

*Dr. A.P.J. Abdul Kalam Young
Research Fellowship
By TERRE Policy Centre
Vol.-2*



**Dream, Dream Dream, Dreams transform into
thoughts And thoughts result in action**

.....APJ Abdul Kalam



APJ Abdul Kalam

Avul Pakir Jainulabdeen Abdul Kalam

A.P.J Abdul Kalam (15 October 1931 – 27 July 2015) was an Indian aerospace scientist and politician who served as the 11th President of India from 2002 to 2007. He was born and raised in Rameswaram, Tamil Nadu and studied physics and aerospace engineering. He spent the next four decades as a scientist and science administrator, mainly at the Defense Research and Development Organization (DRDO) and Indian Space Research Organization (ISRO) and was intimately involved in India's civilian space programme and military missile development efforts. He thus came to be known as the Missile Man of India for his work on the development of ballistic missile and launch vehicle technology. He also played a pivotal organizational, technical, and political role in India's Pokhran-II nuclear tests in 1998, the first since the original nuclear test by India in 1974.

Kalam was elected as the 11th President of India in 2002 with the support of both the ruling Bharatiya Janata Party and the then-opposition Indian National Congress. Widely referred to as the "People's President", he returned to his civilian life of education, writing and public service after a single term. He was a recipient of several prestigious awards, including the Bharat Ratna, India's highest civilian honour.

About A.P.J Abdul Kalam Fellowship

TERRE has declared a national-level 'Young Research Fellowship' in the reverential memory of Dr. A.P.J. Abdul Kalam. Dr. Kalam had high expectations from the youth of India and keeping this in context, TERRE has announced this noble award on the occasion of Late Dr. Kalam's birth anniversary - 15 October 2020.

Academic qualification: Under-graduates, post-graduates, Ph.D. of any stream.

Age eligibility: Minimum 19 years and maximum 25 years of age (as on 01.01.2021)

Research themes: Plastic, Clean Air, Agriculture and Environment Friendly Technology & Innovation.

Fellowship details: Young researchers who have worked or are working in the themes (as mentioned above) will be considered and up to 50 participants will be shortlisted for the fellowship. Innovative & unique idea will be awarded INR 25,000 along with a Citation, Scroll, and Medallion.

Fellowship will be awarded on the remembrance day of Dr. Kalam i.e. 27th July 2021. Scrutinizing committee headed Mr. Ashok Mangotra an Ex Chartered Officer and close acquaintance Late of Dr. Kalam



Mr. Ashok Mangotra (IAS)

Joint Secretary,

President of India Office (Sep 2002 – Aug 2007)

Aiding and Advising the President of India Dr. A.P.J. Abdul Kalam (the highest office in India) in the discharge of his duties including constitutional, diplomatic, ceremonial, protocol and household affairs

Joint Secretary to Govt. of India

Ministry of New and Renewable Energy (Feb 1998 – Sep 2002)

Policy formulation, implementation and roll out of a wide variety of plans, programmes and projects in the field of renewable energy in India. Climate Change negotiations, CDM , UNDP GEF projects etc. were all handled by me at the cutting edge level in this one of a kind Ministry in the world.

Anil Arora



Handled the GEF-UNDP Small Grants Program for 18 years -12 years while employed with UNDP. On retirement, handled the direct implementation of the SGP OP5 program for 6 years on behalf of Centre for Environment Education, SGP's National Host Institution, in the capacity of Senior Project Coordinator.

Worked for a total of 22 years with UNDP and handled the national (Indian), regional and global GEF Full Scale and UNDP's core-funded projects relating to renewable energy technologies, energy efficiency and climate change - small hydro, waste to energy (biomethanation processes), and clean fuels - coal bed methane, biomass power and solar systems.

Worked for 3 years with Earth Day Network as Director-Partnerships (from mid-2017 to June 2020) and focused exclusively on Great Global Cleanup program with focus on plastic pollution, river cleanup programs and how to deal with them at the levels of the community, educational institutions and students directly. Also worked on conservation of species and water conservation.

Satish V. Kulkarni

Dr Kulkarni's experience in the industry, national laboratory, university and US federal government covers a wide range of diverse fields and skills with demonstrated leadership and accomplishments.

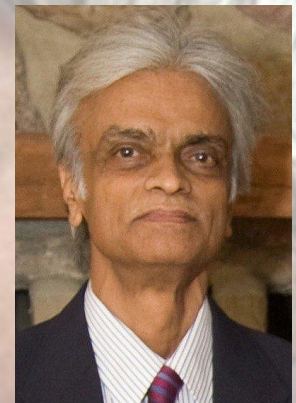
He was the first recipient of the Jagdish Bose National Science Talent Search in Calcutta at the hands of then PM Jawaharlal Nehru. He obtained engineering degrees from Calcutta Univ, IIT Kanpur and Virginia Tech.

He worked for 26 years at Lawrence Livermore National Laboratory of the US Department of Energy, with his most recent assignment being Division Head, Nuclear Test Engineering Division. In 2004 Dr Kulkarni was named Executive Director in the University of California President's office in Oakland, California.

Subsequently, in 2006 he was selected to serve as the Counselor for Science, Technology, Environment and Health Affairs at the Embassy of the United States of America in New Delhi, India with the Department of State as a Foreign Service Officer. His portfolio also included space, nuclear, climate and wildlife matters such as Project Tiger.

In 2009, he joined Georgetown University as Associate VP and later in 2011 was appointed Director of Energy Initiatives at Virginia Tech and concurrently, Research Professor of Engineering.

In 2012, he received the Graduate Alumni Achievement Award during the Commencement at Virginia Tech for 'establishing an exemplary record of innovative scientific, educational, and policy leadership in national and international arenas'. He has presented numerous invited and keynote talks in India, the US, Germany and Singapore on the following topics: US-India relations, science and policy, energy, global warming, sustainability, innovation, technology transfer and leadership.





Dr. Vinita Apte
Founder Director
TERRE Policy Centre

Dr. Vinita a multifacets personality & founder of TERRE started this NGO with a motto **“To think is good but to act is better”**. Dr. Apte has an out of the box thinking process and due to which she has started many different and innovative initiatives. She has developed more than 10 forestries on high mountain ranges through the PPP(Public Private Partnership)model. TERRE Policy Centre implemented a number of projects of Environmental Education, Solar Energy, Awards for innovation at the grassroots level under her able leadership. She implemented the projects on women & energy in rural India and empowered thousands of women. She has started the first-ever online Environmental Olympiad to make digital India stronger and make aware the students at the early age. Women and youth empowerment are on the focus of TERRE.

With the strong communication background, she was working as a consultant in United Nations Environment Programme, Paris and developed Media Strategy, Outreaching strategy for Social Media, implemented the PPP model. Dr. Apte awarded with many awards for her outstanding work, In 2021 with Mahatma Award For Social good, In 2020 with Indian Achievers Award in the category of “Women of Excellence”, Received UNEP award on the 20th Anniversary Montreal Protocol for the ‘Outstanding Contribution’ to the outreaching of the Montreal Protocol (2007). Publications, Rotary Club Special Award, SIAM CSR Environmental Revitalization Action, Narishakti Award (Women Power Award). Dr. Apte represented India in many international conferences on climate change. She is the author of 7 books. One of her book is incorporated into the University Curriculum for Bachelor Of Arts students.

Dr. Rajendra Shende
Chairman
TERRE Policy Centre



Dr. Shende, former Director at United Nations Environment Programme, is a leading expert in sustainable technologies and policies. As head of the Paris based Ozon Action Programme of UNEP, he worked with the governments of 146 developing countries” to develop their national management plans to eliminate use of Ozone Depleting Substances and to contribute to the mitigation of climate change. Through the teams of professionals and experts that he led from UNEP’s five offices worldwide i.e. Paris, Bangkok, Nairobi, Bahrain and Panama City he led the capacity building and technology support programme under the Multilateral Ozone Fund and Global Environmental Facility (GEF). The programme has contributed in stabilizing the Stratospheric Ozone Layer and preventing a global catastrophe by enabling developing countries to comply with the Montreal Protocol. The Montreal Protocol is now considered as the most successful Multilateral Environmental Agreement so far, having put the Ozone layer on the path to recovery. Mr. Shende is a Chemical Engineer by qualification from the Indian Institute of Technology (IIT), Bombay. Before joining the UN, Mr. Shende had a senior management career in the private sector in India and was part of the task force set up by the Government of India to negotiate the multilateral environmental agreement, the Montreal protocol.



Gurkanwal Kaur

*College of Basic Sciences & Humanities
Punjab Agricultural University*

Project Title

Process Optimization for Conversion of Paddy Straw into Ethanol and Xylitol

Objective

- i. To study cellulose production by indigenous fungal strains under different fermentation conditions
- ii. To study saccharification of pre-treated paddy straw using immobilized celluloses
- iii. To study simultaneous saccharification and fermentation of paddy straw for ethanol production
- iv. To standardize the xylitol production of hemi cellulosic rice straw hydrolysate

Method

To study cellulose production by indigenous fungal strains under different fermentation conditions

Methodology: Two fungal strains will be obtained from Biodiesel laboratory, REE. Cellulose production from these strains will be carried out under solid-state and shake flask conditions as per method of Singla *et al* (2018). The actively growing fungal colonies will be aseptically added to the production flasks and incubated at $28 \pm 2^\circ\text{C}$ up to 144 h. The enzyme will be extracted from each flask at different time intervals (24, 48, 72, 96, 120 and 144 h) and analyzed for filter paper (Mandels and Sternberg 1976), endogluconase (CMCase) (Wood and Bhatt 1988), cellobiohydrolase (avicelase) (Wood and Bhatt 1988), β -glucosidase and xylanase (Bailey *et al* 1992) activities.

To study saccharification of pre-treated paddy straw using immobilized celluloses

Methodology: The cellulose produced by the promising fungal strain under solid-state or shake flask conditions (selected from Experiment 1) will be used for immobilization studies. Chitosan coated Fe_3O_4 nanoparticles will be prepared and cellulose enzyme will be immobilized onto magnetic nanoparticles using glutaraldehyde coupling agent as per method of Zang *et al* (2014). The morphological and biochemical properties of the free and immobilized cellulose will be studied. The enzymatic hydrolysis of pre-treated paddy straw will be carried out by using immobilized cellulose as per method of Kaur *et al* (2020) and saccharification efficiency will be compared with that of free enzyme. XRD pattern, Transmission Electron Microscopy, Scanning Electron Microscopy, Thermo gravimetric analysis and Fourier transform infrared (FT-IR) spectroscopy of immobilized enzyme will be performed. The optimum pH, temperature, K_m , V_{\max} , thermal stability and reusability studies of immobilized cellulose will be done. The reducing sugars and per cent saccharification of pre-treated paddy straw with immobilized enzyme will be recorded at different hours and compared with that of free enzyme.

To study simultaneous saccharification and fermentation of paddy straw for ethanol production

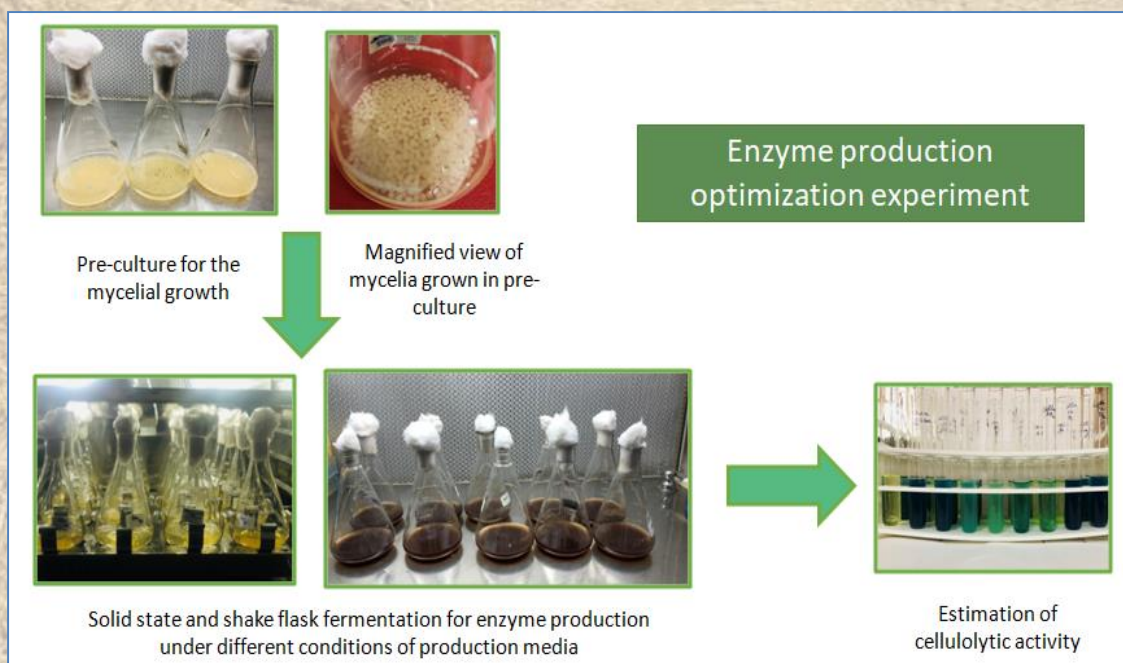
Methodology: The pre-treated rice straw solid residue will be subjected to simultaneous saccharification and fermentation as per method of Phitsuwan *et al* (2017). Pre-treated rice straw will be added in 500 ml flask and the suspension of yeast cells in YP medium along with cellulose enzyme will be added to the reaction medium. SSF will be carried out at 37°C and 150 rpm shaking speed for 96 h. The culture supernatant will be taken periodically after 24 h to determine the reducing sugar and ethanol concentrations in the fermentation broth as per method of Nelson (1944) and Caputi *et al* (1968), respectively. The kinetic parameters such as ethanol concentration (g L^{-1}), ethanol yield (g g^{-1}), conversion efficiency (%) and reducing sugar consumption (g L^{-1}) will be recorded at different hours of fermentation.

To standardize the xylitol production of hemi cellulosic rice straw hydrolysate

Methodology: A pentose fermenting yeast strain (*Candida tropicalis*) will be procured from IMTECH, Chandigarh and paddy straw acid hydrolysate will be used for conversion of xylose into xylitol as per method of Baek and Kwon (2007). The acid hydrolysate will be subjected to neutralization, over liming, ion-exchange resin and activated charcoal adsorption. The compositional analysis of detoxified hydrolysate will be determined after various treatments. Fermentation of detoxified hydrolysates will be carried out at 30°C and 250 rpm. Xylitol concentration will be determined colorimetrically as per method of Sanchez *et al* (1998). The xylose, glucose, total phenols and furfural content will be recorded in detoxified hydrolysates. The xylitol concentration (g L^{-1}), yield (g g^{-1}) and volumetric productivity ($\text{g L}^{-1} \text{h}^{-1}$) of fermented hydrolysate will be recorded.

Outcome

The present research work will help to identify suitable fungal strains as well as the optimum fermentation process along with celluloses with high specific activity that could be produced and utilized for hydrolysis of paddy straw. Further, efforts to immobilize these celluloses on chitosan-coated magnetic nanoparticles for their repeated utilization and fermentation of xylose sugars into xylitol along with ethanol production may help to improve the cost competitiveness of ethanol production.



Manjinder Kaur

*College of Basic Sciences & Humanities
Punjab Agricultural University, Ludhiana*



Project Title

Ocimum based formulations as antifungal coatings to enhancing shelf life of Kinnow Fruit.

Introduction

Three *Ocimum* species will be taken for extraction of essential oil. Out of these three species one best will be selected on the basis of *in vitro* studies conducted in lab for antifungal activity against *Penicillium digitatum* and *Penicillium italicum*.

Objective

1. To extract and evaluate antimycotic potential of essential oil of three *Ocimum* species.
2. To prepare micro and nanoformulations of essential oil of the shortlisted *Ocimum* specie.
3. To prepare and evaluate *in vitro* and *in vivo* antimycotic activity of *Ocimum* based micro and nanoshellac coating of best specie.

Method

1. Extraction and antimycotic activity of essential oil from different species of *Ocimum*.
2. Optimization for preparation of micro and nanoemulsions of essential oil from selected *Ocimum* specie.
3. Antimycotic activity of micro and nanoemulsions of essential oil of selected *Ocimum* specie (*In vitro*).
4. Preparation and antimycotic activity of *Ocimum* based micro/nanoshellac coating (*In vivo*)

Outcome

Development of micro/ nano sized antifungal coatings. For enhancement of shelf life of kinnow fruits and reduction of postharvest losses.

Implementation

Against post harvest pathogens of kinnow fruit.

Summary

Fungal pathogenic invasions in horticultural crops like kinnow substantially result in high post harvest losses. These losses pose big hindrance to the distant marketing of the fruit due to its shorter shelf life. Uses of factitious fungicides to conceal their invasion were not welcomed by investigators owing to their high persistence and toxicity residues causing environmental and health concerns. The major citrus postharvest diseases are green and blue molds, caused by *Penicillium digitatum* and *Penicillium italicum*. Present practice of applying synthetic fungicides in wax is employed for enhancing the shelf life of kinnow. Essential oils (EOs) are naturally occurring volatile mixtures obtained by various extraction methods from various parts of aromatic and medicinal plants. These are composed of non-phytotoxic biologically active compounds with promising antibacterial, antifungal and antioxidant properties. *Ocimum* is one such medicinal plant with promising antifungal potential, whose essential oils have not been explored for green and blue molds. Their applications, as antimicrobial agents for exploring their antifungal potential are however restricted owing to their hydrophobic nature. Advent of nanotechnology has provided another platform to overcome this drawback of essential oils. The present proposal is based on the development of micro and nanoformulations *Ocimum* leaf essential oil of the specie with best antimycotic potential. After *in vitro* scrutiny, *In vivo* experiments will be carried out at room temperature and under cold store conditions to work out the applicability of prepared shellac formulations of the best specie.



Kaniha K. G.



Akshaya G



Gohila Shamily



Yazhini V

Bannari Amman Institute of Technology, Anna University.

Project Title

A Zero Plastic Sanitary Napkin Fabricated with Treated Agro Residue as Absorbent and Herbal Components.

Objective

To produce a Zero Plastic Sanitary Napkin that is highly Bio-degradable and possess anti-cancerous property using *Arachis hypogaea* and *Asparagus racemosus* respectively.

Method

- There are three main layers in the sanitary napkin. The pulverized groundnut shells are treated with the optimized concentration of alkali to enhance their absorption efficiency.
- The extract of the roots of Shatavari is spray coated in the absorbent material which enhances the anti-cancer and anti-microbial properties.
- The bottom layer, also known as the hydrophobic layer is coated with the wax. This enhances flexibility and prevents the outflow of moisture from the napkin.
- Each and every component is significantly selected and optimized in order to ensure the welfare of menstrual hygiene and complete biodegradability of the health care product.

Outcome

- The proposed sanitary napkin is completely biodegradable.
- Addition of Shatavari renders Anticancer and Anti-microbial properties.
- Our absorbent layer is made with treated agro-waste (Groundnut Shells) for better absorption, playing a major role in the cost reduction, which ultimately paves way to be more affordable to all.

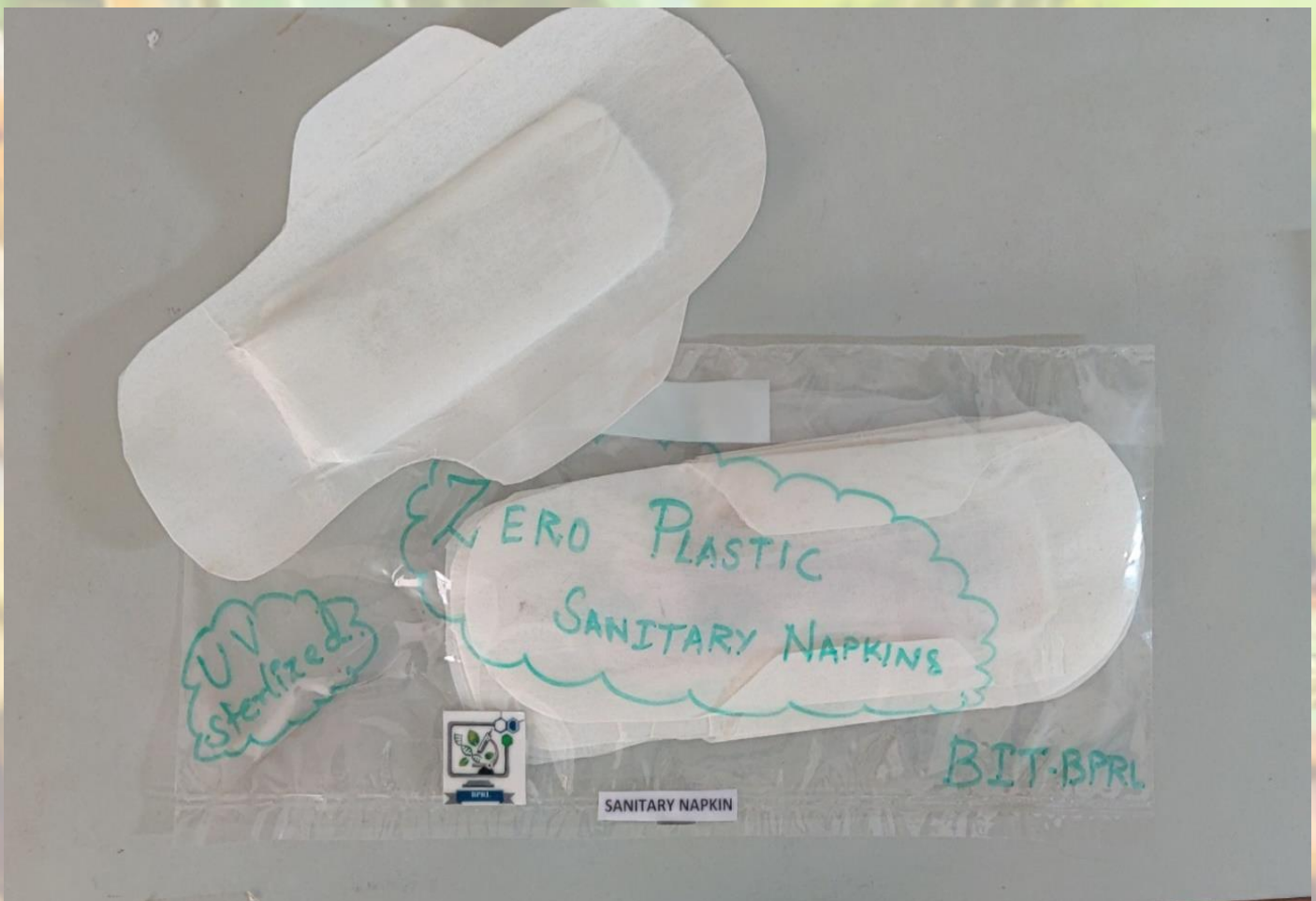
Conclusion

- The roots of Shatavari externally, nurtures the mucous membrane, acts as a blood cleanser, nourishes the ovum and supplies female hormone.
- The extract of the root of Shatavari will be spray coated on the top layer of the sanitary napkin and when they are exposed to the body fluid, the above-mentioned therapeutic properties of the herb are meant to be actional.

- The Novel absorbent composed of the shells of *Arachis hypogaea* is treated with optimized concentration of alkali, to enhance the efficiency of absorption.
- In order to ensure the welfare of menstrual hygiene and complete biodegradability of the health care product, all components included in the Zero Plastic Sanitary Napkin are non-plastic.

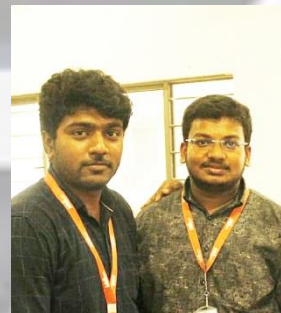
Implementation:-

- The proposed Sanitary Napkin is available in diverse sizes and gauges.
- Both the comfort-ability and the hygiene level of the product is high.



Pavan A. & VENU K. S.

*MVJ College of Engineering
Visvesvaraya Technological University*



Project Title

Acoustics, Magnetics and Vibration Induced Smart Agriculture Methods and Devices.

Objective

Application of acoustics and magnetism in the agricultural field for improvement in yield and pest management to reduce chemical usage and encourage organic methods of farming.

Method

Analogous to how humans respond to the different forms of music-precisely the frequency of the music, the plants also respond to the different frequencies of sound and can resonate them self to that particular frequency.

Sound waves of different audible range including infrasonic and ultrasonic range are applied on different plants shows various results which include physiological growth, endogenous hormones, germination rate, photosynthesis mechanism, disease resistance and transcription of genes. Sound waves of different frequencies modify the growth and germination rates, which induce feedback changes at molecular level inducing release of important plant hormones such as Indole-3-acetic acid [IAA], induced intake of oxygen, induced protein synthesis in RNA and the most complicated gene expression. This undoubtedly evidences the decrease the usage of fertilizers in agriculture and creating a chemical free food and a cleaner environment towards organic world

It is acknowledged that magnetic energy was also accountable for the existence of life on earth. Magnetic field engendered by earth is called Geo-Magnetic field, which defends and keeps earth's interior out from solar winds. Similar to gravitational force- magnetic force is also important to keep Earth blooming. As a part of adaptive behavior possessed by plants similar to sound, magneto tropism can also be utilized to bring up more eminent way of nurturing them.

Exposure of plants at different Magnetic field at different changes can induce- biological effects like: Increased germination rate, increased flowering time, biomass accumulation, activation of crypto chromes and shoot growth.

Outcome

Increased plant germination and growth rate, Decreased dormancy of seeds, Increased plant hormonal level and defensive capability, Zero chemical usage.

Implementation

Application of our device Echo-Germinator at germination phase, Echo-Rakshak at growth and yield phase and Vayu-Rakshak for pest management and crop monitoring



Pavithra Santhosini S .



Infanta Joshy J.



Aiswarya R

*Avinashilingam Institute for Home Science and Higher Education for Women,
Avinashilingam University*

Project Title

Application of Fountain Model Wetland System for the treatment of Dyeing Industry Effluent

Objective

1. To identify the coagulant and adsorbent for the primary treatment process
2. To determine physical and chemical characteristics of effluent from the dyeing industry
3. To design a phytoremediation process in form of a fountain model
4. To develop a prototype model.

Method

This system consists of two treatment processes namely Primary treatment and Secondary treatment. In Primary treatment process Coagulation using Cactus powder and Adsorption using Eucalyptus bark powder would be carried out. In Secondary treatment process would have Phytoremediation technique using reed plants as fountain model.

Coagulation using cactus powder: Coagulation is a process for combining small particles into larger flocs and for adsorbing dissolved organic matter on to particulate flocs so that these impurities can be removed in subsequent solid/liquid separation processes. (Kannadasan, 2013 Year).

Adsorption using Eucalyptus Bark Powder: Adsorption techniques are used as high-quality treatment processes for the removal of dissolved organic pollutants, such as dyes, from industrial waste water. (Kishor Kumar, 2018 year).

Phytoremediation using reed plants: Phytoremediation refers to the technology that uses plants to clean up the soil, air and water that have been contaminated by the chemicals. we found *Eichhornia crassipes* plant which is very effective for the treatment of dyeing industry effluent (Sri Lakshmi, Hema Sailaja, and Anji Reddy, 2015 Year).

Mechanics of Phytoremediation: plants and metal interact in the root environment he contaminates has to be in contact with the roots in order to be uptake transporters that are used for macro nutrients and micro nutrients entrance are also used by plants for heavy metals uptake. Metals are stored in sub cellular compartments like vacuoles. (Milena Materac, 2015 year).

Outcome

1. Characteristics of dyeing industry would be studied.
2. Design and prototype model of fountain would be done.

Conclusion

This could be implemented in small and medium scale dyeing and textile industry.



Cactus



Cactus Powder



Eucalyptus bark



Eucalyptus bark after dried with
sunlight



Prototype for treatment plant



Kasturi Lende

*Sir Parsurambhau College of Commerce
Commerce, Pune
Savitribai Phule Pune University*

Project Title

Sea Fish Breeding on Land by Creating Natural Sea Atmosphere

Objective

1. Conservation of marine fish that are about to go extinct.
2. Providing Organic fish that is free of chemicals & plastic.
3. There are no hatcheries available for endangered marine species in India.
4. Developing this technology and infrastructure that is already available in the USA, UAE, China, Norway and Kuwait.
5. Natural process to create the tank with help of natural sea weeds, corals and phytoplankton.

Method

1. Tank setup keeping it dry and disinfected before water is pumped.
2. Brine solution to be created in separate tanks and mineral water in separate tanks, both solutions will be mixed in the culture.
3. PH level, oxygen, pressure and tides will be maintained in the tank depending upon the species everything will be controlled with continuous oxygen supply.
4. After the tank is set it will be left for 3-5 days to maintain the system that is created.
5. Brood stock will be kept in a separate tank as they are fully matured adult fish which can produce twice a year.
6. Eggs laid will be collected and incubated in an artificial system. Once eggs hatch they are further shifted to 3 different tanks in 3 three different stages depending upon their growth and maturity.

Outcome

1. This is a big change in the fishing industry of India. It is profit oriented business as fishes play an important role in the development of Indian Economy.
2. 2019-20 export of marine products stood at 12.9 lakh metric tons and valued at Rs.46,662.85 crores.
3. India ranks very low in the Innovation sector when compared to world innovation level. We are just trying to make a big difference in this whole traditional system of the fishing industry.
4. Ultimate goal is to conserve and serve organic sea food to everyone.

Implementation:

- I started my research in November 2019 so far I've successfully gathered information, research papers, on field market study and research, meeting scientists who have successfully completed their research and experiments on specific species and gathering the data from them.
- Half part of the prototype is successful in creating perfect PH by mixing brine solution and mineral water. Before water was mixed water testing was done to check if all the elements required are available.
- Patent is filed in high court yet not registered as the full prototype is not completed.
- Looking at the present market condition it is very difficult to start it by investing huge amounts due to reasons such as: lack of skilled workers, direct buyer, exports are closed or open depending on the covid situation.
- Most important point to start this project is that fish should be taken out of the sea, then kept in the oxygenated tank and then it can be brought to land. For this complete process to happen fishermen need time and due lockdown and this was not possible.
- Being a commerce student we have calculated all the risks that can take place if we start this project in a haste.
- This is not a one night process. Scientists who are helping me in this project have spent their entire life over one specie.
- But there is a ray of hope that pomfret culture is not difficult as I know one scientist in Maharashtra who worked on pomfret and they were alive for 3 days on land in a tank. Yes, we have examined all the drawbacks for the failure and they will be worked out.



Ajit Kumar Bishoyi

*School of Pharmaceutical Sciences
Siksha 'O' Anusandhan Deemed to be
University, Bhubaneswar*

Project Title

Bio-synthesis of silver nanoparticles with the brackish water blue-green alga *Oscillatoria* princeps and antibacterial assessment.

Objective

The assessment of In-vitro antibacterial activity of synthesized AgNPs using cyanobacterial extract against multidrug-resistant (MDR) and Methicillin-resistant staphylococcus aureus (MRSA) bacteria.

Method

Field water samples were collected from the Bhabakundaleswar sea mouth, an aquatic biodiversity-rich area in Puri district, East coast of Odisha state (Latitude 19.6851°N, Longitude 85.5165° E). The collection sample were isolation for unialgal culture and submit the sequence data to the National Center for Biotechnology Information (NCBI) for confirmation the particular species. The axenic culture was inoculated CHU#10 medium for a production of a requisite amount of algal biomass. The growth of cyanobacterium *Oscillatoria princeps* was filtered in Whatman No.1 filter paper and grounding in to mortar and pestle. The Cyanobacterium extract powder were synthesized 1mM silver nitrate (AgNO₃) solution. For the green synthesis confirmation, the solution color changes from pale green to deep brown. After biosynthesis of OP-AgNPs was done by different characterization for the confirmation, such as Uv-vis spectroscopy, scanning electron microscopy-Energy dispersive X-ray (SEM-EDX), dynamic light scattering analysis (DLS), X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR). The antibacterial activity followed by the agar well diffusion methods. In these methods prepared the Muller-hinton agar (MHA) and broth (MHB) media for bacterial growth. The MHA medium was prepared and poured the petri plate, after few minutes solidify the agar medium.

Uniformly, the cultures were spreading on culture media with the help of sterile swab sticks. Approximately 7mm diameter agar well was made on the agar plate help of sterilized cork borer. After that the synthesized samples were poured and incubated 37° C for 18-24 hrs. Then the zone of inhibition (ZOI) was measured on the measuring scale and the values were expressed in millimeters (mm). For the minimum inhibition concentration (MIC) study, the using of the 96 microplates. These processes defined as the inhibits the growth of the particular microorganism. The microplate was using the bacterial culture with MHB media, the synthesized products and incubated in the BOD incubator at 37° C for 18-24 hrs. Triphenyl tetrazolium chloride (TTC) was using as the color pigment dye.

Outcome

1. The cyanobacteria have rich sources of the bioactive compounds against antimicrobial activity and therapeutic approaches.
2. Antibacterial activities of the synthesized AgNPs had remarkable control against MRSA and MDR bacteria.
3. The green synthesized OP-AgNPs could be utilized as druggable antibacterial agents in the future.

Conclusion

From a local brackish water, a sea mouth, *Oscillatoria* sp. was isolated in a field sample and this species was ascertained as *O. princeps* being confirmed by the molecular technique. The morphometry was confirmed by SEM and the synthesis and characterization of O.p-AgNPs were confirmed as XRD spectral pattern with an excessive Θ value of AgNPs. From the SEM micrograph and the SEM-EDX picture obtained from the synthesized product the size range was 3.30-17.97 nm. The FT-IR range was 3272.61 cm^{-1} as (O-H str.), which corroborates sizes of AgNPs, study the literature. A remarkable inhibitory activity of O.p-AgNPs were recorded with MDR strains of pathogenic bacteria like MRSA, *S. pyogenes* and *E. coli*, isolated from clinical samples. Thus, it could be stated that O.p-AgNPs had controlling capacity in-vitro on the isolated Gram-positive and -negative bacteria.

Implementation

1. The cyanobacteria are producing large amount of oxygen, which are benefit the environment and it is also cost effective and ecofriendly.
2. Some cyanobacteria are rich sources of protein like *Spirulina* species. It is used as a tablets/capsules.
3. The green synthesized product (OP-AgNPs) is used as antibacterial agent against human pathogenic bacteria (MRSA and MDR bacteria).



Concept By :- Dr. Vinita Apte
Founder Director
TERRE Policy Centre

Project Lead By: - Rajkumari Suryawanshi
Project Leader

Compilation :- Shreeram Nijampurkar
Project Coordinator

Design and Inputs:- Sagar Lakhotiya
Project Leader

Address:- TERRE Policy Centre
A1-207 Siddharth Tower S.No. 12/3-B, G.A. Kulkarni
Road, Kothrud, Pune 411038

Website:- www.drkalamfellowship.com
www.terrepolicycentre.com

Gmail ID:- drabdulkalamfellowship@gmail.com
terrepolicycentre@gmail.com