Conference Journal

SYMBIOT'18

A National Level Biotechnology Symposium on Recent Advances in Biotechnology

19th and 20th October, 2018

Organized by
Institute of Engineers – Biotech Chapter

&

Department of Biotechnology, MIT, Manipal

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SymBiot'18 Itinerary

Friday, October 19, 2018

8:30 AM to 9:30 AM	Registration and Reception @ Sir MV Seminar Hall (AB-2), MIT, Manipal

Friday, October 19, 2018

Day 1	**Venue: Sir MV Seminar Hall, AB-2, MIT**
09:30 AM to 10:00 AM	Inauguration
10:00 AM to 10:30 AM	Tea Break
10:30 AM to 12:00 PM	Guest Lecture – I **Dr. K.V. Venkatesh** Professor, IIT Bombay *Topic: Systems Engineering Perspective of Human Metabolism through a Multiscale Model for Disease Analysis : A Cell to Human Framework*
12:00 PM to 02:00 PM	Lunch
02:00 PM to 03:15 PM	Guest Lecture – II **Dr. Pankaj Kalita** Project Leader, Zydus Cadila *Topic: Development of a Novel Antibody Cocktail for Prophylaxis against Rabies Virus*
03:15 PM to 03:30 PM	Tea Break
03:30 PM to 05:00 PM	Guest Lecture – III **Dr. Alex Hankey** Professor, S-VYASA, Bengaluru *Topic: The Dual Aspect Information Theory of Consciousness Realized through Complexity Biology*

Saturday, October 20, 2018

Day 2	**Venue: Sir MV Seminar Hall, AB-2, MIT**
09:30 AM to 10:30 AM	Oral Presentations
10:30 AM to 11:00 AM	Tea Break
11:00 AM to 12:00 PM	Startup Talks
12:00 PM to 01:00 PM	Oral Presentations
01:00 PM to 02:00 PM	Lunch
02:00 PM to 03:00 PM	Poster Presentations
03:00 PM to 03:30 PM	Certificate and Prize Distribution
03:30 PM to 04:00 PM	Tea Break

MAHE

Manipal, today, is a knowledge powerhouse and a brand name in higher education. Over five and half decades ago, one man, Dr Tonse Madhava Anantha Pai, had a vision which ensured that everything he did then, was consigned to posterity, making sure that generation after generation of students enjoy the fruits of his labour till eternity on this lateritic plateau. And the students will, forever, have one name on their lips, that of Manipal.

Manipal Academy of Higher Education (MAHE) is a name to remember, not just across the length and breadth of India, but worldwide. The fact that students from 52 countries are studying here is a testimony to this fame. Fired by the desire to provide health care and other essential services to the people of this region, Dr TMA Pai transformed the plateau into what it now is. He turned the wilderness into a sanctuary of education.

In 1953, he set up Kasturba Medical College, the first private medical college in the voluntary sector. And, with that began the story of MAHE. Then, in 1957 came the engineering college, the dental college, Pharmacy College and so on and so forth. Initially, these institutes were affiliated to different universities.

Dr TMA Pai passed on the baton of leadership to his son, Dr Ramdas M Pai who is the present President and Chancellor of the University. Located on the west coast of South India, Manipal was a barren wasteland, a plateau with wild animals. It was this plateau that Dr TMA Pai decided to change. His vision for Manipal covered a wide spectrum of interests because he himself donned many hats. He was a physician, an educationist, a banker and above all, a philanthropist at heart.

Then in 1993, MAHE was accorded a deemed university status under Section 3 of the UGC Act 1956, by the Ministry of Human Resource Development, Government of India. At the time of receiving the deemed university status, only five professional institutions existed. Today, it has 20 constituent institutions comprising medical, dental, engineering, architecture, nursing, allied health, pharmacy, management, communication, information science, hotel management, biotechnology, regenerative medicine etc. The university offers Bachelors', Masters' and Doctoral degrees in various specialties.

Encouraged by the new status, MAHE grew by leaps and bounds. The emphasis has always been, and still is, on quality education, which is why the degrees offered by the university are recognized world over.

MAHE provides excellent educational facilities to over 17,000 students in its constituent colleges. It also has an active alumni base of over 65,000 students across the world. With all the experience gained from producing several thousands of graduates, backed by experienced faculty, excellent academic and clinical facilities, MAHE boasts of an educational environment with a touch of world class.

MAHE has branch campuses in Bangalore, Malaysia, Dubai and Antigua in the Caribbean Island. There is also a campus in Mangalore with a medical college, a dental college and a nursing college with attached teaching hospitals. MAHE has an international academic collaboration for twinning programmes in engineering with universities in the US, UK, Australia and other countries.

Manipal Group institutions are located on scenic campuses, which provide high quality lifestyle and ideal environment for study. All campuses have excellent infrastructure for academic activities, sports and other extracurricular activities.

The infrastructure includes air-conditioned lecture halls, skills lab, air-conditioned hostels, and multi-cuisine food court. The state-of-the-art health sciences library is fully air-conditioned, accommodates 1300 learners and has over 62,000 books and over 600 journals. The library facilities include Medline, Proquest medical library of online databases, audio-visual, Cochrane library, e-learning, computer and Internet services. The Skills Lab and Anatomy Museum are considered amongst the best in the world. The latest addition to the facilities, a Simulation Lab with computer driven mannequins, is an achievement, which the university is proud of. It is of considerable help to students in the field of health care.

MAHE believes in providing the finest in infrastructure and facilities to its students when it comes to learning and research. In fact some of the facilities, like the Innovation Centre, have served as a valuable 'incubation centre' for industry and research. The state-of-the art innovation centre bridges the gap between university and industries for industrial academic research.

Other facilities on the campus include gym, swimming pools, and football and cricket grounds. The new indoor sports complex is perhaps one of its kind in Asia. The complex has five badminton courts, four squash courts, three tennis courts, a basketball court, gymnasiums and a walking track. Besides being an ISO 9001:2008 and ISO 14001: 2004 certified University, it is home to many top 10 ranked institutions of India. MAHE has won the prestigious IMC Ramkrishna Bajaj National Quality Award and International Asia Pacific Quality Award during 2007- 2008. MAHE attained the Institute of Eminence by MHRD in 2018.

Manipal Institute of Technology

Manipal Institute of Technology (MIT), one of the Premier Engineering Institutes in India, was among the first self – financed engineering colleges in the country. It was started in 1957 by Padmashree late Dr.T.M.A Pai, as Manipal Engineering College with an undergraduate course in Civil Engineering.

In 1965, the institute got affiliated to the University of Mysore from Karnataka University. In 1974, it was renamed as Manipal Institute of Technology (MIT). In 1980 it got affiliated to the University of Mangalore. After the creation of the Visveswaraiah Technological University (VTU), MIT along with a number of other engineering colleges in the state got affiliated to the VTU in 1998. As the Manipal Academy of Higher Education (MAHE) had acquired a Deemed University status, MIT became a constitution institution of MAHE in May 2000. In 2003, MIT obtained full academic autonomy and adopted credit system with 10 point grading. In 2007 MAHE was renamed as Manipal University and MIT retained its status as a constituent institution of Manipal University. With total student strength of over 7500, MIT has emerged as the largest institute of University.

MIT currently offers undergraduate programs (B.TECH) in 16 disciplines and postgraduate courses (M.TECH/MCA) in 24 different streams and Doctoral programs (Ph.D) in all streams of engineering, basic sciences, humanities and management. Academic programs offered by institute are approved by AICTE and have been accredited by the National Board of Accreditation (NBA). The institution plays a vital role in producing world – class engineers tuned to the demands of a fast changing global village.

Department of Biotechnology

The undergraduate Biotechnology Programme (B.Tech.) in MIT was started in the academic year 2005-06. The course objective is to mold students with a technical base for employment in the diverse areas of Biotechnology, where the industry based arena is expanding rapidly. This course has been designed to provide the students with both theoretical knowledge and practical skills in biochemical engineering, molecular biology, enzymology, bioinformatics etc. to keep pace with latest developments and to cater to the needs of industrial biotechnology sector. This professional course opens up avenues for its graduates to promote entrepreneurship as well as careers in biotechnology related industries.

The department offers a total of eleven laboratories from the 3rd to 7th semester, with 30% weightage to science, 30% to computers and 40% to Bio-processing technology. Students gain hands-on experience in all these three areas, which is unique to the Biotechnology programme at M.I.T., Manipal. In this programme, while constancy on essential areas of biology and engineering curriculum is maintained, considerable flexibility is built in through the electives offered in the study. The students are encouraged to select areas that fit his/ her aptitude and interest, so that they are allowed to specialize in the area of choice as follows: genetic engineering, process development, computer application in bioprocess, design and development of materials and equipments in bioprocess.

Faculty of the department has published many papers in National/International Journals. They are also participating in summer schools, workshops and International/National conferences. Many of our past students are pursuing higher studies in various international universities abroad. The students are encouraged to participate in curricular and co-curricular activities and their efforts have resulted in appreciation for the department.

Guest Speakers:

Dr. K.V. Venkatesh

Professor, IIT Bombay
Topic: Systems Engineering Perspective of Human Metabolism through a Multiscale Model for Disease Analysis: A Cell to Human Framework

Dr. Alex Hankey

Professor, S-VYASA, Bengaluru
Topic: The Dual Aspect Information Theory of Consciousness Realized through Complexity Biology

Dr. Pankaj Kalita

Project Leader, Zydus Cadila
Topic: Development of a novel antibody cocktail for prophylaxis against Rabies virus

Contents

ABSTRACTS

Systems Engineering Perspective of Human Metabolism through a Multiscale Model for Disease Analysis: A Cell to Human Framework

K. V. Venkatesh

Department of Chemical Engineering, IIT Bombay

Human physiology is an ensemble of various biological processes spanning from intracellular molecular interactions to the whole body phenotypic response. Systems biology endures to decipher these multi-scale biological networks and bridge the link between genotype to phenotype. The structure and dynamic properties of these networks are responsible for controlling and deciding the phenotypic state of a cell. Several cells and various tissues coordinate together to generate an organ level response which further regulates the ultimate physiological state. The overall network embeds a hierarchical regulatory structure, which when unusually perturbed can lead to undesirable physiological state termed as disease. Here, we treat a disease diagnosis problem analogous to a fault diagnosis problem in engineering systems. Accordingly we review the application of engineering methodologies to address human diseases from systems biological perspective. The research work highlights potential networks and modeling approaches used for analyzing human diseases. The application of such analysis is illustrated in the case of diabetes and hypercholesterolemia. We put forth a concept of cell-to-human framework comprising of five modules (data mining, networking, modeling, experimental and validation) for addressing human physiology and diseases based on a paradigm of system level analysis. The work emphasizes on the importance of multi-scale biological networks and subsequent modeling and analysis for drug target identification and designing efficient therapies.

The Dual Aspect Information Theory of Consciousness Realized through Complexity Biology

Alex Hankey

S-VYASA, Bengaluru

Based on his research directed by Douglas Hofstadter, Philosopher of Consciousness David Chalmers proposed that any physical theory of consciousness must satisfy four important conditions, of which the most important were that any such theory must be governed by non-reductive physics, and that it should be a 'Dual Aspect Information Theory'. This lecture will show how the kind of theory envisaged by Chalmers has now been completely realized through the new discipline of Complexity Biology; also that it was foreseen by the Rishis of ancient India, who, from their own subjective experience, declared in Mundakopanishad that conscious awareness has two aspects, the witness, Sakshi with the ability to know itself, and the enjoyer of its information content. The actual cognitive form of the information content was also specified by the Maharishis in their Vedic sciences. The first limb of the Vedas, Shiksha – the first Vedanga, explains that the primary content of consciousness is ideas rather than words, as most western scientists conceive. The statement's veracity is demonstrated by considering polylingual abilities. It is also shown to conform to theories of Socrates (his theory of 'forms' given in Plato's dialogue, The Republic), and Immanuel Kant, in his Critique of Pure Reason. Unknown to David Chalmers, his criteria were presaged by philosophers of both East and West. The lecture's second part shows how this powerful combination of philosophic considerations is fully and completely realized thru the modern discipline of complexity biology. Its key insight is that the Loci of Control of all organisms are sited at conditions of physical instability, which afford them a measure of indeterminacy as demonstrated by the new discipline of Fractal Physiology, a central subfield of Complexity Biology. From indeterminate responses to stimuli springs the possibility of genuine volitional control. To demonstrate this idea, the nature of states of critical instability are considered in detail. They turn out to possess a Dual Aspect structure: a central self-observing state that knows itself, fulfils the role of the witness, while an associated catastrophe singularity can encode 'forms', i.e. ideas. As an extra, this new theory of conscious experience satisfies Roger Penrose's major proposals in his books on the topic. The perfectly self-observing system of the witness collapses all wave-functions impinging on it. Quantum theory's hypothesized relationship between consciousness and physical reality is properly realized. It is fulfilled by the instability singularities. And because they encode ideas as 'forms', Penrose's Platonic idealism is also realized.

Development of a Novel Antibody Cocktail for Prophylaxis against Rabies Virus

Pankaj Kalita

Zydus Cadila

India is endemic for rabies accounting for 36% of the world's deaths. Rabies causes 18,000-20,000 deaths every year (http://www.searo.who.int/india/topics/rabies/en/). About 30-60% of reported rabies cases and deaths in India occur in children under the age of 15 years. Death due to Rabies can be totally prevented if post bite prophylaxis is administered in the form of Vaccine and administration of anti-rabies immunoglobulin. There is a shortage of the expensive anti rabies human immunoglobulin as it is collected from human volunteers who have been administered rabies vaccine. Zydus Cadila had developed a cell culture based rabies immunoglobulin- Rabimabs. Rabimabs is a highly pure, safe and efficacious antibody preparation which can be produced in large quantities for the people who are bitten by rabid animals.

Haemolytic Activity and HPLC Studies of *Pandanus amaryllifolius*

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The methanolic leaf extract of Pandanus amaryllifolius (Pandanaceae) was prepared and subjected to phytochemical analysis. Haemolytic activity show positive results and it was not affected erythrocyte in the body hence all the samples can be used for future drug development. HPLC study was carried out using Quercetin and Gallic acid as a standard. Many bioactive compounds were identified in the crude extract, which will be used for polyherbal drug formulations.

Keywords: Leaf extract, *Pandanus amaryllifolius*, HPLC, Haemolytic activity

Bacteria from Motor Garage Soil Grow on Petroleum Crude Oil and Motor Oil

Amrutha K, Ananya, Melita Alva, Jenishia Menezes, C Vaman Rao, Shyama Prasad Sajankila, Louella Concepta Goveas

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Calamities induced by activities of human beings have affected the environment in most harmful ways. Release of hydrocarbon pollutants by oil spills, vehicular emissions, industrial and municipal run offs and effluent release causes contamination of soil ground water and oceans. This is a reason of major concern as these pollutants are persistent organic pollutants that are carcinogenic, mutagenic and teratogenic to all life forms. Microorganisms indigenous to the pollution site have a higher tolerance to the toxicity of pollutants. The current study aims at isolating bacteria from motor garage soil and to test the degrading ability of isolated bacteria on different oils. Bacteria were isolated from motor garage soil and screening for degraders was done by growing bacteria on Bushnell Haas agar with petroleum crude oil and motor oil as sole source of carbon. The ability of bacteria to degrade oils was determined by measuring the reduction in colour of DCPIP (redox indicator that gets reduced on accepting electrons released by oil degradation). It was observed that strain SS1 could decolorize DCPIP in crude oil completely within 24 h whereas strain SS5 reduced the concentration of DCPIP to half within 24 h in motor oil. This study showed that indigenous bacteria from oil contaminated sites have the potential to degrade different crude oils and could be used in their bioremediation.

Keywords: Bacteria, Motor oil, Petroleum crude oil, Bioremediation

Identification of Multi-Targeted Drug for Alzheimer's Disease Using *In Silico* Approaches

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Alzheimer's disease (AD), the leading cause of dementia worldwide is a progressive neurological disease-causing irreversible loss to the human cognition and function. This is characterized by the accumulation of misfolded β-amyloid protein (Aβ) within the brain. The new compounds against Alzheimer activity were identified from various plant species. In this study curcumin, taurine and rosmarinic acid have shown as an effective compound for inhibiting Aβ42 protein among identified compounds based on molecular docking and dynamic simulations. The *in silico* results shown that curcumin, taurine and rosmarinic acid have best docking scores of -10.6371, -6.24671 and -9.22787 respectively, compared to standard Aricept compound docking score -9.42838 with β-amyloid protein. In Molecular dynamic simulations, the rosmarinic acid compound was good in binding the β-amyloid protein and inhibiting the protein to misfold. So, this novel compound may provide some insight into the strategy of structure-based drug design for Alzheimers disease.

Keywords: Alzheimer's disease, β-amyloid protein, Molecular docking, Dynamic simulations

Isolation and Screening of Malachite Green - Degrading Microorganisms from Textile Effluent

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The colored effluents discharged from textile processing and dye manufacturing industries contain a significant amount of unreacted dyes. During dyeing process, upto 15% of the dye stuff does not bind to the fibers and is therefore released into the environment. The increasing use of triphenylmethane dyes in textile industries for dying nylon, wool, silk, and cotton is alarming, given that the release of colored compounds into the environment may cause ecological damage. In recent years, bioremediation is an attractive process in removal of unwanted color and toxicity of textile effluents than other conventional treatment like physical (flocculation, photo-catalytic degradation, adsorption, ion-exchange etc.) and chemical (photochemical oxidation, electrochemical method, etc.) processes. The indigenous bacteria from textile effluent were isolated by serial dilution followed by pour plate method. The resultant colonies (~ 100), eight isolates were selected based on colony morphology and maximum diameter of zone of clearance (MIC). The selected isolates were subjected to overnight incubation (MSM-broth + 0.005g of dye) and their corresponding optical density was measured using a colorimeter at 600nm and along with 24 hrs incubation (MSM-agar + 0.005g of dye), the dimensions of zone of clearance was observed and tabulated. On comparing the results for the above mentioned criterion, four isolates which gave highly appreciable results were selected for further studies. The explicit isolates were subjected to Gram's staining, motility and various biochemical tests. All isolates were confirmed to be Gram positive, Bacilli and motile organism. Almost all isolates showed positive results in some of the biochemical tests. Thus the isolates were capable of producing enzymes like catalase, urease, amylase and could utilize various carbon source (glucose, sucrose, lactose).

Keywords: Malachite green, MIC, Optical density

Extending the Shelf Life of Citrus Fruit Juice by using Chitosan Isolated from Mushroom Wastes

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Effect of chitosan extending the shelf life of citrus fruit. The analyses showed that chitosan concentration extended the quality of the orange juice significantly, reducing enzymatic and non-enzymatic browning and controlling the spoilage during the storage time; however, concentrations 1g L\1 produced a significant reduction in the concentrations of ascorbic acid and carotenoids associated with the positive charge of chitosan and its ability to flocculate and coagulate negatively charged substances. The study recommends the use of chitosan at concentrations 1g L\1 to extend quality and preserve ascorbic acid and carotenoids during storage time of fresh orange juice, thus avoiding the use of standard thermal treatments which produces a negative impact on the nutritional value. The main objective of this study was the study of chitosan as a natural preservative for extending the shelf-life of orange juice and as an alternative to pasteurization.

Keywords: *Agaricus bisporus*, Chitosan, Citrus juice, Quality, Spoilage

Role of CTAB as a Stabilizing Agent in the Synthesis of Silver Nanoparticles Using Methionine: Characterization and Applications

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Silver is known for its antimicrobial properties from ancient times and the properties are enhanced at nanoscale. The purpose of this study is to evaluate the antibacterial and peroxidase like activity of the silver nanoparticles synthesized by chemical reduction method. Silver nanoparticles were synthesized by reduction of silver nitrate in the presence of methionine as reducing agent and CTAB as stabilizing agent. This synthesis was conducted at room temperature and with continuous stirring. Presence of silver nanoparticles was confirmed by UV-vis spectrophotometer, DLS and Zeta potential. Antimicrobial activity was checked against gram negative bacteria by well diffusion method. Peroxidase like activity was assessed using TMB test. The silver nanoparticles were synthesized with size ranging from 140 to 150 nm. Zeta potential results showed that it has positive charge and a characteristic peak was at 400nm when the sample was subjected to UV-VIS spectrophotometer. Silver nanoparticles showed good zone of inhibition against E.coli strain DH5α and peroxidase like activity by change of color from colorless to bluish-green in TMB test.

Keywords: Methionine, CTAB, Silver, Nanoparticles

Hydrophobins from Fungal Contaminant – Unique Proteins with Potential Applications

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Hydrophobins are a class of small (<20 kDa) cysteine-rich proteins in filamentous fungi of Ascomycetes and Basidiomycetes which are the most surface active molecules known and have the ability to convert hydrophilic surfaces to hydrophobic and other way round because they have the ability to self-assemble into an amphipathic layer. Hence these unique proteins have many potential applications in the field of anti-fouling, biomaterials, medical applications, targeted drug delivery personal care, biosensors, emulsifiers and separation technologies. The present study deals with the extraction, purification and biophysical characterization of hydrophobins from a fungal contaminant obtained in our lab. The spores of fungus were observed under scanning electron microscopy and water contact angle analysis (112°) of the fungal mycelium was carried out. This confirmed the presence of hydrophobins on the fungal surface. Hydrophobin was isolated based on its insolubility in hot Sodium Dodecyl Sulphate and then extracted in cold 98% formic acid. Extracted hydrophobins were further purified by adsorption on to silica gel by column chromatography. The purified hydrophobins were coated on a glass slide and on observation under scanning electron microscopy rod like appearance was seen which confirmed that hydrophobin belongs to class II. Purified hydrophobins showed good emulsification effect in the oil-water phase and paper pre-coated with hydrophobin resisted wetting by water for up to 90 seconds. These results implement that the purified hydrophobins from fungal contaminant could be exploited for use in various applications

Effective Nano-formulation Assisted Combination Therapies for Anti-Cancer Studies

Joyceline Praveena D, Bharath Raja Guru

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Till date advanced research in the field of anti-cancer therapeutics has failed to reduce mortality rate in India. Conventional drug-based therapies lack target specific delivery which is very important for effective action. Recent research has revealed nano-based drug delivery coupled with chemotherapy can address and solve the limitations of conventional therapies. The present study was aimed to increase the therapeutic effectiveness by delivering the drugs to diseased site reducing systemic toxicity. Nanoparticle based drug formulations were prepared using a biodegradable PLGA (poly lactide co glycolic acid) polymer encapsulated with the paclitaxel/curcumin and their stability, release activity and anti-cancer effectiveness were studied.

Keywords: Cancer, PLGA, Biodegradable polymer, Paclitaxel, Curcumin, Cytotoxicity, Polymeric nanoparticles, Sustained release, Drug delivery

Screening of Chitinase Producing Marine Bacteria with Specific Preference on the Chitin Length

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Chitin is said to be the second most abundant polysaccharide after cellulose. Thus chitinases, the enzymes which help recycle the carbon and nitrogen from chitin into the ecosystem, hold supreme importance. It is known from literature that the substrate specificity of the chitinases differ, based on the mode of cleavage undertaken by chitinases. Thus in the present study, we have made an attempt to isolate and screen marine bacteria, differing in their specificity towards length of colloidal chitin. Marine bacteria were isolated from the sediment and sea water of Arabian Sea from a depth of 12 m and 50 m using poly-colloidal chitin (PC) and oligo-colloidal chitin (OC). We obtained a total of 11 isolates from these sources, out of which only 3 isolates from 50m were taken forward, which were then purified, and screened for their chitinase activity. The primary screening on the agar plates composed of the two different chitin types suggested that different species preferred different types of colloidal chitin, based on the appearance of halo zones and their growth. This was followed with the quantification of the chitinase activities of these inoculates with N-acetylglucosamine as standard. Both the spectrophotometric assay and the agar plate assay were concordant of the different specificities of chitinase towards the length of the colloidal chitin. Effective application of this idea will aid us in the isolation of maximum amount of chitinase from a particular species, with minimum amount of raw materials required and will also help us to minimize the waste produced.

Design of Diclofenac-Loaded PLGA Nanoparticles for Improved COX-2 Inhibition

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Nano-drug delivery is an extensive technique to enable higher levels of bioavailability of any particular drug and enhance its specificity. Nano-formulations are used to achieve the desired effect and decreased toxicity. Pain and inflammation are some undesired effects of injury, which are suppressed by anti-inflammatory drugs. COX-1 inhibition by these drugs can lead to as gastrointestinal bleeding and renal malfunction, since COX-1 is a regulatory enzyme unlike COX-2. Nonsteroidal anti-inflammatory drugs (NSAIDs) like diclofenac are able to block the expression of Cyclooxygenase (COX-1 and COX-2), being more selective to COX-2 and reduce prostaglandin synthesis, hence are better anti-inflammatory drugs but can also have some side effects like heartburn, nausea, etc. This article aims to discuss the method used in formulation of diclofenac nanoparticles entrapped with poly(lactic-co-glycolic acid) (PLGA), for better and specific delivery to target sites. An RP-HPLC method for characterization and separation of diclofenac sodium was developed using, Acetonitrile and acidified water, with a C-18(150 mm length) column. This method uses an emulsion solvent-evaporation technique with a PVA stabilizer, and their physical characterization was done to evaluate particle size, entrapment efficiency, zeta potential, etc. The mechanism of activation of the COX pathway along with the mechanism of inhibition was also studied for the drug. Various other studies like Drug stability and release can also be evaluated for the formulated nanoparticles to compare with conventional delivery methods.

LED Induced Photomorphogenetic Variations in *In Vitro* Cultures of *Ipomea batatus*

Prakhar Kumar Debata, Joel John, Narasimhan S

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Light is one of the most essential environmental factor that affects plant growth kinetics and morphological development, it has substantial impacts on numerous aspects of plant growth and development. It acts both as an energy source for plant photosynthesis and also acts a regulator of plant physiochemical activity. The photo morphogenetic effects on *Ipomea batatus* as a stress response induced by LED light sources of different wavelengths was studied. Ipomea batatus callus were cultivated in-vitro in MS media in four different light regimes: red (700-635nm), blue (470nm), green (530nm) and white LED (broad spectrum). Red, Blue and White light treated specimens displayed significant morphogenetic growth whereas the *I. batatus* species cultured under the Green LED light source demonstrated a lower photo morphogenetic response. Accordingly, different light regimes could be used for the enhanced production and elicitation of potential secondary metabolites and other phenolic compounds.

Transgenic Plants with Animal Proteins

Nidhi Dwivedi

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With the advent of technologies and vaccination programs it is possible to control various diseases like mumps, measles, cholera, polio, etc. Vaccination has been successful in even completely eradicating small pox and to some extent polio. Though there are some glitches associated with it. This glitches are those relating to transformation of the virus reverting to pathogenic and disease-causing state in injectable viruses or even contamination with another strain. These situation have occurred in Nigeria causing an outbreak of polio in past and a recent one in India where a batch of 50,000 polio injectable vaccine was found to be contaminated with type 2 virus which was administered to children in Maharashtra, UP and Telengana. Hence, search of better alternatives to protect the body against antigen and come up with refined vaccination techniques has become important. Oral vaccination which have been developed or produced in transgenic plants can be beneficial in terms that it would be low cost, have increased safety to contamination or mutations, and would be highly scalable. Thus, development of antigens or proteins by gene transfer using various genetic engineering techniques such as microinjection, electroporation or micro particle bombardment to induce gene transfer and therefore, proving to be a boon as diagnostic or therapeutic agents is crucial.