

Keywords: CMOS, PMOS, NMOS, Bodybias, Dynamic power, Leakage power, Delay, PDP

Introduction

One of the important concerns in the field of integrated electronics is power efficiency. As the complexity of chip increases, power consumption levels increase. Also, the resistance of the chip increases as the transistor gate length as well as path length reduces which led to an increase in power usage. Thus, decreasing power consumption and power management are key challenges [1]. The development rate of battery

technologies is not so capable so the evolution of competitive markets such as laptops, wireless



application, and movable medical devices depends on the power dissipation. It is a major design consideration [2,3].

Fig 1 CMOS inverter schematic with body biasing

Results and Discussion

From the observations being made by taking various combinations of body bias voltages, the voltage vs. PDP graph is shown in the Figure 2, 3 and 4. Since the maximum decrease in power delay product is when both the transistors are reverse body bias. Thus, body biasing is considered as one of the effective techniques to reduce power dissipation.

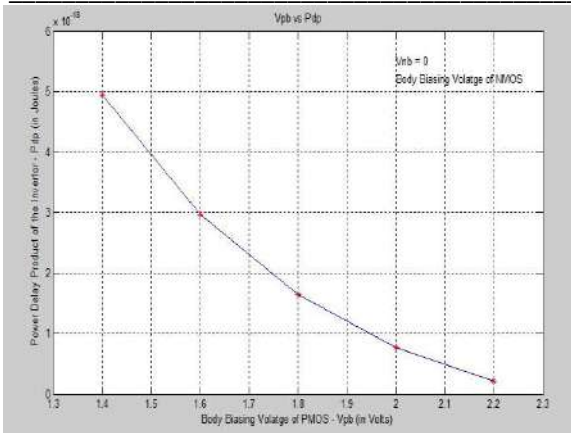


Figure.2: When PMOS body bias voltage is varied and NMOS is fixed.

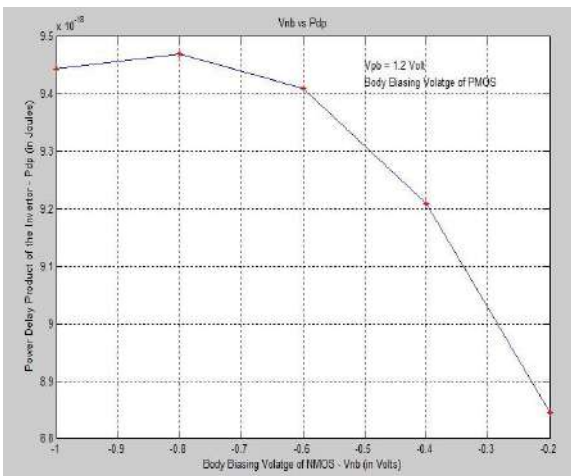


Figure.3: When NMOS body bias voltage is varied and PMOS is fixed.

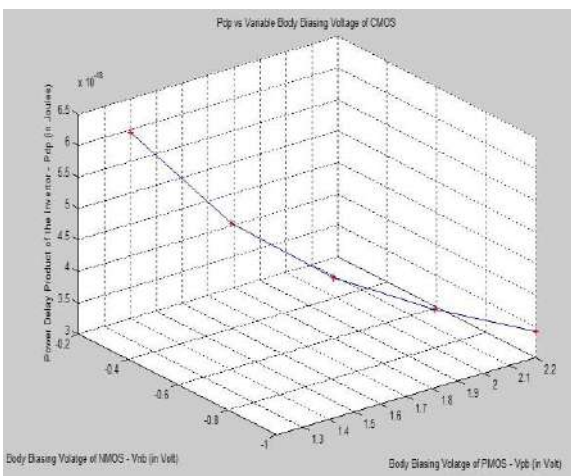


Figure.4 When both NMOS and PMOS both body bias voltage Varied

Conclusion

The forward body biasing mainly related to the speed of the circuit while reverse body biasing is related to the reduction of power dissipation. When only PMOS reverse body bias voltage applied to the CMOS inverter circuit then, dynamic power and delay and PDP decreased but leakage power is almost same as compared to the normal CMOS inverter circuit with zero source to body biasing. When, only NMOS is supplied with reverse body bias voltage in the CMOS inverter circuit then, there is reduction of dynamic power and leakage power whereas delay and PDP is increased as compared to the normal CMOS inverter circuit without body biasing. When, both PMOS and NMOS reverse body bias voltage applied in the CMOS inverter circuit then, dynamic power, leakage power and PDP decreased but delay increases. There is a clear trade-off between power dissipation and delay based on the different applications.

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(ECO-012)

RF Energy Harvesting: An Approach Towards Green Technology

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Abstract

The evolution in energy harvesting captures much attention in this modern world. Various energy-harvesting topologies like solar, vibrational, piezoelectric, RF (Radio Frequency) etc. are available but the RF energy harvesting esteems a bright future in generating a little amount of electric power that drives various low power electronics devices due to its easy availability and self-sustainability. This paper presents the basic overview of RF energy harvesting system that how RF energy is being converted into electrical power using various circuits and topologies.

Keywords: Antenna, Energy harvesting, Impedance, Rectifier, RF, Super capacitors.

Introduction

In today's world, energy and environment, both becomes a matter of concern among the researchers over worldwide. As the environment serves a good amount of energy in various forms like sun, wind, and electromagnetic radiations, it is preferable to utilize that energy in one way or the other. Energy harvesting or one can say energy scavenging is one alternate to use the freely available energy in the environment [1]. The typical energy harvesting system extracts, assembles and stores the energy in order to convert it into useable electrical energy. There are numerous ways to harvest the energy from the environment including solar, thermal, radio frequency, mechanical and so on. Table 1 summarizes the brief

difference between the various types of energy harvesting techniques. Out of all, radio frequency energy harvesting technique is most popular due to its abundance availability [2].

TABLE 1: Different Types of Energy Harvesting:

HARVESTING TECHNIQUE	ENERGY SOURCE	HARVESTING DEVICE	HARVESTED POWER
LIGHT	Sun	Solar cell	100 μ W-100mW
THERMAL	Heat	Thermoelectric generator	60 μ W-10mW
VIBRATIONAL	Stress	Piezoelectric film	4 μ W-800 μ W
RADIO FREQUENCY	Radio Signals	Rectenna	0.001 μ W-0.1 μ W

This paper aims to give the overview of the RF energy harvesting system, which helps in designing the RF energy-harvesting model that delivers the power supply to various other low power electronic devices.

RF energy harvesting system

Radio Frequency (RF) energy harvesting is the phenomenon of capturing the excess amount of energy from transmitted communication signals, converting it onto a usable electrical energy and then utilizes it in any form [3].

The architecture of Radio Frequency energy harvesting system includes of RF energy source, receiving antenna, matching network, RF rectifier and output storage unit as shown in Figure 1, where the electromagnetic RF waves are grabbed with the of receiving antenna, output impedance of antenna is matched input impedance of rectifier using the matching circuit, then RF



signal is converted to dc voltage with the help of rectifying device and finally the output is stored in the storage unit or can be used in any low power application.

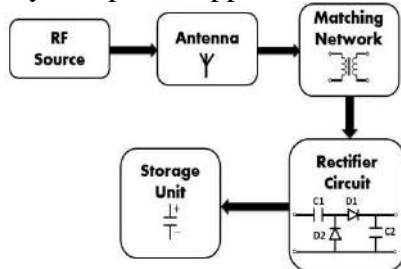


Figure 1: Basic Block Diagram of RF Energy Harvesting System.

Conclusion

By applying RF energy harvesting technique to low-power devices, there's an undoubtedly extension battery life and sometimes-even

elimination of the battery that leads to green technology. The use of energy harvesting reduces the maintenance and cost operation due to which batteries can be almost removed in portable electronic devices.

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(ECO-013)

Investigation of Urban Expansion of New Delhi through Landsat 5 TM and Landsat 8 OLI Sensor Data

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Abstract

In this research work, we have investigated the changes developed in the texture of the National capital of India, New Delhi due to the rapid urbanization in the last 32 years. We have acquired multispectral data for the pre-urbanization image from Landsat 5 thematic mapper (TM) sensor and for the post, urbanization image data is acquired from the Landsat 8 Operational Land Imager (OLI) sensor. Texture visual features obtained through GLCM i.e. Grey level co-occurrence matrix are investigated and a significant amount of change is obtained in them. Correlation, energy, contrast, and homogeneity are considered as texture optical feature and our investigation have suggested the change of 14.1817% in contrast, 19.6504% in correlation, 50.2651% in energy and 1.1774% inhomogeneity. Visual identification in the change is represented by the difference image histogram. Finally, the change in the texture features signifies a reasonable amount of landuse/landcover change in New Delhi.

Keywords: *Thematic Mapper, Operational Land Imager, Grey level co-occurrence matrix, Texture*

Introduction

Change detection techniques have been widely used in the field of satellite image processing and remote sensing [1]. These techniques are broadly classified in two different categories i.e. pre classification change detection and post-classification change detection [1]. Pre-classification change detection provides us only binary

information about various types of statistical changes developed in the landuse/landcover i.e. in yes or no, whereas post-classification change detection techniques not only provides us binary information but also information about various types of changes developed in term of quantification. Here we will be investigating the data acquired from Landsat satellites for exploring the change developed in the texture feature due to the urban expansion of the Nation Capital of India New Delhi.

Methodology

Here we are making an investigation based on the GLCM features that was developed by Haralick, he proposed a set of 14 different texture features like Homogeneity, Angular Second Moment (ASM), Contrast Local Homogeneity, Inverse Difference Moment (IDM), Entropy, Correlation, Sum of Squares Variance, Sum Average Sum Entropy, Difference Entropy, Inertia, Cluster Shade, Cluster Prominence [2] these features were further reclassified in four different categories, here we are using texture visual features i.e. contrast, correlation, energy and homogeneity only. We are quantifying the amount of change developed in the feature values followed by making a comparison in the pre and post urbanization images of New Delhi.

Experimental Results

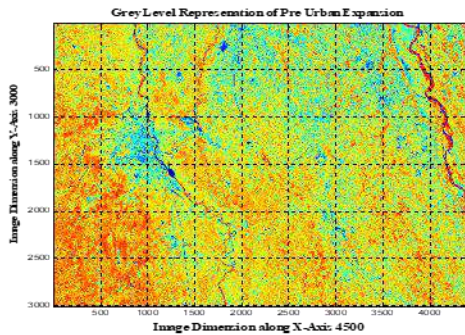
Pre and post urbanization sensor data is acquired from Landsat satellite [3] shown in fig. 1 (a) and (b) respectively.



(a) (b)

Fig. 1 (a) Pre urbanization image (b) Post urbanization image

Grey level versions of the images are obtained and the texture features are quantified for both the pre and post images.



(a)

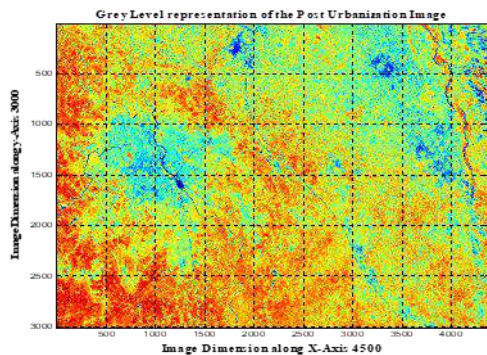


Fig. 2 Grey versions of the pre and post urbanization images

Conclusion

The quantification of the texture features suggests changes developed in the landcover due to the rapid expansion of New Delhi and the change suggest that when the urban expansion of an area takes place texture feature is affected in a unique manner.

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(ECO-014)

Performance Evaluation of QoS in IEEE 802.11 Wireless Adhoc Networks with Mobile Nodes for FTP Applications

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Abstract

In recent times wireless local area networks are in a duration of quality expansion and there is a powerful requirement for them to bear multimedia applications. Wireless adhoc networks are doing better and becoming more famous covering to traditional cellular telephony up to satellite broadcasting since they wider communication on the farther side of infrastructure networks. In these networks the nodes communicate with each other without any central controller i.e. without an access point or a router the nodes in adhoc networks have dynamic topology since they are free to move anywhere in the network therefore topology changes continuously and due to mobility, the network faces various challenges related to routing that affects the quality of service of the network which is one of the crucial factor in victorious implementation of wireless adhoc networks. In this paper the quality of service performance evaluation is done for the routing protocol AODV (reactive protocol) for FTP applications under different mobility conditions using random waypoint mobility model. The simulator used for the simulation is OPNET 14.5.

Keywords: WLAN, adhoc networks, AODV, mobility, OPNET.

Introduction

In this paper the performance evaluation of quality of service in wireless adhoc network with mobile nodes for application is done for various routing protocols AODV, GRP and OLSR using random waypoint mobility model. The simulation is performed with the help of OPNET simulator, the quality of service performance is evaluated for above three routing protocols on the basis of performance metrics throughput, media access delay, data dropped and retransmission attempts. For the evaluation different scenarios are created with for variable node density i.e. 50 and 100 node density.

Results

The simulation results for the different scenarios are taken which shows that the different values of performance metrics i.e. throughput, media, access delay, data dropped and retransmission attempts for various routing protocols and from the result AODV and GRP in terms of throughput and media access delay. From the results OLSR gives maximum throughput and minimum media access delay.

Conclusion

Based on the simulation results OLSR gives maximum throughput and minimum delay and it is concluded that



OLSR outperforms the AODV and GRP and provides better quality of service.

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(ECO-015)

Fuzzy logic- a model to diagnose ADHD

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Abstract

Attention Deficit Hyperactivity Disorder (ADHD) is a mental disorder or condition which is recognized via a repetitive pattern of hyperactivity and /or inattention and/or hyperactivity-impulsivity that affect growth and functioning of child's brain. ADHD children show multiple functional impairments occurring at different levels. The current work has explored the Event-related potential (ERP) signal of ADHD children by analyzing their ability to respond to the target stimuli in a given sequence of standard stimuli. The performance of ADHD and Typically Developing (TD) children have been compared by computing the latency rate and amplitude of the P300 wave. Ten ADHD and ten TD children have been recruited for the study and ERP are recorded in a controlled environment using a BIOPAC MP150 recorder. The results suggest that: (i) ADHD children showed prolonged latency in P300 wave in comparison to TD, and (ii) peak amplitude also showed significant difference relative to TD while responding to the desired stimulus. Moreover, in a few ADHD children, the P300 wave remained absent and they did not respond at the target stimulus. The variance of result obtained is then analyzed using the ANOVA (one-way) method which showed the significant difference between mean of the two groups and within the groups. These results are then implemented using fuzzy logic and a fuzzy model is developed in order to classify and predict ADHD among control group.

Keywords: electroencephalography (EEG), attention deficit hyperactivity disorder (ADHD), event-related potential (ERP), typically developing (TD), analysis of variance (ANOVA).



(ECO-016)

Performance Analysis of Microstrip Patch Antenna with Defected Ground Structure

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Abstract

In this study, sincere efforts have been made to analyze the effect of defected ground structure (DGS) on the performance parameters of the microstrip patch antenna. The antenna possesses simple rectangular structure and printed on the inexpensive FR4 substrate. In order to verify the resonating and radiation characteristics of the antenna with DGS, a critical comparison has been made with its traditional counterpart. The outcomes from the simulated results reveal that the microstrip patch antenna incorporation with DGS proves to be a feasible structure for wireless communication applications.

Keywords: *DGS, Gain, Microstrip patch antenna*

Introduction

The astonishing trends in wireless communication system and an increasing demand to integrate different technologies in to compact equipment has remarkably augment the fashion of utilizing small size antennas. Microstrip patch antenna, because of its compact size, low profile, low manufacturing cost and ease of integration with feed networks, is find extensive applications in wireless communication system. Due to extremely low profile (0.01 to 0.05 wavelength), printed microstrip antennas have possess heavy applications in military aircraft, missiles, rockets and

satellites. Nowadays in view of further reducing the size of icrostrip patch antenna and to improve its performance parameters, DGS has become hot area of reserch for antenna system design engineers. In its basic nature, DGS greatly influence the current distribution of the antenna. This leads to the variation in the resonating properties of the microstrip patch antenna. In this paper a small size planar microstrip patch antenna using defected ground have been designed to analyze the relationship between the resonant performances of these antennas. The radiation properties of the antenna have also been examined.

Results and Discussion

The presented antenna has been designed with FR4 substrate and simulations have been performed using full wave electromagnetic simulator IE3D which is based on the methods of moment technique. The results obtained from the simulations depicted that the proposed antenna inconjunction with defected ground not only reduce the size of the antenna but also improves its radiation and resonating properties significantly.

Conclusions

The proposed microstrip patch antenna is smaller in size with rectangular structure. Further implementation of defects in the ground plane enhances the performance of the antenna.



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(ECO-017)

Small Size Multiband Fractal Antenna for Wireless Applications

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Abstract

Fractal geometries are gaining interest in wireless communication because of their capability to produce miniaturized multiband antennas. This paper describes a square shape compact fractal antenna. The antenna has been made on duriod substrate having electrical permittivity of 2.2 and suitable height of 1.53 mm. Further to explore the effect of dimensional behavior, side of the square has been varied and analyzed. It has been observed that with increase in the dimensions of the proposed antenna, resonant frequency and bandwidth decreases with considerable improvement in the reflection coefficient.

Keywords: *Fractal, Multiband, Reflection coefficient*

Introduction

The advancement and dramatic development of a variety of wireless applications have remarkably increased the demand of multi-band/wideband antennas with smaller dimensions than traditionally available. One of the methodologies used to reduce the antenna size is application of fractal structures. The increasing need for miniaturization, not only requires compact devices, but also small-sized radiators. Fractals, because of their geometrical properties, can be utilized successfully in antenna miniaturization and recently some interesting applications have been studied and presented in the literature. Since the fractal geometries are generated by a recursive process, they can produce a very long length or a wide surface area in a limited space. Fractals are geometrical objects featured by a highly irregularity that

makes it difficult to describe with the classic Euclidean geometry. The benefits of using fractal shaped antenna elements are manifold. These geometries may results in antennas with multiband characteristics, often with similar radiation properties in these bands. In this paper, a small size square shape fractal antenna has been designed to produce wireless applications and an analysis has been done by varying the sides of the proposed geometry.

Results

The IE3D electromagnetic solver has been utilized to simulate the antenna. It has been observed that there is a considerable improvement in the value of reflection coefficient with increase in the number of iterations. Further by varying the side of the fractal antenna it has been analyzed that as the side increases, there is a decrease in the bandwidth and resonating frequency of the antenna.

Conclusions

A square shape miniaturize multiband fractal antenna has been discussed in this paper. An analysis has been given to enumerate the resonant properties of the fractal structure by varying the sides of the square. The obtained results confirm the feasibility of the antenna for various wireless applications.

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(ECO-018)

Fuzzy Logic Based System for Soft Fault Diagnosis in Analog Circuits

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Abstract

In this study author present an intelligent virtual instrument system design for the diagnosis of parametric (soft) faults in analog circuit using curve fitting method. In this method output response of the analog circuit obtained from AC analysis is curve fitted using polynomial curve fitting. The polynomial coefficients are used as signature parameters for fault diagnosis. The parametric variations in the component values are analyzed by Monte-Carlo analysis. The fuzzy logic based system is used for the classification of the faults. Along with fault classification, fuzzy logic based system also gives the estimated value of the component in faults. All these features are implemented in the design of a virtual instrument. The results of the fault diagnosis are presented for Sallen-Key band pass filter circuit a benchmark analog circuit using simulated data.

Keywords---*Fuzzy Logic, Analog Circuit, Polynomial Curve Fitting, Virtual Instrument.*

Introduction

With the rapid growth of the electronics manufacturing units, testing in electronics products includes the testing of the analog parts of the mixed signal circuits. Hence fault diagnosis in analog electronic circuits is a major research area. The tolerances in the circuit component values, availability of limited test nodes and their nonlinear nature makes the fault diagnosis in analog circuits difficult. Faults in the analog circuits are categorized as catastrophic (hard) faults and parametric (soft) faults. Catastrophic faults are represented at circuit level as open and short circuit faults.

Parametric faults are caused by variation in the values of circuit component parameters. The use of artificial intelligent techniques in the fault diagnosis in the analog circuits leads to the automation in the fault diagnosis process in analog circuits.

In the fault diagnosis study with simulated data, the analog circuit is simulated using MULTISIM software to obtain the output using AC analysis. A virtual instrument is designed using the graphical programming in LabVIEW. In simulation study virtual instrument includes the polynomial curve fitting tool, fuzzy classifier and the graphical codes used to display the results visually and directly.

Results

The proposed method is validated with experiments on benchmark analog circuit namely Sallen-Key band pass filter circuit. The fault diagnosis results are presented for the circuit under test using simulated data. In the example of Sallen-Key band pass filter all the fifteen soft fault models (including nominal) are correctly diagnosed except some ambiguity groups occurring due to overlapping.

Conclusions

In this paper, the polynomial coefficients obtained by fitting the frequency response of the circuit under test using polynomial curve fitting have been used. A design of the intelligent virtual instrument presents a new concept in the fault diagnosis of analog circuits. Since the parametric variation in the component value is detected with good diagnosis efficiency, it shows that this study has a good impact on the fault diagnosis in analog circuits. Moreover the method is



generalized by implementing fault diagnosis in the benchmark analog circuit using simulated data.

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(ECO-019)

Comparative analysis of orthogonal space time block code (OSTBC) for MIMO Rayleigh channel

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Abstract

Multiple-input and multiple-output (MIMO) is an emerging technique in wireless communication to achieve reliability and high throughput. MIMO system can be implemented using higher order modulations to achieve large data capacity. In this paper, a general orthogonal space time block code (OSTBC) is proposed for multiple-input multiple system for different antenna configuration at transmitter and receiver. The Bit error rate (BER) performance is evaluated using digital modulation techniques like 16-QAM, 64-QAM, 256-QAM with STBC and MRC diversity techniques over Rayleigh channel. The simulation is done for the calculation of BER of higher order modulating techniques and lower order modulating techniques. Receiver diversity technique is used to improve the BER. Simulation is obtained for the cases: Three transmitter-one receiver (3Tx-1Rx), four transmitter-one receiver (4Tx-1Rx), Three transmitter-two receivers (3Tx-2Rx) and four transmitter-two receivers (4Tx-2Rx) for code rate $\frac{1}{2}$ and $\frac{3}{4}$.

Keywords: MIMO, OSTBC, nTx-nRx, QAM, BER

Methodology Proposed

When transmitting antennas of MIMO transmit different symbols simultaneously, the received signals are summed up. Then receiver separates them in order to detect signals from particular transmitter. The signals are combined in such a way that BER or data rate for each user will be improved. STBC is technique that operates on block of input symbols producing a matrix and outputs whose columns represent antennas and rows represent time. It provides full diversity with low encoder/decoder complexity. Thus, STBCs are effectively used to exploit the advantage of MIMO systems. A simple orthogonal STBC requires two transmit-one receiver (2Tx-1Rx) antenna.

For systems with more than two transmit antennas complex orthogonal codes are used. In real orthogonal codes, it is possible to reach full rate, however, it is not possible for two-dimensional constellations, i.e., complex signals. For complex signals, the theory of orthogonal designs can be used to generate coding matrices that achieve a transmission rate of $\frac{1}{2}$ for the cases of three and four transmission antennas.

Results and Discussion

The simulation is carried out for comparative analysis of the performance of STBC using 16-QAM, 64-QAM and 256-QAM modulation techniques over Rayleigh fading channel for Three transmitter-one receiver (3Tx-1Rx), four transmitter-one receiver (4Tx-1Rx),



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Three transmitter-two receivers(3Tx-2Rx) and four transmitter-two receivers(4Tx-2Rx) for code rate $\frac{1}{2}$ and $\frac{3}{4}$.

Conclusions

Performance of MIMO system is analyzed under Rayleigh fading channel. Simulated results are provided to compare the performance over different modulation techniques for code rate $\frac{1}{2}$ and $\frac{3}{4}$ over Rayleigh channel. It can be concluded that if number of receiving antennas are increased by keeping transmitting antennas same, the BER decreases. So the systems having two receivers and 4 or 3 transmitters give better performance than systems having one receiver and 4 or 3 transmitters.

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(ECO-020)

Analysis of bit error rate performance with linear block codes in wireless communication system

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Abstract

Linear block code (LBCs) viz. Bose-Chaudhuri-Hocquenghem (BCH), Hamming, Cyclic Redundancy Check (CRC) and Reed Solomon (RS) codes were used for forward error correction (FEC) to estimate bit error rate (BER) of the wireless communication system (WSN). The BER performance of these codes was studied at specified block length (255, 247) over an Additive White Gaussian Noise (AWGN) channel using Binary Phase-shift keying (BPSK) modulation. Simulation process for coding and decoding of these codes was performed with MATLAB (R2017a) software. While comparing BER performance, lower signal-noise ratio (SNR, E_b/N_0) values varied between 0 and 9. RS codes gave lower BER, compared with other codes. At a SNR value of $E_b/N_0=0$, the BER measured using BCH and Hamming codes was ~7.9 and 10.2% higher, respectively compared with RS codes. Similar trend was observed for entire SNR range ($E_b/N_0 = 0$ to 9). The BER decreased by ~82% with increase in SNR $E_b/N_0=0$ to 1. Further, it was observed that BER exhibited a substantial decrease (98%) with further increase in SNR $E_b/N_0=0$ to 2. At higher SNR range between 0 and 18, similar trend of BER was observed using different codes.

Keywords: Additive White Gaussian Noise, Bit error rate, Bose-Chaudhuri-

Hocquenghem, Linear block codes, Signal-noise ratio

Methodology Proposed

In the present study, AWGN channel was used. Information transmitted via channel could be represented as continuous-time signals. Let $x(t)$ denote the information-bearing signal sent by the transmitter over the AWGN channel; then the decoder will receive a signal $y(t)$ (Eq. 1).
 $y(t)=x(t)+n(t)$
 .(1)

where, $n(t)$ is a Gaussian process corresponding to the distortion introduced by the channel. Due to electronic circuit noise and thermal noise, Eq. 1 can be written as Eq. 2

$$y(t) = h(t)x(t) + n(t)$$

.....(2)

The first proposed simulation model for LBCs with block length (255, 247) over AWGN channel at certain value of E_b/N_0 has been illustrated in **Figure 1**.

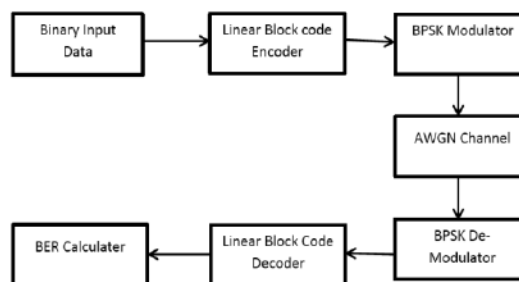


Figure 1. Proposed simulation model for LBCs (block length=255 and 247).



(ECO-021)

Design of Dual h Shape Microstrip Patch Antenna for Multiband Applications

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Abstract

An antenna plays an important role in wireless communication. Several microstrip patch antennas of different shapes such as circular, square, disk shape have been already designed. In this paper, the design of dual h shape microstrip patch antenna with defected ground plane is presented that works for multiband applications. The proposed antenna is designed on the FR4-epoxy substrate having the dielectric constant 4.4 and height 1.6 mm. The software used for antenna designing and simulation is High Frequency Structure Simulator (HFSS). The antenna operates at five different frequencies such as 1.7GHz, 2.7 GHz, 4.5GHz, 6.6GHz and 8.5GHz with return loss -20dB, -21dB, -17dB, -19dB and -25dB. The gain values at these five frequencies are 16dB, 9.5dB, 3.5dB, 4.3dB and 6.6dB. As a result, miniaturization of proposed antenna is taking place. The effect of the addition of slots both on the patch and on the ground plane is also evaluated.

Keywords: :- *microstrip, multiband, dielectric, antenna.*

Introduction

An antenna is an important component for the low profile wireless communication. A length of a conductor which is used to send or receives the electromagnetic waves is known as antenna. In last few decades, techniques have been developed for using electromagnetic carrier wave over a radio frequency as well as microwave frequency. In current scenario, an affordable and compatible microstrip patch antenna is

developed in wireless communication to improve antenna performance. It converts electrical power in to radio waves and vice versa. It consists of a metallic conductor which is electrically connected to the transmitter or receiver.

Results and Discussion

The antenna consists of two h-shaped slots of the same size that are etched on a rectangular patch to achieve multiband applications. The valuable return losses are received at five frequencies i.e. 1.7 GHz, 2.7 GHz, 4.5 GHz, 6.6 GHz and 8.5 GHz are -20dB, -21dB, -17dB, -19dB and -25dB respectively. The gain at corresponding resonant frequencies is 16 dB, 9.5 dB, 3.5dB, 4.3 dB and 6.6 dB.

Conclusions

In this work, a dual h shape microstrip patch antenna with defected ground plane for multiband applications is presented. The antenna design has a compact size of 19mm×25 mm. The antenna consists of two h-shaped slots of the same size and impedance matching in this design is achieved by printing a circular shape patch that is gap-coupled with rectangular ground plane on the other side of dielectric substrate.

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(ECO-022)

**Energy Efficient Virtual Machine Migration Approach With Sla
Conservation In Cloud Computing: A Review**

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Abstract

As envisioned by the researchers, dependency of human beings on computing power has increased a lot because of higher role of communication in day to day life at global level using Information Technology. Thus cloud computing has transformed the huge expenditure on infrastructure by individuals, industry and small organizations into state of the art pay-as-you go model in order to reduce individual burden. Data centers in its models allows to provision virtual machine with huge flexibility. In past few years, many algorithms have been proposed to solve running cost expenditure optimization problem. However those approaches are still lacking in achieving maximum efficiency. This article surveys the highlights of various resource optimization algorithms, their advantages, loopholes and the principle areas that require further research .

Keywords: *Virtual Machine Migration, Meta Heuristic, Evolutionary approach*



(ECO-023)

LEACH based Clustering Methods: Recent Developments

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Abstract

A network containing sensor nodes having communicating and computing capabilities are known as sensor networks (SNs). In successful implementation of sensor networks the protocols which ensure energy efficiency and high network lifetime are desired. Clustering based protocols are the most accepted methodologies which are accepted in literature for designing energy efficient SNs. LEACH is one of the popular clustering method which widely investigated and a number of methods have been proposed to further improve its performance. In this paper, we have presented survey on recent LEACH based clustering methods for SNs.

Keywords: *Sensor networks; energy efficiency; clustering; LEACH protocol; communication; cost; scalability.*

Methodology proposed

In this paper we have presented the basics and pros& cons of the latest LEACH based clustering methods in a manner such that their relevance in real time applications of WSNs can be easily understandable.

Conclusion

Cluster based routing techniques play an important role in the efficiency of WSNs as they contribute to the reduction of energy consumption and latency and also provide

high data throughput, network lifetime and quality of service. LEACH protocol is the fundamental clustering based routing protocol for WSNs. Considering LEACH as a base protocol, various protocols have been developed. Each new protocol of LEACH was implemented to solve some limitations of original LEACH algorithm. In this paper, we have described various routing protocols based upon the standard LEACH protocol and their comparison to other protocol. The parameters selected are based upon the applications and environment on which the SN is operating.

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Recognition of Foreign Material in Wheat Kernels Using Machine Vision

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Abstract

The present paper reports on the development of an Artificial Neural Network (ANN) based new classifier for recognition of foreign material in wheat kernels using machine vision. Three types of classifiers are reported till-date for machine vision based recognition of foreign material in Wheat Kernels including statistical classifier, discriminant classifier and ANN classifier. However, all these classifiers are implemented using a large number of input features thus making the classifier complicated. In order to address this issue, the present study reports on the development of an efficient classifier using a small number of morphological features as input for identification of foreign material in non-touching wheat kernels.

Keywords: Wheat kernel, foreign material, classifier, machine vision

Introduction

India is largely an agricultural country with approximately 50% of the living population indulged in the field of agriculture to earn their livelihood. This accounts to around 15% of the total GDP [1]. Having this huge population indulged in agricultural sector, the production of India is still not at the level it should have been till-date. The main cause of this is the conventional practice of food product recognition is

still followed. The increased demand and cognizance in consumers has led to realization of improvement of food products. This in turn increased the demand for enhanced quality of food products [2]. Grain is one of the most important foods in the world both as a source of nutrition and income. Determination of grain type and quality is a crucial aspect at every stage of grain postharvest handling. Traditional manual analysis and grading of grains have many limitations and certain drawbacks. It is subjective as it is highly influenced by anthropogenic and environmental factors [1]. Moreover, such methods are inefficient and time-consuming as well as prone to grading inconsistencies caused by the influence of external factors on human perception [3]. Therefore, what is needed is an efficient system that is capable of objectively and rapidly applying evaluation criteria and would be an advanced tool for grain handling and quality control. The most useful measure to achieve such a system is to use of machine vision based inspection methods.

Results and Discussion

The proposed classifier is executed using Levenber-Marquardt learning algorithm which ensures faster training of proposed classifier. Foreign component used in the present work includes other grains as well as dockage component. Rigorous experimental investigation reveals an accuracy of more than 98.5%



for the proposed classifier. The results of present study are quite promising.

Conclusions

The results of present study are quite promising. The proposed system has potential future in the field of on-line marketing of agriculture produce.

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