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College with UGC STRIDE Component – I

Proceedings of International e-Conference

DEPARTMENT OF BIOTECHNOLOGY ORGANIZED

IQAC INITIATED UGC STRIDE SPONSORED
TWO DAY INTERNATIONAL e-CONFERENCE
ON

"BRIDGING THE GAP BETWEEN
ACADEMIA | RESEARCH | INDUSTRY
FOR LOCAL & GLOBAL COMPETENCY"

ON 27TH & 28TH OCTOBER 2020

Website : www.klesnc.org | Email : biotechdept@klesnc.org

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College with UGC STRIDE Component –I
IInd Block, Rajajinagar, Bengaluru-560010

Title:

Proceedings of IQAC Initiated UGC STRIDE Sponsored Two Days International e-Conference on "Bridging the Gap between Academia, Research & Industry For Local & Global Competency".

Author's Name : Dr. Prathibha K. S.

Editorial Committee:

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2	Dr. Prathibha K. S.	Co-ordinator	Associate Editor
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Dedicated to

Dr. PRABHAKAR B. KORE

Member of Parliament
(Rajya Sabha)
Chancellor: KLE University, &
Chairman : KLE Society, Belagavi
Karnataka State, India

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Dr. Balakrishna P Shetty, MD, DNB, MD (USA)
Certified Fellow Ped Radiology; CT/MRI, Univ of Texas, USA,
Vice Chancellor, Sri Siddhartha University Tumakuru, Bangalore.
Professor and Consultant in Radiology, ISHA Diagnostics, Bangalore.
Member, Consortium Universities for Global Health (CUGH), Washington DC
Day 1 : 27/10/2020 Time : 10 AM to 10.45 AM

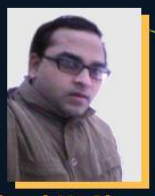
President

Dr. Arunkumar B. Sonappanavar
Principal,KLE Society's
S Nijalingappa College
Day 1:27/10/2020, Time :10::50 to 11:00 AM

Invited Guest Speakers

"Can I be an entrepreneur?"

Dr. Dharma Prasad, PhD
CEO and Chief Scientist, Prosetta
Bioconformatics Pvt Ltd
Mysuru, India
Day 1:27/10/2020 Time :11:00 to 11: 45 AM



"Current Challenges to bridge academia and industry"

Dr. Kiranj K. Chaudagar
Postdoctoral Fellow, Tumor Immunology
The University of Chicago Medicine
Day 1 : 27/10/2020 Time :12: 00 PM to 12:40 PM

'Opportunities for budding entrepreneurs'

Prof. H. Niranjana Murthy,
Professor Dept. of Botany, Dharwad 580003
Day 1:27/10/2020 Time :1 00 PM to 1:40 PM

Crossing over: Biotechnology as a bridge to connect academic research in cotton to its industrial applications.

Dr. Shanmukh Salimath, Ph.D.
Research Scientist I, BioDiscovery Institute
Department of Biological Sciences,
University of North Texas, Denton, TX 76203
Day 2:28/10/2020 Time : 9:00AM to 9:40 AM

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Day 2: 28/10/2020
Paper presentation
Time : 10:00AM to 3:PM

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- Abstract: A short abstract / summary into more than 250 words) is to be in the Times New Roman in MS word 12pt.
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- Left margin 1.5 and 1 on other three sides o Paragraphs are to be Indented 0.5" from the left.
- Figures and Tables have to be inserted at appropriate places along with captions.
- Article should not exceed 15 pages Declaration of originality must be submitted to the below mentioned email id
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TECHNICAL PRESENTATION
Day-2 : 28th October 2020
Time : 10.15 AM to 1.30 PM

Chief Guest :
Dr. VAGEESHBABU S. HANUR
Principal Scientist (Biotechnology)
ICAR-IIHR, Bengaluru

VALEDICTORY :
Day-2 28th October 2020
Time : 2.00 PM to 2.30 PM

Presided By :
Dr. ARUNKUMAR B. SONAPPANAVAR
Principal, KLE Society's S Nijalingappa College

CALL FOR PAPERS : Selected papers will be published with ISBN

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on 27th & 28th October 2020

INAUGURAL CEREMONEY

AGENDA

Tuesday on 27th October 2020

Time	Event		
9:30 – 10.00am	Online Entry for Participation & Presentation		
10.00 -10:45am	INAUGURATION		
	Invocation	:	Miss. Deeksha.III B.Sc.
	Welcome and Introduction of Chief Guest	:	Dr. Prathibha K. S. HOD, Biotechnology, Organizing Secretary
	Inaugural Address &	:	Chief Guest
	Keynote Speaker	:	Dr. Balakrishna P. Shetty, *MBBS, MD, DNB, MD (USA)* Certified Fellow Ped. Radiology, CT/MRI University of Texas, USA.,Vice Chancellor, Sri Siddhartha Academy of Higher Education, (Deemed to be University), Tumkur, Karnataka
10.50 -11:00am	Presidential Remarks	:	Dr. Arunkumar B. Sonappanavar Principal
	MoC	:	Smt.Pallavi M. Prasad
	Technical Session : I		
11.00 -11:45am	Welcome & Introduction	:	Mr. Rajeev R. Potadar
	Technical Speaker	:	Dr. M. Dharma Prasad, Ph.D CEO|Entrepreneur |Mentor|Author, Chief Scientist Prosetta Bioinformatics Pvt. Ltd. Mysuru, India
	Technical Session : II		
12.00 -12:40pm	Welcome & Introduction	:	Dr. Tejaswini V. Nandi
	Technical Speaker	:	Dr. Kiranj K. Chaudagar Ph.D Post Doctoral Fellow, Tumour Immunology, The University of Chicago Medicine.
	Technical Session : III		
01.00 -01:40pm	Welcome & Introduction	:	Dr.Prathibha K.S.
	Technical Speaker	:	Prof. H. Niranjana Murthy Ph.D Professor, Dept of Botany, Karnatak University, Dharwad, India.
	Vote of Thanks	:	Dr.Prathibha K. S.

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on 27th & 28th October 2020

AGENDA

Wednesday on 28th October 2020

08.50am -10:0am	Welcome & Introduction	:	Dr.Prathibha K. S.
	Technical Speaker	:	Dr. Shanmukh Salimath Ph.D Research Scientist I, Bio Discovery Institute, Department of Biological Sciences, University of North Texas, Denton-TX 76203
			Virtual Oral Paper Presentations
10.15am - 01:30pm	Welcome & Introduction	:	Smt. Roopashri M. G.
	Chair Person for Technical Session and Virtual Oral Presentations	:	Dr. Gopalakrishna Ph.D Associate Professor in Biotechnology Head, Department of Biotechnology, Vijaya College, R. V. Road, Bengaluru.
		MoC :	Smt. Pallavi Prasad M.S.

VALEDICTORY AGENDA

02.00 -02:30pm	Welcome & Introduction of Chief Guest and Report	:	Dr. Prathibha K. S.
	Address By Chief Guest	:	Dr. Vageeshbabu S. Hanur Ph.D Principal Scientist (Biotechnology) ICAR, IIHR, Bengaluru.
02.30pm onwards	Presidential Remarks and Best Presenter Announcement	:	Dr. Arunkumar B. Sonappanavar Principal
		MoC :	Smt. Pallavi Prasad M.S.
	Vote of Thanks	:	Mr. Rajeev R. Potadar

K.L.E . Society's
S. NIJALINGAPPA COLLEGE

Message from Principal

It gives me immense pleasure to welcome all the eminent speakers and delegates to the UGC-STRIDE Sponsored Two Day International e-Conference on "Bridging the gap between Academia, Research and Industry for Local & Global Competency".

The e-conference covers a keynote address followed by three technical sessions on Day-1 of e-conference by scientists, eminent speakers, technical speakers and renowned academicians. On Day-2 of e-Conference covers a technical speech and Virtual Oral Presentations by faculty, research scholars and students across the country.

Two day academic deliberations in the e-Conference would enlighten the faculty, researchers and students to bring awareness about the impact of nCovid-19 on academia, research and industry.

On this occasion, I extend a heartfelt welcome to all the delegates to KLE Society's S. Nijalingappa College, Bengaluru. The college will bring out proceedings of the e-Conference.
I congratulate the organizing committee members of e-Conference in conducting such an event to boost the knowledge of faculty, researches and students.

Dr. Arunkumar B. Sonappanavar
Principal
KLE's S. Nijalingappa College, Bengaluru.

K.L.E . Society's
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Message from Organizing Secretary

Department of Biotechnology would be delighted to bring the Proceedings of the full length papers presented during technical sessions of UGC-STRIDE Sponsored IQAC Initiated Two Day International e-Conference on "Bridging the Gap between Academia, Research & Industry For Local & Global Competency" held on 27th & 28th October 2021.

This conference brought together students to excel in education, research and entrepreneurship with the context of local and global scientific scenario in the mind Department of Biotechnology has organized Two Day International e-Conference under UGC-STRIDE Component-I. International conference provided a challenging forum, vibrant opportunity and global platform for academicians, entrepreneurs, researchers, faculty, students and brought together leading & esteemed resource persons from organizations of international repute to share scientific experience with delegates, faculty and students.

All honorable delegates scientists, researchers, authors, and students were encouraged to contribute and support the shape of the e-Conference through submissions of their academic experience and research findings. Further, high quality research contributions describing of conceptual, constructive, experimental or theoretical work in all areas of Academia, Research, and Industry were invited for presentations at the e-conference. Technical sessions of the International e-Conference involved deliberations covering the major thrust areas & sub-themes as follows.

- Scenario of 21st century Higher Education
- Wealth of technology & software tools for industry and research
- Opportunities for Budding entrepreneurs
- Current challenges to bridge academia and industry
- Recent trends in research to ignite scientific temper.

Dr. Prathibha K.S.
Organizing Secretary, e-Conference,
Coordinator, Department of Biotechnology.
KLE's S. Nijalingappa College, Bengaluru.

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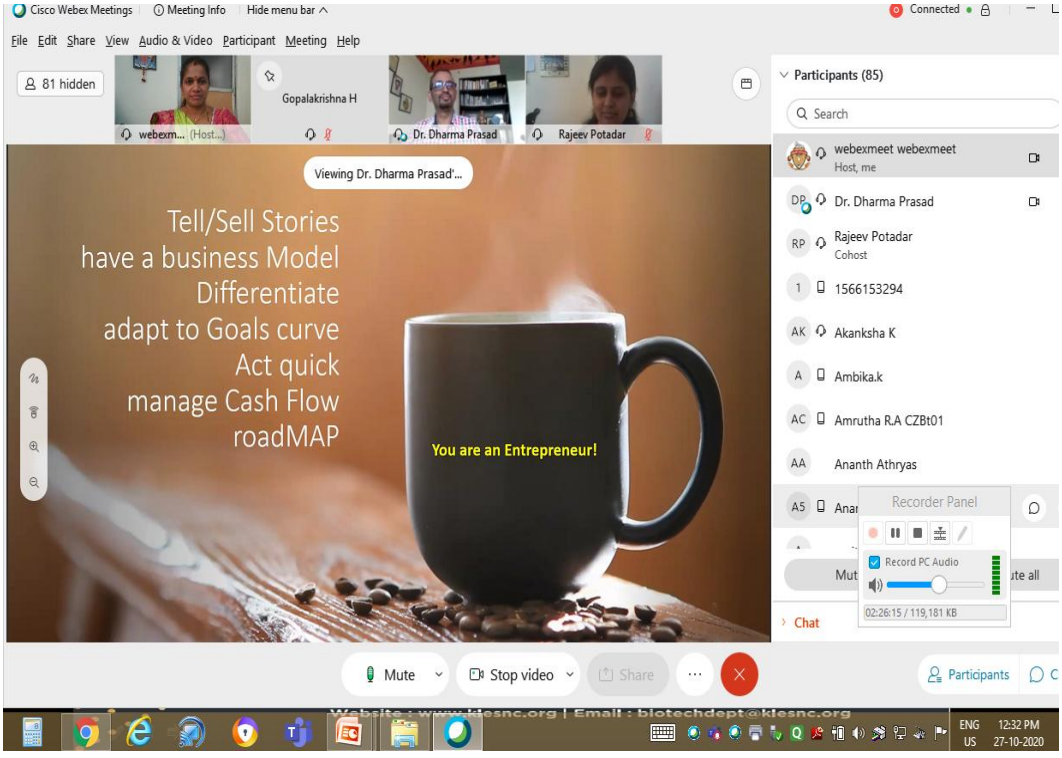
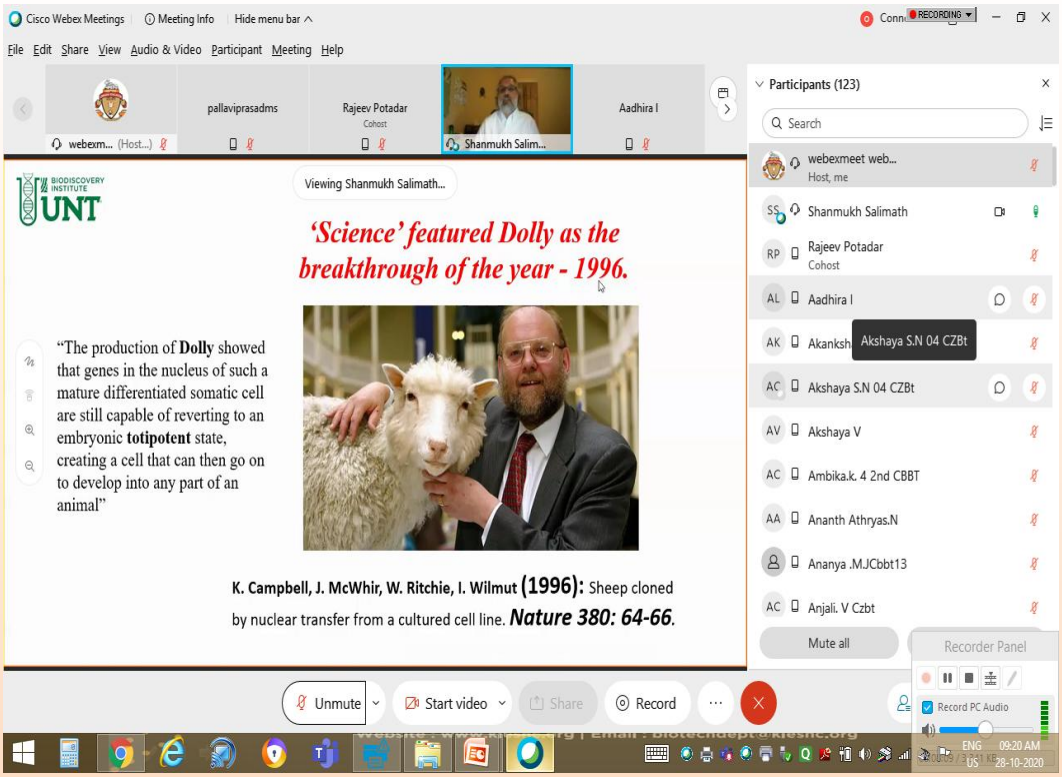


Day – I Technical Session - Dr. M. Dharma Prasad, Dr. M. Dharma Prasad, CEO, Entrepreneur, Mentor, Author, Chief Scientist Prosetta Bioinformatics Pvt. Ltd. Mysuru



Day 2. Technical Session – I - Dr. Shanmukh Salimath Research Scientist I, Bio-Discovery Institute, Department of Biological Sciences, University of North Texas, Denton.

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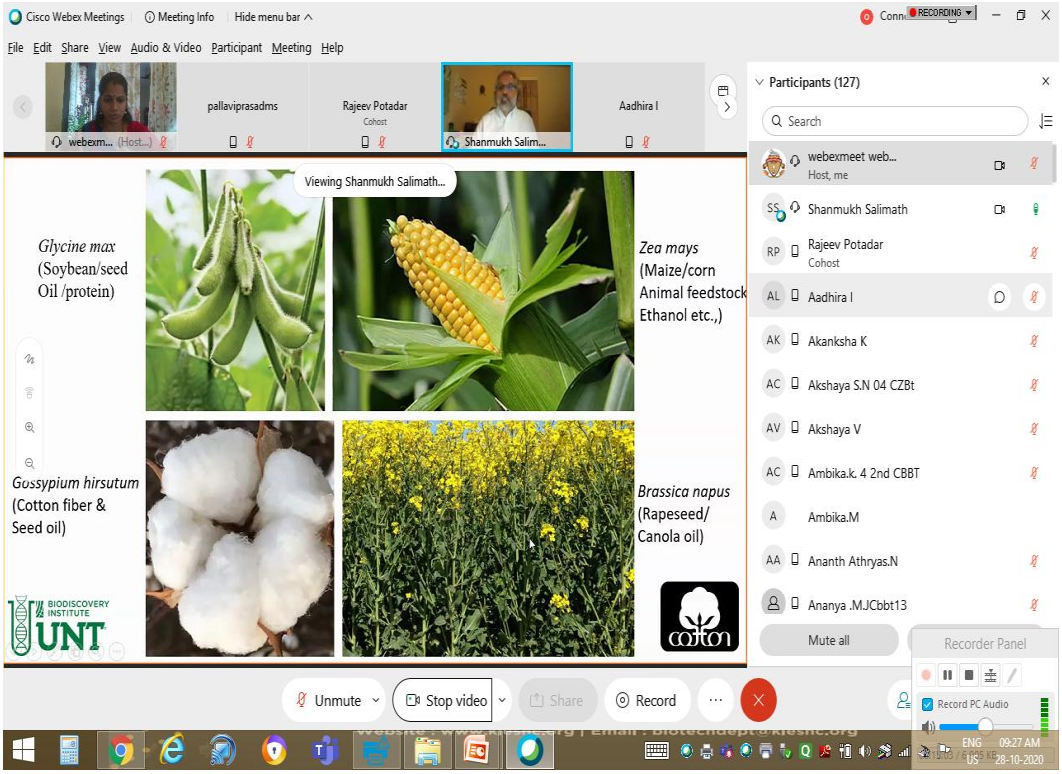
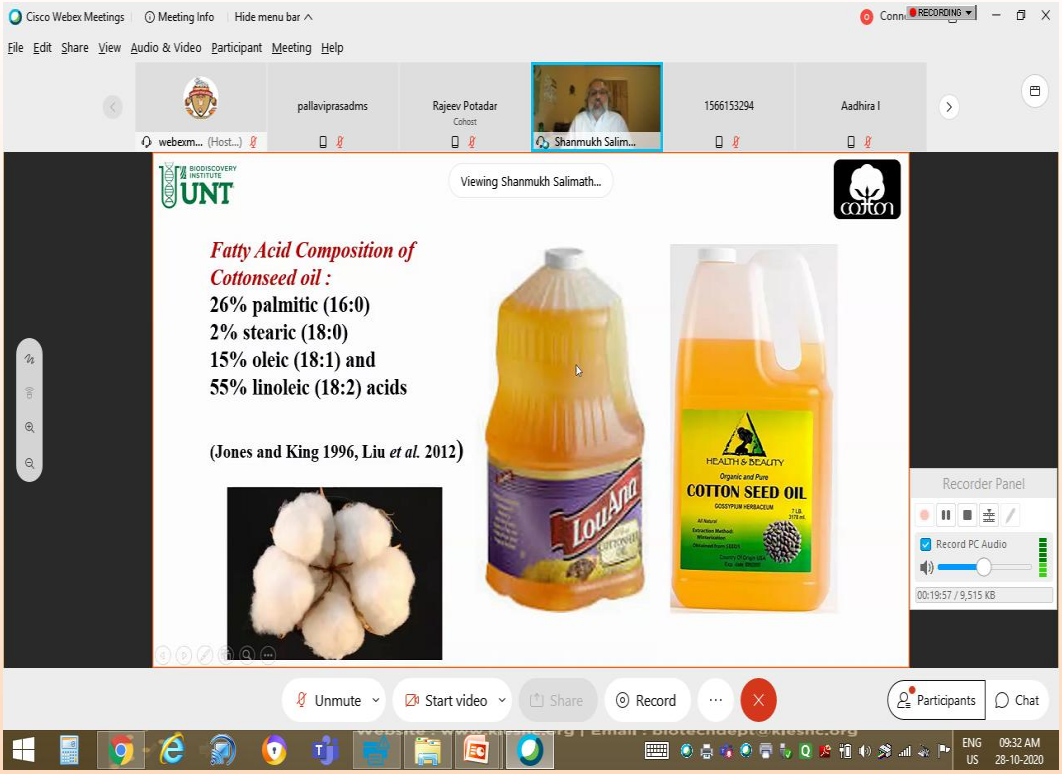


Day 2. Technical Session – I - Dr. Shanmukh Salimath Research Scientist I, BioDiscovery Institute, Department of Biological Sciences, University of North Texas, Denton.



AUTHOR's Index

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Impact of Covid-19 on higher education systems

Swapnali Anant Kadge[1]

KLE Society's Science and Commerce College, Kalamboli Navi Mumbai- 410218
Email id: swapnali.k@klemumbaicollege.com

Abstract

Covid-19 the term changes the image of the world for a while, which will leave the mark as permanent changes in most of the fields of the world. As the lockdown started, the main change starts from moving towards technology and adapting new challenges in all the systems along with education system. COVID-19 period seems to be a live example of how need truly is the mother of invention or reinvention, in this scenario.

COVID-19 has also led to an increase in entrepreneurial activity in our country. Most of the existing but unknown technologies were focused and now being a part of our day to day life. Academicians have accepted challenge to learn the technology and to keep alive teaching learning process in pandemic situation.

This might be first time, moving to online education system which was never before thought or implemented. COVID-19 pandemic situation affected all sectors like health, banking, finance, sports, education, government, private and many more.

Every situation has positive and negative effects, so considering positive impact we learn to use technology for local as well as global communication and by overcoming many difficulties how to lead ahead. Online technology application in every sector helps to save time and environment. E-learning, e-content development are the challenges faced by academicians, learners. Though the pandemic situation changed the routine work methodology it also leads to learn innovative ideas, hidden talents, importance of life, relations and to overcome a situation.

Keywords: Covid-19, entrepreneur, online education system, technology etc.

1. Introduction

Covid-19 means Corona Virus disease invented in 2019 from China and marked its presence all over the world. Sudden lock down was done mostly all over the world and everyone was inside the home but the new ideas have come out from different minds as minds were not locked. People got time to interpret themselves which was lacking from long time in their hectic schedule of day to day life. COVID-19 pandemic situation was affected mostly all sectors around us, including one of the most important sector is

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Education system which never stops in any situation. Teaching learning process has adapted to Virtual platform during pandemic and might be it will be continued as blended mode of learning in future also. In higher education system, different online teaching tools and techniques are already available since last few years but during this pandemic situation it's used on large scale. From blackboard to virtual board, PPTs, effective online teaching virtual tools and platforms like google meet, zoom, Cisco-WebEx, Microsoft teams etc. are utilized in pandemic situation for online teaching.

It was really a big challenge for all the faculties to adapt to virtual teaching and learn so many new thing for implementing in online teaching for students. It doesn't involve only teaching, along with that online examination, assessment and evaluation all these are also big challenges for teachers. As for learning there is no limitation on age only determination and confidence is required to improve or develop soft skills and which is achieved in higher education system. Students also learned to use different virtual platforms for learning, attending virtual classes and adapted to this situation. Actually, it is really difficult for every person to keep them physically and mentally strong during pandemic situation. As, for virtual platform connections internet connectivity is required which was not possible at remote places, villages etc. also device availability is also another problem in online teaching learning process.

2. Review of Literatusre

In Covid -19 pandemic both teachers and students are facing some unusual challenges. There is a rapid transition from traditional offline learning methods to distance education trough virtual classrooms.

Literature review from "The likely impact of Covid-19 on education: Reflections based on the existing literature and recent international datasets", suggested that COVID-19 will

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not affect students equally, will influence negatively both cognitive and non-cognitive skills acquisition, and may have important long-term consequences in addition to the short-term ones.

3. Objective

- To study change in teaching learning process
- Use of online platform
- Application different virtual teaching aids
- Scope for skill development

4. Scope

This research paper is focusing on adaption of virtual teaching learning platform in education system. This research paper may help to improve existing teaching learning process in the future. This paper tries to analyze the change in teaching and learning process during pandemic situation.

5. Research Methodology

Primary and secondary data is collected through different websites, research papers, research articles, journals etc.

6. Findings

1. Teacher's need to adapt with technology
2. Use of teaching aids such as LMS technology, use of whiteboard, google classrooms, you tube videos etc. is increased
3. Globalization in education
4. Leads to entrepreneurship

7. Conclusion

- As, this pandemic situation is not going to end soon, so in the future also blended mode i.e. offline and online can be used in teaching learning process.
- Education never stops only platform or medium of communication can changes
- Scope for Self-growth, development
- Learned new technology and innovations in teaching
- Increased use of internet

8. References

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Present Scenario of Science in India

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Abstract

Global scientific chases provide a huge amount of new revelations about the natural world, the gap between lay public and the scientific community widens more than ever. Frequent instances of a disturbing public show of ignorance about rather established scientific knowledge, almost all over the world, may well be dismissed as rather outliers or means for political or economic gains. In contrast, scientific endeavours all around the world increasingly depend on popular support for such efforts, as the policy decisions are largely driven by popular insights. This article aims to dissect out the prevalent public outreach strategies, by closely examining the nature of the key components. Here the article provides a discussion on the different thoughts on more effective programs to enhance public understanding of science and scientific temper, like setting up of rural hands-on science education centers as widely as possible and initiation of nationwide science programs.

Keywords: Education policy, Science and Technology

Introduction

Policies for rigorous public outreach programs globally, taken up by the scientific academies and governments. It can also be seen over the era when an enormous amount of effort has been put in to bring scientific parlances and ideas within the reach of the public. Increasing technological ease provided by the innovative digital networking of global citizens has also been very helpful in this respect. All the efforts have also led to another set of problems, scientific knowledge of unparalleled enormity and complexity becomes a burden on the early learners (Imura, 1999). One can guess that this is perhaps true also for the adult 'public' reached out to later in their lives. The public show of insolence toward rather established scientific knowledge, from natural progress to climate change, at times even the shape of the planet, by groups of people almost all over the world, confuses the scientific community.

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The discussion is of even more importance given that the future of fundamental scientific research will increasingly depend on public funding and thus public perception about science should be in line. Because politicians in a democratic country do and should respond to the core dreams of its citizens and thus incorporating the practice of science into this core mind is bound to influence the politicians as well.

The Scientific Approach

To understand the general managerialplanning of the process of public outreach events, in the context of India.These events are organized within a very short distance from a city or town, at least within a distance that can be travelled back and forth within a day or so.What one should compare with these efforts is the public outreach of religious thoughts. But the prominent methodology adopted over the ages has been of a scale that the public outreach of science could never have imagined. So one can imagine that the spread of rationalism and scientific awareness stands nowhere in terms of scalability. The only hope science has is in the teachers that these children get to know and learn from.

We can now go back to the roofed building where the children, the future 'public', may get exposed to principles of rationalism and scientific thoughts - the 'school'. In fact, if one considers comparing the influence of organized public outreach activities and school teaching on the development of rational thoughts among the school-going children, the latter will appear to be far more efficient. Whether the outcome of the aforementioned influence is enough for the children is arguable in a different forum. Another major public-funded effort toward public scientific outreach is establishing science centers or museums. Science museums have a quite long history and in general, their inception was rather to showcase human scientific achievements, and in some cases national might, to the citizens.

Moreover, such centers all over the world, including India, are mostly located in big cities. Thus one can hardly argue that such science centers and museums have effectively contributed to the widening scientific temper among the uninitiated citizens. It is true that designing science centers is an active field of research and new ideas keep flowing in. But when the author of this article once had a perfunctory look at those upcoming ideas, they too seemed to fail the proclaimed purpose.

The usual science outreach activities have variable reach for the clients, depending on the methodology adopted. But what is more important is the client composition which is

greatly biased by the already existing perception of science in general. In other words the 'public,' that the usual ways of science communication end up reaching out to, may not be a true random representation of the total population.

One can also be sure that the majority of Indian population will be represented in the categories left out. In fact, even in the UK, almost 42% of the study population belonged to either the concerned or the indifferent group, far exceeding the fraction comprising both the engaged groups. The study could also discern the difference in sourcing science-related information among these categories. Obviously, there was not much surprise – concerned and indifferent had their inputs mostly from newspapers and television, late adopters and disengaged sceptics from the internet. Both the engaged groups were open to varied sources that enriched them about science.

These international studies do provide some very crucial insights into the problem and in the absence of an Indian study; they should guide the concerned Indian agencies. It must be stressed that the clientele for the prevalent outreach programs conducted by scientific communities and science activists fall short of reaching out to the key sections of the public.

Having considered all of this, can one imagine a detour in the outreach avenues to further the goal of spreading scientific awareness and developing a scientific temper among the Indian citizens? It is imperative to get engaged into such imaginations, because even when we are sceptic about the extent of our success in improving the popular perception about science and rationalism in the country, we cannot deny that there is a fairly large contingent of motivated and skilled science popularizes and activists that independent India has managed to gather over past decades. A large number of practising scientists have also been continually engaged in such efforts, although the size of the practising scientific community in India is unthinkably small in comparison to the nation's population.

Science in India

The major problem is the limited reach of the science educator pool to the vast majority of the public. What if we start thinking about ways in which science itself, not the science educators, can systematically reach the populace? When one talks about science and its appeal to a rational human being, one must discern that it is the scientific methodology, not the scientific wonders, that appeals to one the most. One is tempted to reiterate the

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famous saying by Marie Curie - 'I believe that science has great beauty. A scientist in his laboratory is not a mere technician: he is also a child confronting natural phenomena that impress him as though they were fairy tales' (Labouisse 1937). When a science educator reaches out to the public by talking about human accomplishments in the scientific pursuit and the consequent unravelling of certain truth about the natural world, for an initiated audience it becomes a way to further enrich their already existing appreciation of science. But these efforts fail to impress upon that 'fairytale' feeling, which would have been much more successful to engage the uninitiated, be it children or adults. This can only be accomplished when one is made to rediscover any natural phenomena following a scientific methodology, which unfortunately the usual ways for public outreach lack. But this approach can truly take science to the public, excite their imaginations and inculcate the appreciation of the rational approach to the natural world.

The most efficient way to accomplish this is to let children perform experiments on their own and arrive at scientific conclusions following a rational way of deduction. But the curricular science teaching cannot manage to incorporate these elements to the extent it should be done. Major efforts are underway globally to rejuvenate teaching methods, but for obvious practical reasons, this is not something that can be accomplished easily. This can be done by building a new breed of science centers all around the country, which will serve as resource laboratories for the school-going children. But it has to move away from the conventional model of such centers. We have to imagine science centers on a shoestring budget, with provisions for very simple experiments to be done by the visiting students. The present author believes that public funds can easily come up with tens of thousands of such science centers in all parts of the country if while making them the only consideration remains the inculcation of scientific methodology through the simplest of experiments, the real core goal of the project. The architectural extravagance commonly associated with such centers does not serve any real purpose; rather such centers should be designed keeping the locale in mind. Imagine children visiting such a center close to their house, getting to play with few convex lenses and prisms, take a bunch of leaves and have a look at them through a simple microscope, take a telescope out on a starry night and feasting their eyes, any day they want. Imagine their parents, accompanying the children on one of those days, learning from their children about how to look through a microscope or a telescope, what to expect when sunrays are made to pass through a

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convex lens and why. That is how science can reach the public. Add a small library with a collection of introductory books in the center itself, written in vernacular languages on different scientific disciplines, for the children to ponder over and find out rational explanations for the phenomena they just observed.

A science museum adorned with colourful buttons can never have the same impact on the masses. The scale that is reachable in terms of the actual intended goal for such a center is unthinkable for a glass facade of a science center in the city.

Another promising approach towards a greatly effective science communication is to engage the public in actual scientific activities. This approach is the basis for the 'citizen science' programs adopted all around the world in the past decade or so (Bonney *et al.* 2016). Such programs are formulated in a way that allows engagement of the lay public in collection and processing of data towards a scientific goal steered by a group of practising scientists. Citizen science programs have been initiated in a great variety of scientific domains from ecology and biodiversity to astronomy. A number of such programs have already yielded desired outcomes in terms of important scientific insights. Instances where lay citizens take part in serious scientific activities and make significant contributions are not new to science and started with amateur naturalists. Names of Charles Darwin and Alfred Russel Wallace can also be presented as examples. But the amateur naturalist endeavours were driven by individual motivation. Citizen science programs have an inherent dependence on large numbers of individuals being directed towards a common well-designed scientific goal.

Other such programs include Breeding Bird Survey by US Fish & Wildlife Service (Robbins *et al.* 1979), Cornell Nest Record Card program, Birdhouse Network program, Seed Preference Test by Cornell Lab of Ornithology, National Institute of Invasive Species Science program, Monarch Larva Monitoring Project, More recent data collection programs have engaged citizens to aid in scientific discoveries in diverse contexts, *viz.*, geographical distribution and effects of pollen color of a flower (Austen *et al*. 2018), photo-based insect and plant records (Osawa*et al.* 2017), long term annual trend and seasonality of river nutrient abundance (Abbott *et al.* 2017), smartphone-based ocean transparency data (Seafarers *et al*. 2017), tracking of migratory birds (Wilson 2017), sampling butterfly legs for a genetics-based species identification (Wilson J.J), etc.

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In addition to the domain of nature conservation and biodiversity, the citizen science approach is prevalent in the field of astronomy since long. A great number of amateur astronomers all around the world pursue the activities driven by individual efforts but collect data on emergent as well as stable celestial phenomena to international professionally managed data archives. These data then are used by professional astronomers for scientific discoveries. A fairly large contingent of amateur radio-astronomers are also very active all around the world and a sizeable fraction of them was engaged in the Search for Extraterrestrial Intelligence (SETI) program in which the National Aeronautics and Space Administration (NASA) also engaged in the 1970s.

More organized programs in astronomy include the Galaxy Zoo project where public is engaged in classifying celestial images gathered by the Hubble Space Telescope (Lintott *et al.* 2008) and the very recent 'Crayfis' project where the goal is to engage public into a cosmic ray source localization program using smartphones (Whiteson*et al.* 2014). In fact, an online portal called Zooniverse is in place for recruiting volunteers in ongoing citizen science programs in the domains of physics, space science, medical science, biology, climate sciences, and even in social sciences.

The citizen science programs are expected to have an inherent 'outreach' and 'awareness' outcome in addition to the apparent scientific goals. People have actually acknowledged that citizen science programs can in some way democratize science. This is undeniable as these programs are by nature 'deliberative' and 'participatory' with a great deal of involvement of the citizens in the scientific methodology itself, although measuring the actual effect in terms of scientific awareness and rational temper of the involved citizens is difficult (Bonney *et al.* 2016; Sauermann and Franconia 2015). In some citizen science programs effort was put in to decide upon these outcomes. For example, the Galaxy Zoo project did find that the volunteering citizen scientists wanted to further develop on the project by themselves and create their own infrastructure and methods (Fortson *et al.* 2011). Similar phenomena were also apparent in another citizen science project in astronomy, 'Citizen Sky' steered by the American Association of Variable Star Observers —within six months of engagement, the understanding and the attitude toward science among the participating citizens was significantly influenced (Aaron *et al.* 2013). Exposure to actual scientific methodology should induce longer-term rational behaviour and the ability to judge pseudo-science from science. In terms of design, the citizen

science programs can be data collection projects, large-scale data processing projects, curricular recruitment or more inclusive community science projects (Bonney, *et al.* 2016). General induction of public understanding of science can be imagined in all these different designs but with variable effectiveness. More importantly, this approach obliterates the distance between science and the public, obviating the mediation by educators and circumventing the already discussed issues with this mediation process.

Organisations in India

The Indian subcontinent has seen numerous individual efforts in addition to the publicly funded organized programs for public outreach of science. Most notable among them being Kerala Sasthra Sahitya Parishad and a number of organizations spread nationwide that are affiliated to All India Peoples Science Network. An important contribution of these decade-long efforts has been popular science books in vernacular languages published by the aforementioned organizations, as well as by public agencies like National Council of Science & Technology Communication and National Institute of Science Communication and Information Resources.Public agencies have also been supportive of private efforts toward science communication by providing financial and logistic support. But one must recognize that most of these efforts follow more conventional approaches, as we have discussed already.

The citizen programs in the field of amateur astronomy are notable in India, although the geographic footprints of these programs are much limited. But it is time for Indian practising scientists to come up with more indigenous programs in different fields of science that have the ability to engage the public in large numbers.

Even in the conventional public outreach dissemination programs, the scientific content is limited to well-established scientific notions, largely representing the international scientific community, while the practising Indian scientific communities are largely underrepresented in such deliberations. More such efforts will lead to a better connection between the practising Indian scientists and the lay public, leading to the development of trust and support for Indian science in general, apart from the positive impact on the 'awareness' aspects.

Most notable among them are the phenomenal efforts put into the 'Toys from Trash' project led by Arvind Gupta and his team, who introduce children to a world of toys made from trivial trash based on some simple scientific principles something that needs to be

widely propagated and replicated all around the country. Rural centers in the underprivileged remote areas of the country, incorporating location-specific environmental and architectural elements, equipped with simplest of tools to allow local school-going children to run experiments based on their textbook knowledge, will be a great way to induce scientific temper among the future citizens and engage more people with the process of scientific progress in general.

As prudently summed up in a recent treatise on the necessity of public outreach, and more importantly public understanding of science, the question of why one needs public engagement in science has already been replaced by the question on how to most effectively do it (Stilgoe*et al*. 2014). The effectiveness of a certain approach toward this goal should be assessed based on the more general outputs on public engagement with policy directions on science, participation of the hitherto disengaged fractions of the public, incorporation of the already engaged sections of the public into the process of scientific discoveries through citizen science programs, induction of scientific temper in the populace that perpetuates through generations, and finally a population resistance to irrational social behaviours and pseudo-science.

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Implementation of artificial intelligence for sustainable agriculture

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Abstract: -

According to UN Food and Agriculture Organization, the population will increase by 2 billion by 2050. However, only 4% additional land will come under cultivation by then. In this context, use of latest technological solutions to make farming more efficient, remains one of the greatest imperatives. While Artificial Intelligence (AI) sees a lot of direct application across sectors, it can also bring a paradigm shift in how we see farming today. AI-powered solutions will not only enable farmers to do more with less, it will also improve quality and ensure faster go-to-market for crops. In this article, we will discuss how AI can change the agriculture landscape, the application of drone-based image processing techniques, precision farming landscape, the future of agriculture and the challenges ahead.

Keywords: - Artificial Intelligence, IOT, Precision Farming and Agriculture.

Introduction: -

Agriculture is seeing rapid adoption of Artificial Intelligence (AI) and Machine Learning (ML) both in terms of agricultural products and in-field farming techniques. Cognitive computing in particular, is all set to become the most disruptive technology in agriculture services as it can understand, learn, and respond to different situations (based on learning) to increase efficiency. Providing some of these solutions as a service like chatbot or other conversational platform to all the farmers will help them keep pace with technological advancements as well as apply the same in their daily farming to reap the benefits of this service.

Growth driven by IOT

Image-based insight generation Huge volumes of data get generated every day in both structured and unstructured format. These relate to data on historical weather pattern, soil reports, new research, rainfall, pest infestation, images from Drones and cameras and so on. Cognitive IOT solutions can sense all this data and provide strong insights to improve yield. Proximity Sensing and Remote Sensing are two technologies which are primarily used for intelligent data fusion. One use case of this high-resolution data is Soil Testing. While remote sensing requires sensors to be built into airborne or satellite systems, proximity sensing requires sensors in contact with soil or at a very close range. This helps in soil characterization based on the soil below the surface in a particular place. Hardware solutions like Rowbot (pertaining to corns) are already pairing data-collecting software with robotics to prepare the best fertilizer for growing f corns in addition to other activities to maximize output Precision farming is one of the most discussed areas in farming today. Drone-based images can help in in-depth field analysis, crop monitoring, scanning of fields and so on. Computer vision technology, IOT and drone data can be combined to ensure rapid actions by farmers. Feeds from drone image data can generate alerts in real time to accelerate precision farming.

Companies like Aerialtronics have implemented IBM Watson IoT Platform and the Visual Recognition APIs in commercial drones for image analysis in real time. Given below are some areas where computer vision technology can be put to use: •

Disease detection: Pre-processing of image ensure the leaf images are segmented into areas like background, non-diseased part and diseased part. The diseased part is then cropped and send to remote labs for further diagnosis. It also helps in pest identification, nutrient deficiency recognition and more. Images of different crops under white/UV-A light are captured to determine how ripe the green fruits (Fig 1). Farmers can create different levels of readiness based on the crop/fruit category and add them into separate stacks before sending them to the market. Using high-definition images from airborne systems (drone or copters), real-time estimates can be made during cultivation period by creating a field map and identifying areas where crops require water, fertilizer or pesticides. This helps in resource optimization to a huge extent. Based on multiple parameters like soil condition, weather forecast, type of seeds, infestation in a certain area

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and so on, cognitive solutions make recommendations to farmers on the best choice of crops and hybrid seeds. The recommendation can be further personalized based on the farm's requirement, local conditions, and data about successful farming in the past. External factors like marketplace trends, prices or consumer needs may also be factored into enable farmers take a well-informed decision. This technology will also be used to monitor crops along their entire lifecycle including report generation in case of anomalies.

In terms of human intensive processes in farming, irrigation is one such process. Machines trained on historical weather pattern, soil quality and kind of crops to be grown, can automate irrigation and increase overall yield. With close to 70% of the world's fresh water being used in irrigation, automation can help farmers better manage their water problems.

Before the crop cycle, drone can be used to produce a 3-D field map of detailed terrain, drainage, soil viability and irrigation. Nitrogen-level management can also be done by drone solutions • Aerial spraying of pods with seeds and plant nutrients into the soil provides necessary supplements for plants. Apart from that, Drones can be programmed to spray liquids by modulating distance from the ground depending on the terrain.

Crop Monitoring and Health assessment remains one of the most significant areas in agriculture to provide drone-based solutions in collaboration with Artificial Intelligence and computer vision technology. High-resolution cameras in drones collect precision field images which can be passed through convolution neural network to identify areas with weeds, which crops need water, plant stress level in midgrowth stage. In terms of infected plants, by scanning crops in both RGB and near-infra red light, it is possible to generate multispectral images using drone devices. With this, it is possible to specify which plants have been infected including their location in a vast field to apply remedies, instantly. The multi spectral images combine hyper spectral images with 3D scanning techniques to define the spatial information system that is used for acres of land. The temporal component provides the guidance for the entire lifecycle of the plant.

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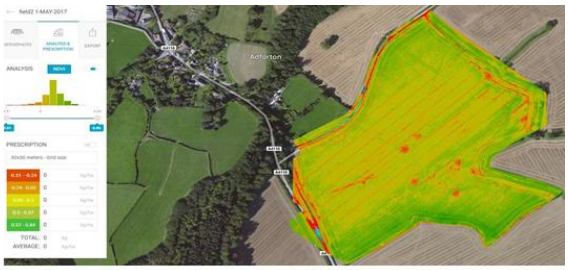
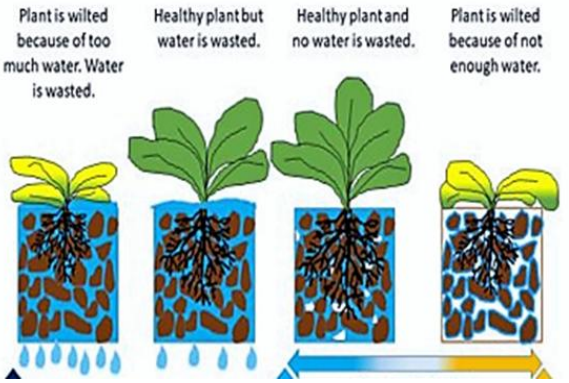


Fig 1:-Disease Detection by using Artificial Inteligence



Automated irrigation system: Automated Irrigation system helps in Reducing production costs of vegetables, making the industry more competitive and sustainable, maintaining (or increasing) average vegetable yields. Minimizing environmental impacts caused by excess applied water and subsequent agrichemical leaching. Maintaining a desired soil water range in the root zone that is optimal for plant growth Fig:2. Low labor input for irrigation process maintenance, substantial water saving compared to irrigation management based on average historical weather conditions.

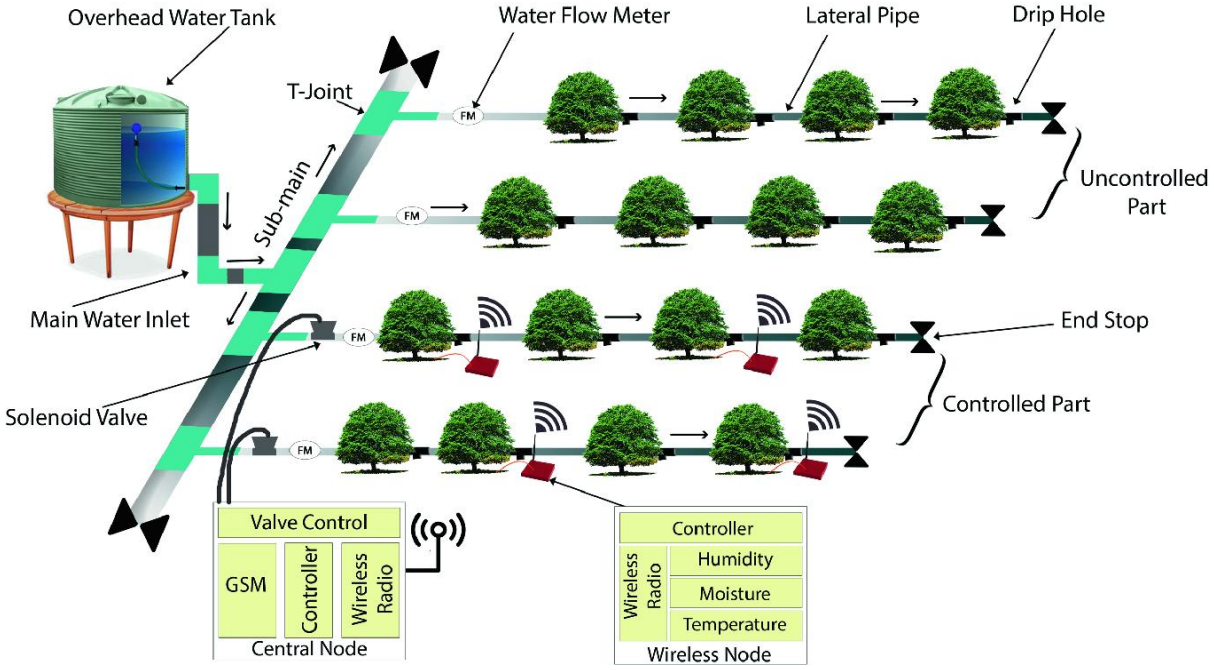


Fig:2:- Automated Irrigation facility by using AI (Source:- Barman A., Neogi B., Pal S. (2020)

Precision Farming The phrase "Right Place, Right Time, Right Product" sums up precision farming. This is a more accurate and controlled technique that replaces the repetitive and labor-intensive part of farming. It also provides guidance about crop

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rotation, Key technologies that enable precision farming are given below: • High precision positioning system • Automated steering system • Geo mapping • Sensor and remote sensing • Integrated electronic communication • Variable rate technology optimum planting and harvesting time, water management, nutrient management, pest attacks and so on.

Image based Insight generation- Use of Computer Visions Technology for Disease detection:

Preprocessing of image ensure the leaf images are segmented into areas like background, non-diseased part and diseased part Fig 3. It also helps in pest identification, nutrient deficiency recognition and more.

Fig 3:-Computer Visions Technology for Disease detection

AI -Driver Less Tractor

Using ever-more sophisticated software coupled with off-the-shelf technology including sensors, radar, and GPS, the system allows an operator working a combineto set the course of a driverless tractor pulling a grain cart, position the cart to receive the grain from the combine, and then send the fully Fig 4.

Fig:-4

AI –Driver Less Tractor Yield Management using AI

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The emergence of new age technologies like Artificial Intelligence (AI), Cloud Machine Learning, Satellite Imagery and advanced analytics are creating an ecosystem for smart farming. Fusion of all this technology is enabling farmers achieve higher average yield and better price control. Microsoft is currently working with farmers from Andhra Pradesh to provide advisory services using Cortana Intelligence Suite including Machine Learning and Power BI. The pilot project uses an AI sowing app to recommend sowing date, land preparation, soil test-based fertilization, farm yard manure application, seed treatment, optimum sowing depth and more to farmers which has resulted in 30% increase in average crop yield per hectare. Technology can also be used to identify optimal sowing period, historic climate data, real time Moisture Adequacy Data (MAI) from daily rainfall and soil moisture to build predictability and provide inputs to farmers on ideal sowing time. To identify potential pest attacks, Microsoft in collaboration with United Phosphorus Limited is building a Pest Risk Prediction API that leverages AI and machine learning to indicate in advance, the risk of pest attack. Based on the weather condition and crop growth stage, pest attacks are predicted as High, Medium or Low.

How Robotics helping in Digital Farming: -

Fig 5:- Drones in Crop Monitoring

Summary

Prospera, founded in 2014. This Israeli startup has revolutionized the way farming is done. It has developed a cloud-based solution that aggregates all existing data that farmers have like soil/water sensors, aerial images and so on. It then combines it with an

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in-field device that makes sense of it all. The Prospera device which can be used in green houses or in the field, is powered by a variety of sensors and technologies like computer vision. The inputs from these sensors are used to find a correlation between different data labels and make predictions. Though Artificial Intelligence offers vast opportunities for application in agriculture, there still exists a lack of familiarity with high tech machine learning solutions in farms across most parts of the world. Exposure of farming to external factors like weather conditions, soil conditions and presence of pests is quite a lot. So what might look like a good solution while planning during the start of harvesting, may not be an optimal one because of changes in external parameters. Another important aspect is the exorbitant cost of different cognitive solutions available in the market for farming. The solutions need to become more affordable to ensure the technology reaches the masses.

Conclusion: -

AI can be appropriate and efficacious in agriculture sector as it optimises the resource use and efficiency. It solves the scarcity of resources and labour to a large extent. Adoption of AI is quite useful in agriculture. Artificial intelligence can be technological revolution and boom in agriculture to feed the increasing human population of world. Artificial intelligence will complement and challenge to make right decision by farmers. The future of farming depends largely on adoption of cognitive solutions. While large scale research is still in progress and some applications are already available in the market, the industry is still highly underserved. When it comes to handling realistic challenges faced by farmers and using autonomous decision making and predictive solutions to solve them, farming is still at a nascent stage. In order to explore the enormous scope of AI in agriculture, applications need to be more robust. Only then will it be able to handle frequent changes in external conditions, facilitate real-time decision making and make use of appropriate framework/platform for collecting contextual data in an efficient manner.

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Bioplastic, An alternative to reduce Plastic Pollution: Status in today's India.

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Abstract

Since its invention, plastics have been an indispensable part of our life. But the worst effect of plastic on world environment have been alarming. As the conventional petroplastics are considered as the major ecological toxic waste, we need to find out an alternative solution- the bio plastics that give us the access to plastics but avoid these serious problems. Bioplastics are obtained from renewable biomass sources or agricultural by-products which are fully or partially bio-based, and/or biodegradable or compostable. The present global bioplastics & biopolymers market size is expected to grow more than two times by 2025. But in India, bioplastics are still in their nascent stage. The Indian bioplastics market is facing many critical challenges such as, more expensive than petroplastics, low customer awareness, technical uncertainties with the right choice of raw material etc. In India, Another important limitation of use of bioplastic is their unique disposal process. For composting, bioplastics require specific pH, temperature, humidity etc. which can only be found in industrial composting facilities. To overcome these problems in coming days we have to improve technology transfer and knowledge exchange mechanisms and also intensify the application-oriented cooperation between research and industry.

Keywords: *petroplastics; toxic waste; bioplastics; sources; Indian market.*

1. Introduction

Traditional plastics are produced from petroleum-based raw materials. Recently people are very much concise about the harmful effects of petro plastic in the environment. To control plastic pollution, scientists have invented bioplastic which is the main eco-friendly alternative to plastics. They have some advantages such as low carbon footprint, independence, energy efficiency and eco-safety [14].These are disposed in environment and the enzymatic degradation can take place. Carbon dioxide, methane, water, biomass, humic matter and various other substances are produced from the degradation of bioplastics [2]. Bio plastic is also less toxic and does not contain bisphenol A (BPA) and di-(2-ethylhexyl) phthalate (DEHP) [6]. BPA is a hormone disrupter and DEHP causes

cancer to human that is often found in traditional plastics. A plastic is known as "bio-based" when at least a part of it comes from either plant or animal origin. The major difference between synthetic polymer and natural polymer is that the natural polymers are biodegradable as they are made up of oxygen and nitrogen[3]. Petro plastics dominate the market because they are durable, light-weight and cheap, but most of them can't be recycled or reused. 6.3 billion tons of plastic waste were produced between 1950 and 2015 and only 9% of that was recycled. The rest of it ended up in landfills or landed in the ocean. The global bio plastics market size was valued at $21,126.31 million in 2017, and is estimated to reach $68,577.25 million by 2024. Depending on the type, the bio plastics are two types - biodegradable and non-biodegradable. Biodegradable bioplastics are further divided into polylactic acid, polyhydroxyalkanoates, starch blend, polyester and cellulose acetate. Non-biodegradable bioplasticsare also divided into epoxy, polyurethane, polyethylene terephthalate, and others polyamide, polyethylene, ethylene propylene diene monomer rubber and polytrimethylene terephthalate. With a population of 1.252 billion, India is one of the fastest growing countries in the global economy. Indian biodegradable plastic industry will lead to huge demand by 2021 in different sectors such as automobiles, packaging, healthcare and agriculture.

2. Types of bio plastics

2.1. Starch-based & Cellulose-based plastics

Cellulose, lignin, and starch are commonly available in the environment. Cellulose is abundant in all plants. Generally wood is the main source of lignin and starch is commonly found in plants such as corn, potatoes and wheat. Corn, potatoes, wheat and whole plant body are renewable, biodegradable and easily available raw materials [13]. Pure starch can easily absorb moisture and is used as suitable material in the pharmaceutical sector. Starch can be plasticized by relatively low levels (15-30 wt %) of molecules that are able to bind with the starch hydroxyl groups, such as glycerol,water and sorbitol, known as "thermoplastic starch" (TPS).Thermoplastic starch currently represents the widely accepted bio plastic, constituting about half of the bio plastics market. TPS properties can be improved by blending with other polymers, fillers, and fibres. Natural and synthetic polymers such as cellulose, zein (a protein from corn), natural rubber, polyvinyl alcohol, acrylate copolymers, polyethylene and ethylene copolymers, polyesters, and polyurethanes have been used for bio plastic production.

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Cellulose are mainly used as the cellulose esters, (including cellulose acetate and nitrocellulose) and their derivatives, including celluloid.

2.2. Protein-based plastics

Bio plastics can also be made from different protein sources. The albumin, soy and whey protein provide possible sources of raw material for bio plastic production. They have already been utilized in the area of edible films [7].

2.3. Some aliphatic polyesters

Aliphatic polyesters play a vital role as biodegradable polymers.They are having potential hydrolysable ester bonds and relatively short aliphatic chains. These are the most representative examples of environmentally relevant polymeric materials [16]. Bio based polyesters including polylactic acid, poly-3-hydroxybutyrate, polyhydroxyalkanoates, polyhydroxyvalerate, polyhydroxyhexanoate PHH, polyamide 11 are sensitive to hydrolytic break down and can be blended with other compounds.

- **Polylactic acid (PLA)**

  Polylactic acid is a transparent plastic produced from corn or dextrose. It is similar with petrochemical-based plastics like PET, PS or PE and already exists for the production of some conventional plastics. PLA and PLA blends are generally found as granulates which are used in the plastic processing industry such as for the production of films, fibres, plastic containers, cups, bottles and biodegradable medical devices (e.g. screws, pins, rods, and plates). In past decade, remarkable research interest has been seen in PLA based blends and composites in the field of automotive, electronics and semi structural parts [12].

- **Poly-3-hydroxybutyrate (PHB**)

  The PHB (poly-3-hydroxybutyrate) is polyester produced by few bacteria processing glucose, corn starch or wastewater. Their features are similar with the petro plastic polypropylene. PHB is distinguished primarily by its physical characteristics. It is biodegradable and can be processed into a transparent film at a melting point higher than 130^0 C.

- **Polyhydroxyalkanoates (PHA)**

  PHAs are nontoxic, biodegradable and biocompatible bio plastic and they have similarpropertieswith conventional plastics [8]. PHAs are linear polyesters produced naturally by bacterial fermentation of sugar or lipids, to store carbon and energy.

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Commerciallyfrom the bacteria polyester is extracted and purified. More than 150 different monomers can be combined within PHAs to give materials with different properties. These plastics are widely used in the medical industry.

- **Polyhydroxyurethanes**

  In 1937, Bayer discovered urethane polymers by polyaddition reaction betweendiisocyanates and macrodiols [1]. Recently bio-based and isocyanate-free polyurethanes have been produced enormously. Unlike traditional cross-linked polyurethanes, cross linked polyhydroxyurethanes have been shown to be capable of recycling and reprocessing through dynamic trans-carbamoylation reactions.

- **Polyamide 11 (PA 11)**

  Polyamide 11isone of the most important bio-based polymer.It is a commercial aliphatic polyamide. It is produced from castor oil [11]. The trade name of polyamide 11 is Rilsan B. PA 11 is not biodegradable and belongs to the technical polymers family. The thermal resistance of PA 11 is higher than PA 12. It is used in the area of automotive fuel lines, pneumatic airbrake tubing, electrical cable anti-termite sheathing, flexible oil and gas pipes, control fluid umbilical, sports shoes, electronic device components, and catheters.

  A similar plastic is Polyamide 410 (PA 410). Mostly it is derived from castor oil, under the trade name EcoPaXX. PA 410 has a high melting point (approximately 250°C), low moisture absorption and excellent resistance to several chemical substances.

  This class also includes polymer such as PVC, PE, PP, PET, nylon and polyamides (PA) named as bio plastics [17].

2.4. Bio-derived polyethylene

Bio-derived polyethylene is chemically and physically similar to polyethylene. Both are non biodegradable but can be recycled. Bio-derived polyethylene can also reduce greenhouse gas emissions. Green PE has the same properties, performance and various applications like fossil-based polyethylene. For these features, it is able to replace the petro plastics and also recyclable in the same recycling chain used by traditional polyethylene. Green PE is an option for applications in rigid and flexible packaging, closures, bags and other products as it is part of the high-density polyethylene (HDPE) and linear low-density polyethylene (LLDPE) products.

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2.5. Genetically modified bio plastics

Genetic modification (GM) is also a challenge for the bio plastics industry. With the help of recombinant DNA technology, production of succinate, lactate, and polyhydroxybutyrate from cyanobacteria is now possible. *Synechocystis* and *Synechococcus* species of cyanobacteria can produce succinate and lactate, which are used to generate bio plastics [9].

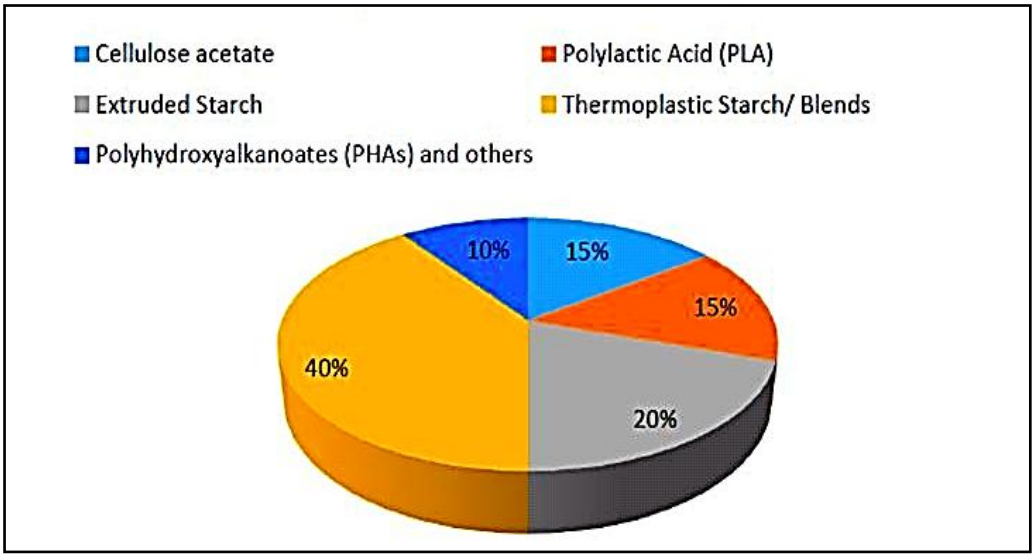

Figure 1. Market share depending on different types of bioplastics

3. Application of bio plastic

The largest field of application for bio-based plastics is packaging (both flexible and rigid packaging) which accounts for over 50% of 1.14 million tons of bio-based plastic production. Bio plastic also used in textile, consumer goods, agriculture and horticulture, automotive and transport goods, coatings and adhesives, building and construction, electrics and electronics and other fields [17].

- Few bio plastics are easily degradable and used in flexible packaging as they are eco friendly.
- They are used in packaging for food items, medicines, beverage bottles and packaging of nonfood products. They are also used in flexible and loose fill packaging.
- Bio plastics made of cornstarch used in flexible and loose fill packaging.
- Polylactic acid (PLA) is used mainly in the packaging of food items while packaging films are made up of biopolyethylene terephthalate (PET), biopolyethylene and biopolypropyleneare.

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- Recently plastic bags and organic waste collection bags which are used in commercial and retail outlets, houses, hospitals, hotels and restaurants, are mostly manufactured from bio plastics.
- As environmental concern is growing across the world, the usage of bio plastics is increasing in the packaging sector.
- Asia-Pacific has the highest manufacturing capacity of bio plastics with around 45% of the global capacity. Moreover, with the increase in awareness among consumers few countries including India have started promoting the consumption of bio plastics in different field.

4. Current market status of bio plastics in India

India bio plastics market is projected to grow at a CAGR of 23.91% to reach US$754.648 million by 2025**.** Increasing environmental consciousness is one of the major factors that is set to drive the Indian bio plastic market to a new zenith during the forecast period. The other important factor that is stimulated the growth of the market is the increasing focus of sustainability with the aim of reducing their carbon footprint.

In India, Jammu & Kashmir is the first state where bio plastic product manufacturing facility have built with an installed capacity of about 960 metric tons per year. Maharashtra and Tamilnadu are also the pioneers in bioplastics industry in India. The other companies operating in India's bio plastic market are Envigreen, Ecolife, Plastobags, Earth soul India and Truegreen. Though bio plastics market in India is in infant stage. In India, few companies are operating in the bio plastic segment. Environmental awareness programs, easy availability of feedstock and government backing giving major support to bio plastics manufacturers in India [15].

As of 2019, around 18 states of the country have enforced a band on single-use plastics. Bio plastics also play an important role in developing bio economy. Increasing use of bio plastics in developing countries like India will create new job opportunity. Bio plastics market is a growing market and it increases about 20%~25% per year globally [4].

As most of the countries in Asia-Pacific, like China, India, Japan, South Korea, Bangladesh and others are environmentally concerned. These countries are shifting to the use of bio plastics which helps them to gain a higher consumer market share. Asia Pacific is likely to register a steady growth rate due to the availability of skilled labour at a low

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cost. Particularly in China and India, increasing production of biodegradable plastics is expected to influence regional market growth.

Based on geographical location, bio plastics market can be divided into North America, Europe, Asia Pacific, Middle East & Africa, and Latin America. In terms of value, North America leading the market followed by Europe and Asia pacific. The market is growing rapidly due to rapid commercialization with latest innovations and advance applications in different industries.

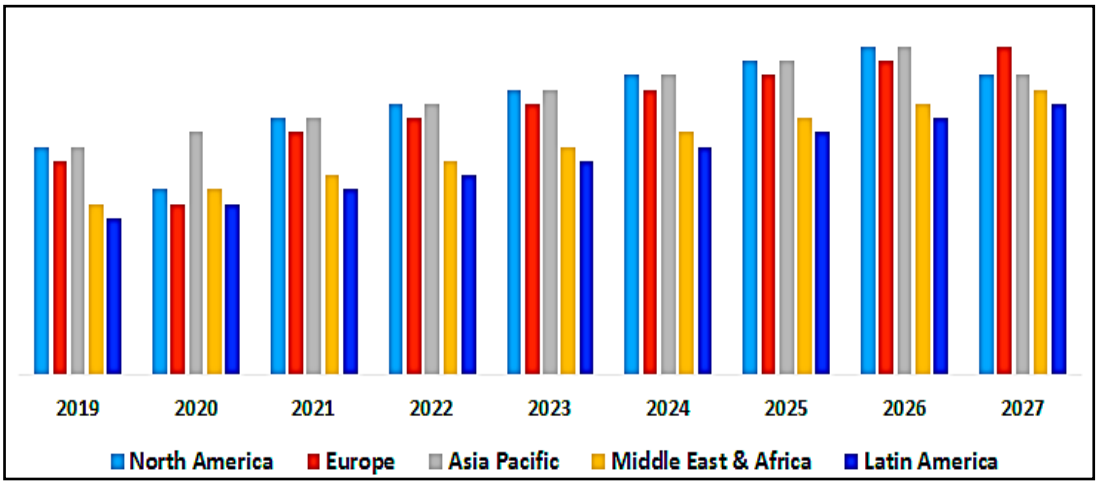

Figure 2. Bioplastic market by Geography (2019-2027)

Based on product, Indian bio-plastic market is sub segmented into biodegradable and non-biodegradable plastic [19]. In India, major application segments of bioplastics market are packaging, textile, agriculture & horticulture, consumer good, automotive, electronics and building& construction. Indian bio-plastic packaging segment is expected to account for almost 60 % of the overall market share. Recently fresh food, dry snacks, candy, bakery goods, juice and frozen meat are packaged in different bioplastic containers.

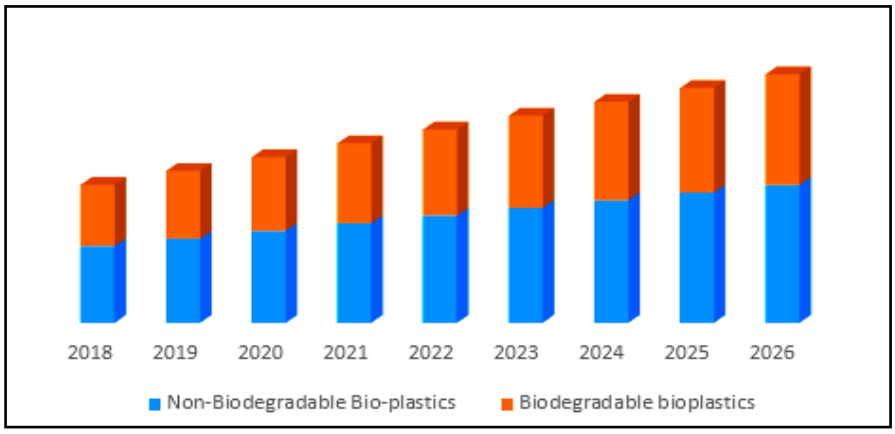

Figure 3. Bioplastic market status in India

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5. Global market

In the recent years, there are several technological discoveries which directly help the global bio plastics market to grow resulting in boost to the competition [20].According to a report by Grand View Research, the global bio plastics market is expected to reach USD 26.0 billion by 2027. It is projected to expand at a CAGR of 16.1% over the forecast period [18].Europe dominated the global bio plastics market especially with the demand coming from Germany, followed by France, Italy and United Kingdom. The German economy is the largest in Europe, and the fifth-largest in the world. The United Kingdom stands to be the fourth-largest consumer of plastics. In the United Kingdom, advanced and modified plastics development has been identified as one of the advanced countries. With increasing awareness about the environmental impact of petroleum-based non-biodegradable plastics, the advanced countries are very much serious regarding the production of bioplastics alternatives.

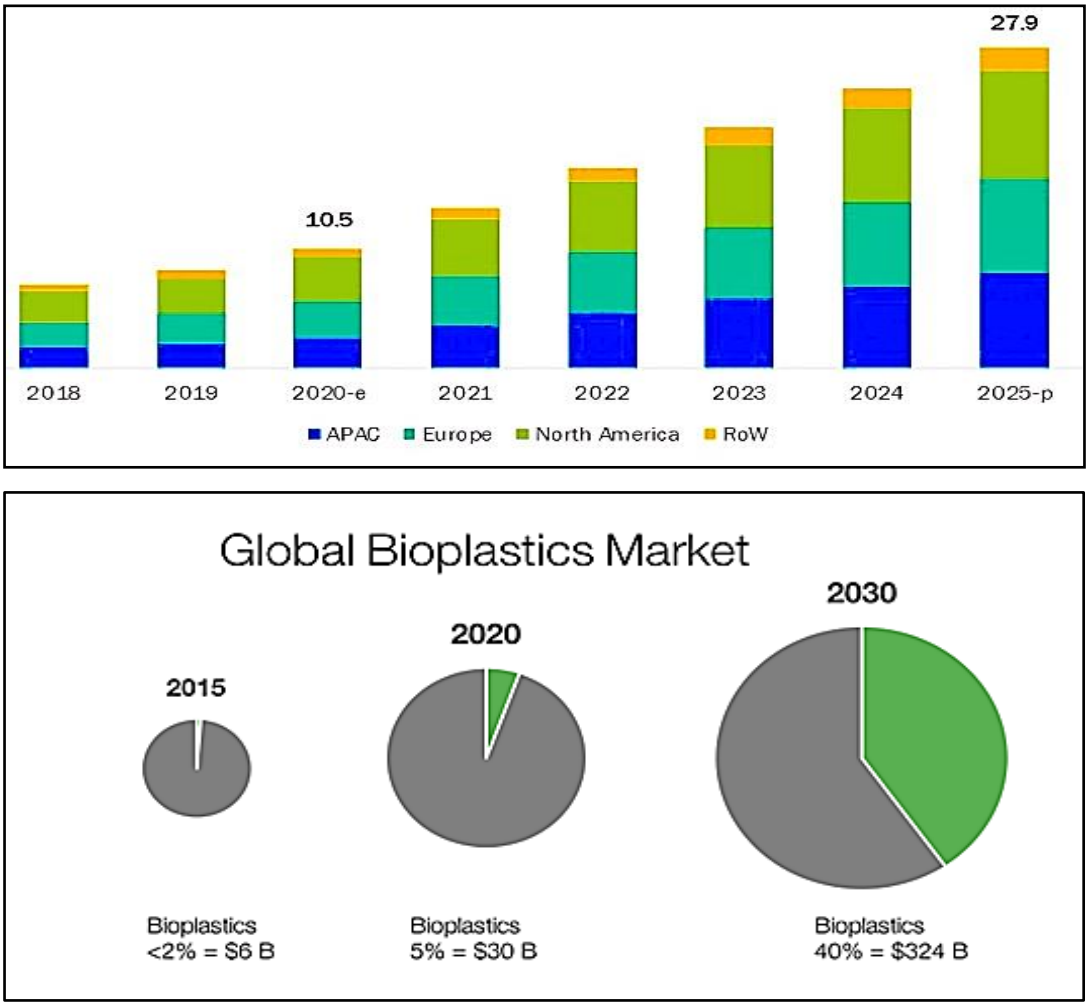

Figure 4A & 4B. Global Bioplastic market status (USD Billion)

6. Conclusion

Recently the public awareness for the environment and the limited fossil fuel are driving all government and non-government organization to find eco-friendly resources alternatives to petroleum. Different kinds of synthetic plastics are currently used for extensive range of requirements, but in order to reduce petroleum-based plastic pollution, considerable attention has been focused on "green" plastics. Though bio plastic market has several challenges regarding reducing raw material, costly than petro plastics, uncertainties in technologies and processes, lack of legislation, customer awareness etc. To overcome these problems in coming days scientists across the India working for the development of bio plastics. Many technological discoveries and knowledge exchange mechanisms have boosted Indian bioplastics market and significant growth in industry has been observed. It is up to every individual to stop the use of conventional plastics in their daily life as much as possible. It is concluded that the use of bio plastics will help in sustainability and national development thus making the environment less overloaded with greenhouse gases and reduction of waste biomass.

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Potential of Boeravinones From *Boerhaavia diffusa* L. As HCV NS3-NS4A Protease (4A92) Inhibitors By Molecular Docking

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Abstract

Hepatitis C virus (HCV) infection is a global health burden with over 180 million people infected worldwide. HCV is known to cause severe liver disease leading to cirrhosis and hepatocellular carcinoma. Forviral replication, NS3 protein is very much needed. N-terminal serine protease domain and a C-terminal helicase/NTPase domainis present in the NS3 protein. It also requires NS4A protein to act as a cofactor along with NS3 for its complete activity.NS3-NS4A protease of HCV is the primary target for direct-acting antiviral agents development. Till date, there is no licensed drug available in the market for HCV. Plant-derived bioactive compounds provide a vast source for new drug discoveries. *Boerhaaviadiffusa*L. has medicinal properties such as anti-bacterial, anti-nociceptive, hepato-protective, hypo-glycemic, anti-proliferative, anti-estrogenic, anti-inflammatory, anti-convulsant, anti-stress and anti-metastatic activities. The antiviral property of the bioactive compounds of *Boerhaaviadiffusa*Lhas not been studied. Therefore the present study aims at investigating the inhibitory property of the bioactive compounds, Boeravinones derived from *Boerhaaviadiffusa*L. against HCV NS3-NS4A protease, 4A92 by *in silico* molecular docking. The results showed potent inhibitory activity of all the Boeravinones selected for the study against 4A92. The best-ranked lead molecule was Boeravinone C with the binding energy of -11.2 kcal/mol. This specified that these bioactive compounds may be extracted and isolated from the plant, modified and synthesized *in vitro* to be used as potent inhibitors against HCV protease by carrying out cytotoxicity assay.

Keywords: HCV, 4A92, Boeravinones, Effective inhibitor

1. Introduction

Hepatitis C is caused by the Hepatitis C Virus (HCV) belonging to the Flaviviridae family and known to affect the liver cells. HCV causes acute hepatitis, chronic hepatitis and cirrhosis [1-3]. About 180 million people are infected across the world leading to serious

public health issues. The genome of HCV is made up of single-stranded RNA, which encodes for a single polyprotein precursor. The polyprotein consists of Structural proteins (Core protein, E1 and E2) and Non- Structural proteins (NS2, NS3, NS4A, NS4B, NS5A and NS5B). The NS3-NS4A protein is vital for viral replication, thus it is considered a target for the drug discovery study.

Phytochemical constituents such as flavonoids, alkaloids, terpenoidsetc have been known to play an important role in antiviral activity [4[. Many of the plant-based products are used in drug discovery as lead molecules because of their minimal side effects [5]. In the present study, the phytochemical compounds from *Boerhaavia diffusa* L is used to study its antiviral property against HCV using molecular docking.

Boerhaavia diffusa belonging to the family Nyctaginaceae is found in the tropical and subtropical regions of the world. It is a creeper weed that is perennial in nature. It is used as a medical plant and endemic to India. The different parts of the entire plant are used in traditional medicine for treating disorders related to kidney, liver, abdomen, heart, and asthma [6]. The bioactive compounds of the plant show significant medicinal properties [7]. The bioactive compounds include Rotenoids, Phenolic glycosides and Methyl flavone, which exhibited anti-inflammatory, immunomodulatory, antiproliferative and antiestrogenic activity in the study [8]. Since the antiviral property of these bioactive compounds, Boeravinones against HCV is not yet studied, therefore an attempt has been made to study this activity in our present work by *in-silico* computation methods.

2. Methodology of computation

Molecular docking is one of the most important computation methods for the study of the binding of small ligand molecules to the target molecule [9]. The PyMOL software along with the AutoDockVina tool helps to study the interaction of the ligand with the protein [10]. The interaction can be later visualized and captured by using Ligplot software.

2.1 Protein design for docking

The protease of the HCV virus used for the docking study, 4A92 was downloaded from the protein data bank. The protein was later modified, stabilized and used for the docking study. The optimized molecule was saved in .pdb format for further analysis.

The active sites, Ala-156, Asp-168 and Arg-155 covering the protease receptor (x=37.79, y=71.39 and z=111.89) was used for the docking study.

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2.2 Ligand design for docking

The phytochemical constituents, Boeravinones of *Boerhaaviadiffusa* were used as ligands [11] for the study. The structures of these compounds were drawn using Chem Draw, converted to 3D structures and saved in .mol format. The .mol format was later converted to .pdbqt for docking studies.

2.3 Methodology of docking study

The molecular docking study helps to predict how the binding takes place between the protein and the ligands. It shows the lead molecules with the least binding energy. The ligand-protein complex interaction can further be analyzed using the Ligplot software. In the present study, NS3-NS4A protease was docked with the different Boeravinones to study their interaction.

3. Results

Molecular docking results revealed effective interaction with NS3-NS4A protease. The docking results of the eight Boeravinones (Table 1) from *Boerhaavia diffusa* showed different binding affinities with the protease as shown in Table 2.

Table1- Bioactive compounds from *Boerhaavia diffusa*

Sl. No	Bioactive compounds
1	Boeravinone A
2	Boeravinone B
3	Boeravinone C
4	Boeravinone D
5	Boeravinone E
6	Boeravinone F
7	Boeravinone G
8	Boeravinone H

Table 2- Docking results with Binding affinity of Boeravinones

Sl no	Bioactive compounds	Binding affinity with 4A92 (-kcal/mol)
1	Boeravinone C	11.2
2	Boeravinone D	11.0
3	Boeravinone G	11.0
4	Boeravinone H	11.0
5	Boeravinone F	10.9
6	Boeravinone E	10.8
7	Boeravinone B	10.5
8	Boeravinone A	10.3

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3.1 Ligplot study

The Ligplot analysis showed potent and effective interaction with all the Boeravinones. Among the Boeravinones that were docked, Boeravinone C exhibited the best interaction with the NS3-NS4A protease by the least binding affinity of -11.2kcal/mol (fig. 1)

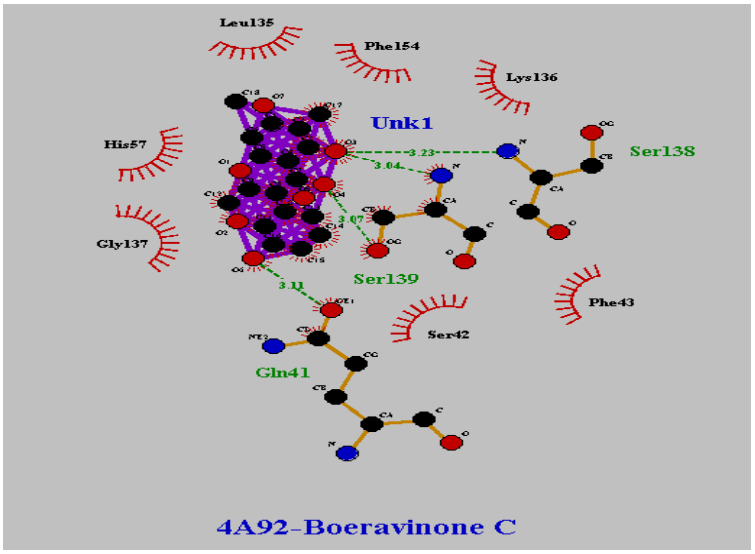

Fig.1 Ligplot showing the interaction of Boeravinone C with the NS3-NS4A protease.

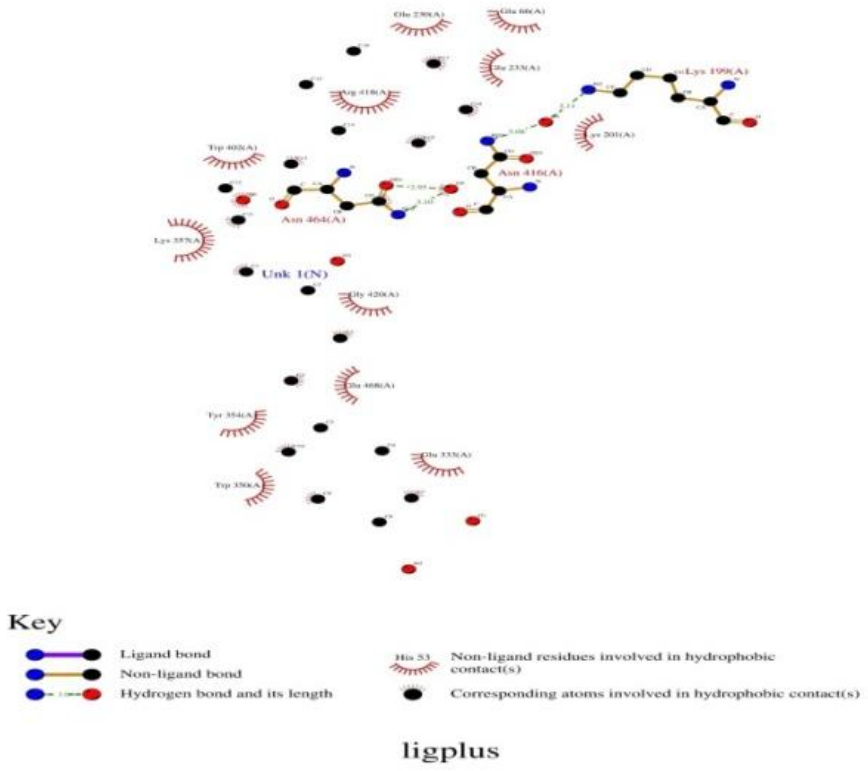

Fig.2 Ghost view of Ligplot showing the interaction of Boeravinone C with the NS3-NS4A protease

4. Discussion

Phytoconstituents have been used in traditional medicine since ancient times. These phytoconstituents are known to combat diseases with minimal or no side effects. Therefore, many of the drugs are extracted, synthesized and modified for their effective use to fight against various diseases.

Antiviral drugs against the Hepatitis C virus is an urgent need in the interest of public health [12]. Therefore in the present work, an attempt has been made to study the interaction of plant-based compounds, Boeravinones against the NS3-NS4A protease of HCV.

The study revealed potent inhibition of the Boeravinones used in the study. Boeravinone C showed the best interaction with -11.2kcal/mol (Hydrophobic interactions- Leu-135, Phe-154, Lys-136, his-57, Gly-137, Ser-42, Phe-43 and Hydrophilic interactions-Ser-138, Ser-139, Gln-41) as shown in fig.1 and fig 2. This was followed by Boeravinone D, Boeravinone G and Boeravinone H with a binding affinity of -11.0kcal/mol.

The results displayed that Boeravinones in general and Boeravinone C, in particular, a very good inhibitor and can be extracted, synthesized and modified to exhibit their efficiency as an anti-viral drug against HCV.

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Effect of lower concentration of NRG-I levels on retrieval of oocytes from *in vitro* grown sheep preantral follicles

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Abstract

Ovaries contain a thousands of preantral follicles and an important alternate to surface antral follicles as a source of a good number of cultivable oocytes. Many scientists worked to establish *in vitro* conditions for oocyte maturation and fertilization to improve the developmental efficacy of sheep oocyte (Tsafriri *et al.*, 2005) for increasing reproductive efficiency. The objective was to observe the effect of different levels of neuregulin-1 (NRG-1) on retrieval of good oocytes from sheep PFs grown in vitro. The PFs were separated from ovarian pieces by micro-dissection method using disposable needle and scalpel blade. These were cultured under mineral oil in 35 mm petridish placed in CO_2 incubator (38^0C, 5% CO_2 in air, 90-95% relative humidity) for 4 days with different concentrations of NRG-1(1ng or 2ng or 3ng or 4ng). Follicular viability was checked by treating with 0.05% (w/v) trypan blue (Himedia Lab., Mumbai, India). Live cells exclude the stain whereas dead cells take up the stain and appear blue in colour. Follicular morphology i.e. presence of dark patches within membrana granulosa and degeneration morphology (Gupta *et al.*, 2002) was assessed under stereo zoom microscope (330x). Retrieval rate of oocytes was significantly ($P<0.05$) more in the PFs cultured with 4ng of NRG-I compared to control and other Groups with different doses of NRG-I. Likewise, retrieval of cultivable oocytes was significantly more ($P<0.05$) in the PFs cultured with 2ng or 3ng of NRG-I compared to control and Group with 1ng of NRG-I. Whereas no significant difference was observed when the values between the control Group and Group with 1ng of NRG-I were compared. It is concluded that culturing of PFs with 4ng of NRG-I was beneficial during *in-vitro* condition

Keywords: Preantral follicles, Oocytes, Neuregulin (NRG-I), *in vitro*

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1. Introduction

In-vitro development system that supports oocyte growth in follicle is an ambitious one because in domestic animals compared to laboratory animals, oocyte development takes a long time. During development, the oocyte must grow and attain competency to undergo meiotic maturation and further development. Limited success was reported on isolation and culture of preantral follicles containing immature oocytes to a stage where they can be fertilized and develop to live young, that too in rodents only (Eppig and O'Brien, 1996) has provided a hope that similar results may be achieved using follicles from the domestic species. Culture system for cow and sheep are not yet established (Telfer, 1998) and most effort has been devoted to defining optimal conditions for the early stages of follicle growth (Ralph *et al*., 1996).

Growth of PFs of murine *in vitro* led to the antrum formation (Eppig and Schroeder, 1989). Whole preantral follicle with theca cells could be isolated from the young mice ovaries, which were found to be grown *in vitro* to Graffian stage. Formation of antrum in larger PFs was accomplished in pig (Hirao, 1994), sheep (Cecconi *et al*., 1999), goats (Huanmin and Young, 2000) and cows (Gutierrez *et al*., 2000). Lussier *et al*., (1987) demonstrated that a PFs in cattle which has attained an antrum needs 40 days to reach ovulatory size. By analysing this data it was estimated that preantral stage i.e., primary or secondary follicle requires nearly 80 days to grow to maturity. PFs of Bovine and ovine were capable of growing to antral stages of up to 1 mm in diameter in serum free conditions (Guiterrez *et al*., 2000). Antrum formation in vitro was achieved in hamsters (Roy *et al*., 1989). FSH stimulated proliferation of granulosa cell and growth of follicles to attain antrum formation (Hulshof *et al*., 1995). Antrum formation did not occur until the follicle reached approximately 140 μm in diameter in Hamster and human (Lussier *et al*., 1987). FSH and estradiol synergize the mechanism of antrum like reorganisation of granulosa cells in rat preantral follicle culture and pig preantral follicles were successfully developed to antral follicles in the presence of FSH and estradiol (Hirao *et al*., 1994). Some growth factors such as activin, epidermal growth factor (EGF), Transforming growth factor-β1 (TGF-β1), basic Fibrobalst growth factor (bFGF) and Insulin like growth factors (IGFs) have been shown to stimulate bovine follicular growth through granulosa cell proliferation (Hulshof *et al*., 1995). Many growth factors like FGF and

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EGF were shown to have potent mitogenic effects on bovine, porcine and human granulosa cells (Wandji *et al*., 1996). bFGF stimulated the growth of bovine preantral follicles (Wandji *et al*., 1996), probably via granulosa cells multiplication (Nuttinck *et al*., 1993). In addition bFGF binding sites were detected in granulosa cells from bovine primary and secondary follicles, where as the FGF itself could be immunohistochemically demonstrated in oocytes from primordial and primary follicles (Tsuji et al., 2012).

Growth factors not only may act directly on follicles but also indirectly via other ovarian components like blood vessels, for e.g. bFGF (Gordon *et al*., 1996) have been shown to be role in angiogenesis during folliculogenesis. In granulosa cells of cattle PFs could bind either FGF or FSH, while EGF like activity not found in them (Wandji *et al*., 1992). FGF-2 is a potent mitogen and morphogen for many mesoderm and neuroectoderm derived cell types (Gospadarowicz *et al*., 1985). Bioactive FGF-2 mRNA transcripts have been demonstrated in granulosa cells of bovine and bFGF caused a dose dependent enhancement in the diameter of preantral follicle of bovine in culture with higher stimulation at 25 ng/ml, FSH (100 ng/ml) and bFGF (50 ng/ml) individually or in combination with EGF was more potent than EGF (50 ng/ml) in increasing the diameter of preantral follicles (Wandji *et al.,* 1996). Vasoactive intestinal polypeptide (VIP) was also shown to stimulate the growth of isolated bovine preantral follicles *in vitro* (Van den Hurk *et al.,* 1997). The NRG-1 secreted from granulosa cells acted both on granulosa and cumulus cells during ovulation and necessary for oocytes meiotic maturation in primates and rodents as has been putforth by Nyholt *et al.* (2009). Further, they also observed it binds to ERBB3/ERBB2 complexes which are shown in granulosa cells and cumulus cells. On the other hand, Noma *et al.* (2011) opined that NRG-I stimulated selectively the AKT/PKB phosphorylation in granulosa cells when compared to ERK1/2 and participated both in paracrine and autocrine manner during ovulation. They reported that NRG-I regulated luteinization and maturation of oocytes and also caused suppression of spontaneous resumption of meiosis when COCs were separated from preovulatory follicles. Further, they also postulated that NRG-I enhanced the competency of oocytes during *in vitro* fertilization (IVF).

2. Materials and Methods

2.1 Collection and separation of preantral follicles

Ovaries from a civil slaughter house, Bangalore were brought in the warm (32 to 33 °C) normal saline supplemented with gentamicin (50 µg/ml) for the isolation of preantral follicles. ovarian sections were made and digested with trypsin (1 %) by incubating at 37 °C for 10 minutes. Large preantral follicles were isolated from ovarian pieces by micro-dissection method using 26 G disposable needle and scalpel blade. The diameter of preantral follicles was measured and those follicles with normal appearance and without visible signs of degeneration (Gupta *et al.,* 2002) were selected for further study.

2.2 Effect of NRG-I levels on retrieval of good oocytes from *in vitro* grown PFs

This experiment was on effect of different concentrations of NRG-I on retrieval of good oocytes from PFs. Groups of PFs were allocated to 5 Groups as control (Culture media) and 4 treatments Group (Culture media+NRG-1ng or 2ng or 3ng or 4ng) and were cultured for 4 days. Growth of PFs was monitored on day 0, 2 and 4. Oocytes growth in the PFs of above mentioned Groups were monitored while monitoring the growth of PFs on day 0, 2 and 4. After 4 days of culture oocytes were retrieved from the *in vitro* grown PFs and examined for percentage of COCs retrieved.

3. Results and discussion

3.1 Effect of NRG-I levels on retrieval of good oocytes from *in vitro* grown PFs (Table 1)

Retrieval rate was ($P<0.05$) higher in the PFs cultured with 4ng of NRG-I compared to control and other Groups with different doses of NRG-I. Likewise, retrieval of cultivable oocytes was more ($P<0.05$) in the PFs cultured with 4ng of NRG-I compared to control and Groups with 3ng or 2ng of NRG-I. Whereas no difference was found to exist when the values between the control and Group with 1ng of NRG-I were compared. This is due to significant expression of NRG-I in granulosa cells stimulated proliferation by increasing mRNA expressions of EGFR, FSHR and cell cycle regulating genes (cyclins D1 and E1, cyclin-dependent kinases 2 and 6) accompanied by decreased expression of mRNA of LHR (Lin *et al.,* 2011) thereby appreciably affected the retrieval of good oocytes. Hence, the results with respect to retrieval of oocytes from PFs cultured with NRG-I is in accordance with the study of Son *et al.* (2004).

Table 1: Effect of NRG-I levels on retrieval of good oocytes, COCs expansion, maturation of oocytes retrieved from *in vitro* grown PFs and formation of granulosa cell monolayer

Treatment (NRG-I; ng/ml)	PFs	Retrieved oocytes, n (%)
0-Control	50	2 (4.0±1.06) [a]
NRG-I(1ng)	60	3 (5.0± 1.58)[a]
NRG-I(2ng)	57	5 (8.7±1.69)[a]
NRG-I(3ng)	48	5 (10.41±1.92)[b]
NRG-I(4ng)	55	8 (14.54±1.69)[b]

Different concentrations of NRG-I on GCs monolayer formation (8 replicates per treatment with plot;treatment/replicate; 0.5- $0.8x10^6$ cells per drop), retrieval rate and maturation rate of oocytes (Based on 20 replicates per treatment with 2-3 oocytes per plot) from *in vitro* grown PFs (mean ± SEM) during *in vitro* culture were examined.

Values with different superscript letters differ significantly ($P<0.05$) within column.

4. Conclusions

Retrieval of oocytes was higher in the PFs cultured with 4ng of NRG-I compared to control and other groups with different doses of NRG-I.

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Characterization of Multiple Drug Resistant Biofilm Forming Bacteria From Urinary Tract Infected Patients and Its Inhibition by Processed *Tamarindus indica* Seed Extract

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Abstract

Biofilms are the major cause for increase in antibiotic resistance and virulence of microorganisms. Both gram positive and gram negative pathogens do produce biofilms. They cause persistent UTIs which undergo frequent relapses. The inhibition of biofilm formation can play a major role in reducing the resistance of biofilm forming gram positive and gram negative bacteria against antibiotics. The present study focuses on, isolation of bacteria UTI infected patients and its characterization. The efficiency of the isolates to form biofilms is analysed using biofilm assay by subjecting the samples to screening by ELISA plate reader. N-acylhomoserine Lactone (AHL), an autoinducer responsible for the formation of biofilms was extracted and estimated colorimetrically and spectroscopically by using Fourier Transform Infrared Spectroscopy (FT-IR). The extracted AHL showed a characteristic absorbance for C==O bond of lactone ring, and N==H and C—O bond of acyl chain obtained by FTIR. Processed tamarind seed extracts exhibited antimicrobial effect and was confirmed by agar well diffusion assay. It was found that cooked tamarind seed extract had the highest antimicrobial activity among all the sample extracts and was therefore carried out for their biofilm inhibition capabilities by biofilm inhibition assay. The test confirmed that the processed tamarind seeds exhibited anti-biofilm activity. The study can be used to reduce the biofilm forming ability of the bacteria making it more vulnerable to antibiotics.

Keywords: UPEC, AHL, Liquid Liquid Extraction, Biofilm, FTIR, *Tamarindus indica*

Introduction

Extracellular polymeric substance (EPS) which surrounds a mono or multi specie population of microbial cells adhered to a surface is called a biofilm (Donlan *et al*., 2002). The composition of the matrix varies from specie to specie and depends on the type of microbial species which have formed the biofilm (McCrate *et al*., 2013). A biofilm generally comprises of complex carbohydrates such as polysaccharides, nucleic acids and proteins. 90% of the dry weight of a biofilm is because of the extracellular polymeric substance depending on particular microbial isolates. which is the main or most important component of a biofilm (Flemming and Wingender 2010).

Microbial biofilms occupy about 99% of the surfaces. The competition between microbes for nutrients and other growth factors play an important role in the development of a biofilm. The chemical signals produced by the high density of organisms in the biofilm signals with the responding cells in the biofilm, thus by this factor the complexity of the biofilm structure is increased. Also, the expression of cognate receptors, exopolymeric molecules and different adhesins also help in the formation of biofilms. Quorum sensing mchanisms are possibly used by many bacteria to regulate biofilm formation and other social activities. Biofilms help the bacteria to carry out various coordinative functions such as collective actions, division of labour with their neighbours. For example, vastly biodiverse dental plaque is a well-recognized biofilm community characterized by its high cell density (10^{11} cells/g wet wt) . Pathogenic strains like Escherichia coli, *Klebsiella pneumonia*, *Proteus mirabilis*, *Enterococcus faecalis*, *Pseudomonas aeruginosa* and *Staphylococcus saprophyticus* cause UTI. The most common pathogen is *E. coli* classified as uropathogenic *Escherichia coli* (UPEC) (Ronald A, 2003).

Alkaloids, tannins, flavonoids and other aromatic compounds are secondary metabolites of plants and they have a defence mechanism against microorganism and insects. This is what may confer the antimicrobial effect that certain seeds have (Cowan MM, 1999)., Tamarind seed is one of them. Tamarind is used in treatment of cold, fever, diarrhoea, jaundice and in skin cleanse. Tamarind seeds have a good composition of various amino acids like Methionine, Phenylalanine, Valine, etc. Tamarind seeds are also a good source of vitamins and various minerals like potassium, calcium and magnesium. Broad spectrum of antimicrobial activity is shown by tamarind extracts and this can be used for

control of infectious diseases. Tamarind seed extracts were found to have antibiofilm forming properties. It has ability to lessen the formation of biofilm by certain strains of bacteria like *Pseudomonas, Escherichia,* etc (Rasheed, 2014).

The present study is aimed at isolating and characterizing the biofilm forming multiple drug-resistant bacteria from UTI samples and to determine the inhibitory effect of processed tamarind seeds against biofilm forming organisms.

Material and methodology:

Plant source: The seeds of *Tamarindus indica* were collected from local areas of Bengaluru district, Karnataka State, India. The seed samples obtained were dried in sunlight for 24 hours, washed with normal water and stored until further use.

Plant sample processing : Tamarind seeds were collected and processed by different methods. Group 1(control) seeds The control group of seeds were not processed. Group 2 (soaked) seeds were soaked in water for five days and were then dried at 60°C. Group 3 (dehulled) **s**eeds soaked for five days and hand pound to separate the hull from the seeds. The dehulled seeds were then dried at 60°C. Group 4 (cooked) seeds were cooked for 30 minutes and the mucus was washed away from the seed coat and the seeds were dried at 60°C. Group 5 (autoclaved) seeds were autoclaved and cooled. They were then dried at 60°C. Group 6 (germinated) seeds were treated with 50% Sulphuric acid for thirty minutes after which it was washed and sowed into a medium containing coco pith and sand in the ratio of 1:1. Ten days later the seeds were cleaned, dried overnight at 60°C. All the above samples were finely powdered after they were dried at 60°C.

Aqueous extract of processed seeds: Each of the 6 processed samples were ground in a mortar and pestle into fine powder. 5% and 10% extract of each sample was prepared using distilled water and stored in cold conditions.

Bacterial Isolates: multi-drug resistant Bacterial cultures were isolated from UTI samples of a diabetic patient from Bhagwan Mahaveer Jain Hospital, Bengaluru. Two strains out of the four isolated strains were chosen based on their biofilm formation in TSB medium on an overnight incubation.

Biochemical Classification of Bacterial Isolates : The obtained samples were cultured onto McConkey agar plates and also various biochemical tests were performed to characterize such as MR-VP, indole, citrate, oxidase.

AHL Extraction from Bacterial Source: AHL was extracted according to the method in Taghadosi *et al.*, 2015

AHL Detection : Phthalic anhydride were prepared in distilled water and the absorbance was taken to obtain a standard graph. 40µl of the AHL extract obtained from each bacterial culture was added to microtiter wells. 2M hydroxyl amine and 3.5M NaOH were mixed in a ratio of 1:1 and 50µl of this was added into the wells. A mixture of 10% ferric chloride in 4M HCl and 95% ethanol prepared in the ratio of 1:1 was also added to the wells in volumes of 50µl. Absorbance was read at 520nm. (Yang YH *et al.*, 2006*)*

AHL Determination: Lactone functional groups by Bruker-alpha FT-IR 19 of the AHL extraction was analyzed.

Well diffusion assay: The organisms were inoculated into 20ml of nutrient broth. After overnight incubation at 37˚C, 1ml of the broth was spread over nutrient agar plates using sterile spreader and air dried. Using a sterile well puncher, wells were punched equidistant from each other and 10µl of 5% plant extract were added to wells. Ampicillin drug was loaded as a positive control and DMSO was loaded as negative control. The plates were incubated at 37˚C overnight and observed.

Biofilm Inhibition by plant sample extracts: To the microtiter plate 100µl of overnight incubated TSB broth containing bacterial culture was added. Each bacterial isolate was treated with 5% and 10% plant extract and incubated at 37˚C overnight. The next day, cells suspension was aspirated and the wells were washed with distilled water. 1% crystal violet was added to the wells and was incubated at room temperature for 30 minutes. The dye was then removed and the wells washed with 0.1M PBS. The wells were then emptied of PBS and further 95% ethanol was added to each well and incubated at room temperature. After 15 minutes, the plate was read at 600nm in ELISA plate reader.

Results and Discussion

The main driving force behind biofilm research is the desire to understand the mechanisms governing the antibiotic tolerance of biofilm-growing bacteria found in chronic bacterial infections. Rather than genetic traits, several physical and chemical traits of the biofilm have been shown to be attributable to antibiotic tolerance. During infection, bacteria in biofilms exhibit slow growth and a low metabolic state due to O_2 limitation imposed by intense O_2 consumption of polymorphonuclear leukocytes or

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metabolically active bacteria in the biofilm periphery. Inhibition of biofilms is important to reduce the anti-microbial effect induced by the films and the use of natural products like Tamarind seeds which has anti-microbial properties is more beneficial than use of chemically synthesized products. Understanding bacterial social behaviours and their molecular mechanisms in the development of biofilms will significantly facilitate the development of novel strategies in the prevention and treatment of biofilm infections.

Isolation and Characterization of Bacteria : Bacterial cultures identified as multi-drug resistant were isolated from a diabetic patient suffering from UTI. The samples were cultured onto McConkey agar plates to differentiate colonies that ferment lactose, provided in the medium. The color of clones varied from pink to red. The cultures were further isolated by further subculturing them onto uninoculated McConkey agar plates. The colony characteristics of the pure isolates were as tabulated in Table 1.

Table 1 : Colony Characteristics

Isolate Number	Size	Colour	Shape	Margin	Elevation	Transparency
1	0.3cm	pale yellow	Round	entire	Flat	Opaque
2	0.3cm	Pinkish yellow	Scalloped	scalloped	Flat	Opaque
3	0.5cm	yellow	Round	Crenate	Flat	Transluscent
4	0.2cm	pale yellow	Round	Entire	Flat	Transluscent

The four isolates that were obtained were further inoculated into TSB and incubated at 37 °C for overnight. After 24 hours, the level of biofilm formation was noticed at the surface of the incubated media and at the inner sides of the tubes. Isolate 3 and 4 were found to exhibit maximum biofilm formation and hence further analysis was carried out using them.

Biochemical Identification : The bacterial isolates obtained were identified by performing various biochemical tests such as IMViC test, oxidase test, catalase test, casein hydrolysis, urease test, starch hydrolysis as tabulated in Table 2.

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Table 2 : Biochemical Tests

	Isolate 3	Isolate 4
MR	-	-
VP	+	+
Indole	-	-
Citrate utilisation	+	+
Oxidase	+	+
Catalase	+	+
Casein Hydrolysis	+	+
Urease test	+	+
Starch Hydrolysis	-	-

AHL colorimetric Detection and Estimation : The amount of AHL was detected to be 16 µg/mL and 15 µg/mL approximately for isolate 3 and isolate 4 respectively (Table 3) using the standard graph of phthalic anhydride.

Table 3 : Standard values for Phthalic Anhydride

CONCENTRATION (µg/ml)	ABSORBANCE AT 540nm
Control	0.9
10	0.23
20	0.32
30	0.46
40	0.49
50	0.56

Figure 1 : AHL detection from isolated sample

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AHL Determination: FT-IR spectrophotometric determination of the extracted AHL sample was performed that was based on the principle that in the infrared region of the electromagnetic spectrum (4000 - 600 cm-1) most molecules absorb light. The absorption peaks from the FT-IR graphs correspond to the bonds present in the sample. They are characteristic of the vibrational modes of the bonds or molecules in sample that is analyzed. IR absorption table concluded that both the strains 3 and 4 showed strong peaks in the range of 1750 - 1735 cm-1 which corresponds to the C=O bond of the lactone ring. Strong peaks were also observed between 1300-1000 cm-1 which corresponds to C-O bond in AHL. Peaks were obtained at 1736.69, 1233.93 and 1043.41 in the case of isolate 3(Figure 2) corresponding to C-O in AHL whereas peaks were obtained at1736.78, 1233.37 and 846.91 in the case of isolate 4(Figure 3).

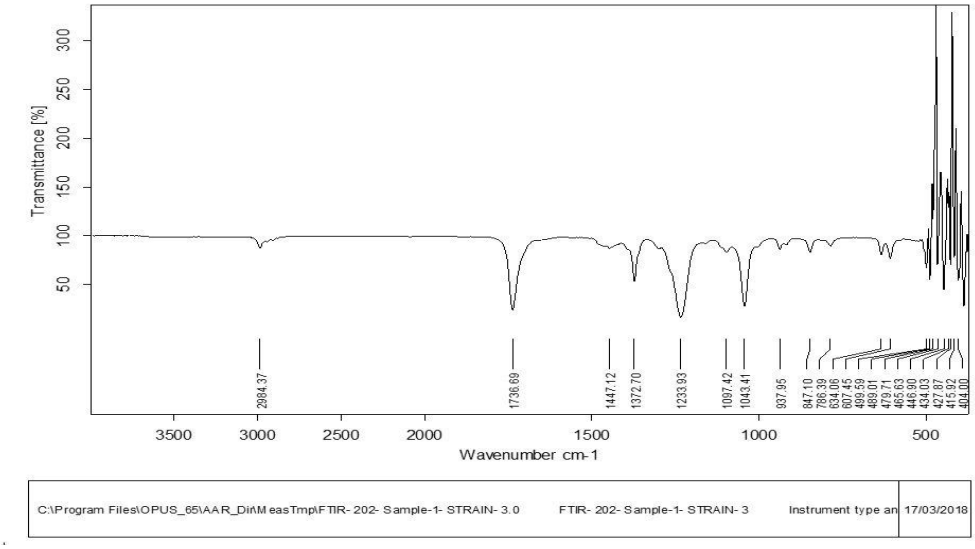

Figure 2 : FTIR Analysis of isolate 3

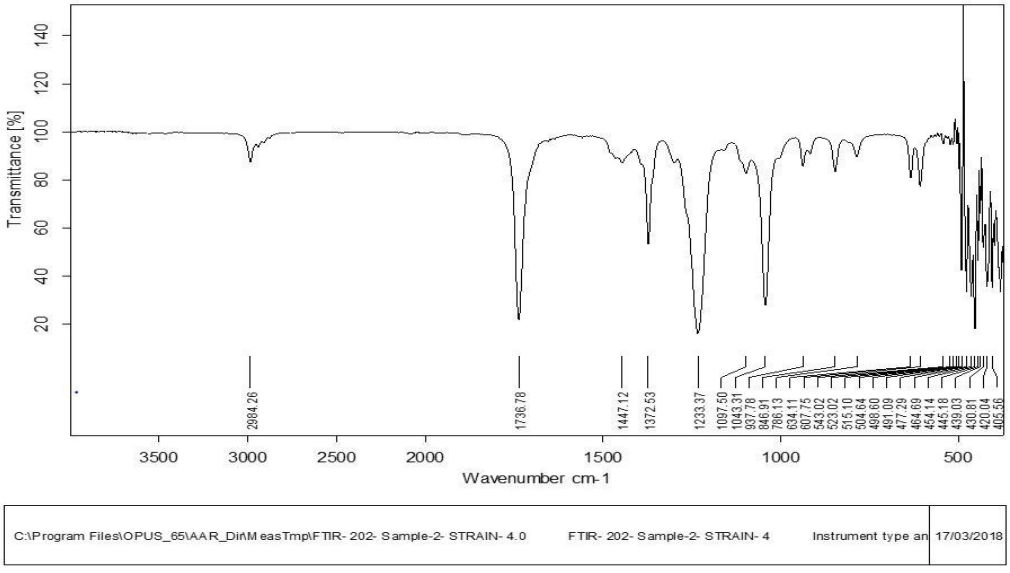

Figure 3 : FTIR Analysis of isolate 4

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Well diffusion assay : To plates with overnight growth culture, 10µl of 5% plant extract were added to wells. A positive and negative control was maintained. Ampicillin drug was loaded in the positive well and DMSO was loaded in the negative. The plates were incubated un-inverted overnight at 37˚C and observed the next day. It was observed that in isolate 3 and isolate 4 (Figure 4 and Figure 5), the cooked seed extract that is sample 4, had the highest antimicrobial property by displaying largest zone of inhibition among all the other samples. Therefore further on tests were done using samples 4.

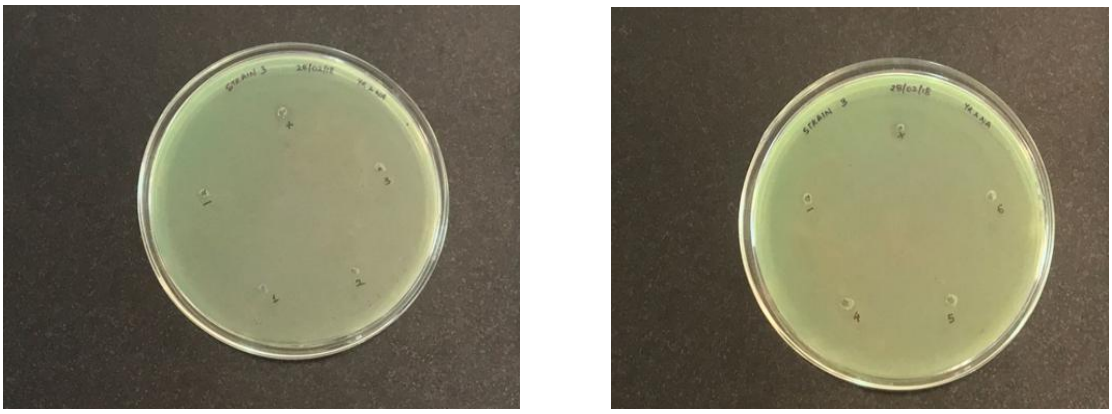

Figure 4 : The well diffusion plates along with positive and negative control for isolate 3

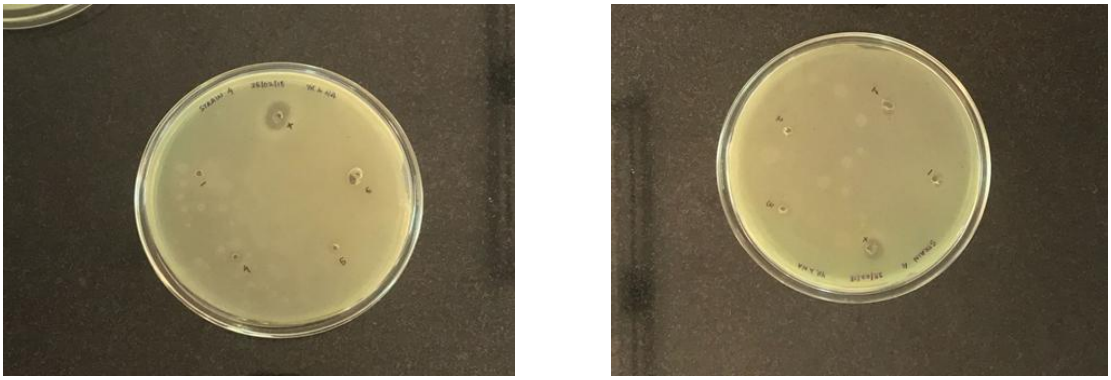

Figure 5 : The well diffusion plates along with positive and negative control for isolate 4

Biofilm Inhibition by plant sample extracts : Sample 4 was used for further testing. Percentage of inhibition was calculated using the formula stated below.

% of Inhibition = (OD in control -OD in treatment x 100) / OD in control

Biofilm formation can be inhibited by sample 4 as illustrated in Figure 6, and it is determined that 10% extract of sample 4 has a higher inhibitory effect than 5% of sample

4, against isolate 3 and isolate 4 as shown in Fig 6. It was noticed that 10% extract showed an inhibition of 73.82% and 5% extract showed an inhibition of 32.68% against isolate 3.

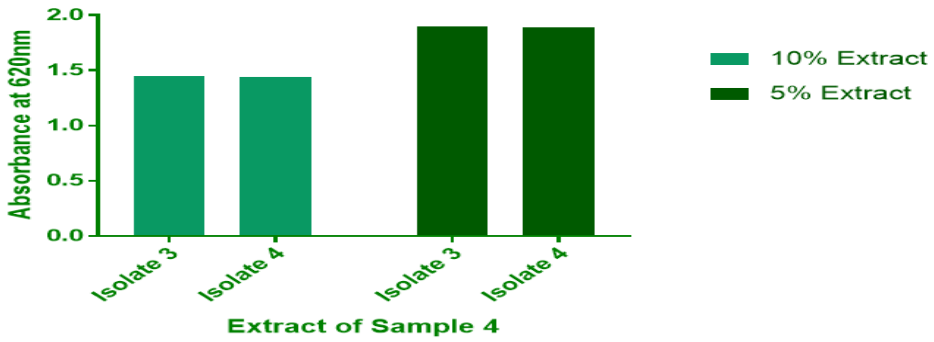

Figure 6 : Compilation of the graphical representation of biofilm inhibiting activity of sample 4

Against isolate 4, 10% extract exhibited a 51.35% inhibition and 5% extract showed 15.05% inhibition. The seed samples were found to have biofilm inhibition which could be due to presence of any photochemical group present in them. Individual compounds were not isolated nor further characterized to isolate the compound of interest that is able to confer the biofilm inhibition property. Hence, the specific compound(s) responsible for biofilm inhibition is unknown. Further isolation and detection of the phytochemical present that provide the anti-biofilm property is required (Figure 7).

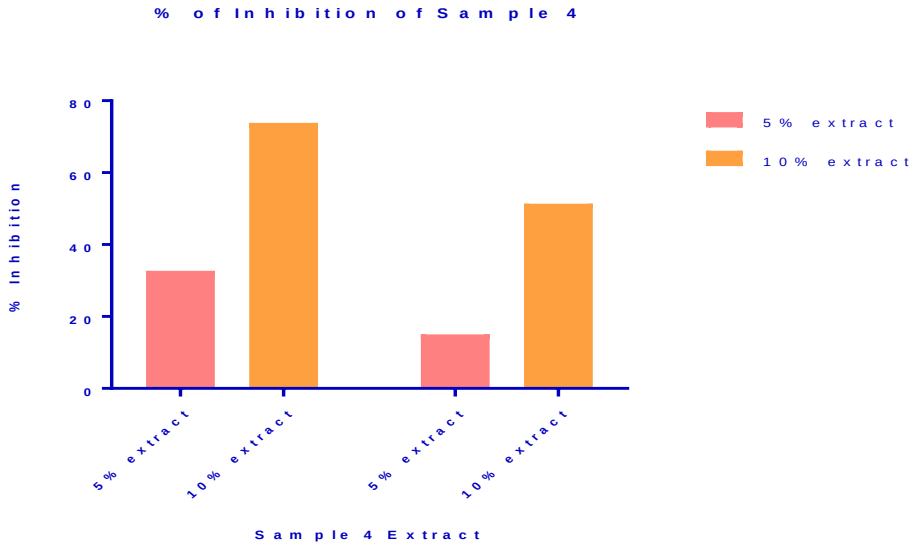

Figure 7 : Percentage inhibition of biofilm by sample 4

Conclusion

The isolation of pure colonies from the urine sample of diabetic patients was carried out, and was further classified and characterized by various biochemical tests which included IMViC, oxidase test, catalase test, casein hydrolysis test, urease test, and starch hydrolysis test. Using the standard curve of phthalic anhydride, the extracted AHL was quantified. The qualitative determination of double bonds present in AHL was determined by FT-IR. Antibiofilm activity of *Tamarindus indica* seeds, that were subjected to various processing methods was performed. Zone of inhibition was noticed in sample 4, i.e., cooked seed extract, hence antibiofilm assay was performed on isolate 3 and isolate 4 using sample 4 extracts. Percentage inhibition for 5% and 10% extract of sample 4 against isolate 3 was found to be 32.65% and 73.82% respectively. Percentage inhibition for 5% and 10% extract of sample 3 against isolate 4 was found to be 15.05% and 51.35% respectively. Phytochemical group responsible for the antibiofilm activity was not isolated and hence requiring further work to be carried on to identify the compound. This will give an understanding of the mechanism of action providing antibiofilm effect.

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This International e-Conference provides a global platform for the Eminent speakers, Researchers, young scientists and research scholars to present their scientific findings and disseminate knowledge among the students and academic fraternity. For the young minds, we have organized for the first time in the department Virtual international platform which witnessed participation from attendees various parts of India and abroad which is one of the major event highlights. The e-Conference organized ignited scientific temper among the students and academicians to keep abreast with the latest developments happening around the globe. This rich academic activity would facilitate students to learn the intricate nuances of the field and gain first-hand knowledge. In conclusion, congratulate Department of Biotechnology for successful conduct of International e-Conference. I wish great success for the department of Biotechnology for future endeavours to conduct various scientific events and create platform for budding research scholars, faculty and students.

Dr. Prathibha K. S.
Coordinator, Dept of Biotechnology

It is with great pleasure that, I present to you the proceedings of the International e-Conference. The Department of biotechnology has expanded its horizon for the conduct of various academic events. It is a matter of immense pride for all of us to host many events like webinars and e-conference during the pandemic period. We invited the students, faculty, research scholars, academicians and professional delegates to present their scientific work; this scientific gathering has provided a better platform for all the delegates from vivid streams. This proceedings underwent rigorous reviewing of full length papers and selection of manuscripts by the editorial committee for publication. A total of 30 papers were received. Full length papers were reviewed and further, selected for publication. I thank KLE management and Principal for their continuous support and encouragement in bringing this conference proceedings.

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