

VISION, 2025

Document of ENVIS CENTRE on Environmental Biotechnology 2016-2025



ENVIS Centre on Environmental Biotechnology
(Supported by Ministry of Environment, Forest & Climate
Change, Govt. of India)

Department of Environmental Science

University of Kalyani, Kalyani

Nadia, West Bengal-741235, India

www.deskuervis.nic.in

© Copy Right: ENVIS Centre on Environmental Biotechnology
Department of Environmental Science
University of Kalyani, Kalyani, Nadia, West Bengal
E.mail: desku@envis.nic.in

Edited &Compiled by: Prof. S. C. Santra and Dr. A. Mallick

This volume is published with the financial support from
Ministry of Environment, Forest & Climate Change, Govt. of India,
New Delhi

Published in India, July 2016

Preface

Environmental Information System (ENVIS) is established in the year 1984 as a network of Information Centre. It is planned by the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India. Aim of this programme is to provide descriptive data and environmental subject related numerical data. Now 69 centres are working under this network on various subject areas in the country.

ENVIS Centre on Environmental Biotechnology in the University of Kalyani, Nadia, is funded by MoEF&CC is meeting the task of disseminating information on various Environment biotechnology related subject area.

Environmental biotechnology is the application of all components of biotechnology to environmental problems. The prime target of this science is to abatement of pollution through bioremedation/ biotreatment or supporting as resources for human use in non polluting ways. It can also help in cleaner production of existing products. On the whole it encompasses aspects of natural resources management. With the emphasis on the management of natural resources and abatement of pollution as well as hazardous waste management, it is therefore proposed to set up an ENVIS Centre on 'Environmental Biotechnology'. Major emphasis of databank will focus on 'Pollutant Biodegradation' and its allied aspect.

The objective of this centre is to collect data, related to the above mentioned subject, from different major libraries with different journals, Annual reviews, Internet to generate a database and to create a website with this database from 2002 onwards. View point of this centre is to help the interested research workers, scientist, administrator and the public. Here various topics like Bio-engineering, Bio-degradation, Bio-remediation, Bio-transformation, Biosensor, Nano-biotechnology, Biomimicry etc. are covered. We are grateful to the various libraries and their staff for their extended cooperation in the collection of the articles.

First of all I would like to express my appreciation and thanks to Ministry of Environment, Forest & Climate change, Govt. of India for providing financial support. I am thankful to Department of Environmental Science, University of Kalyani and University authorities for providing support and functioning of the ENVIS Centre. Lastly I would like thanks to our associates Dr. Soma Mukherjee, Dr. A. C. Samal, Dr. A Mallick and Mr. Surov Banerjee for their enormous help during preparation of the vision document.

Prof. S. C. Santra
ENVIS Coordinator
ENVIS Centre on Environmental Biotechnology
Department of Environmental Science
University of Kalyani, West Bengal

About the ENVIS

The Ministry of Environment, Forest & Climate Change (MoEF&CC) has implemented a Central Sector Scheme entitled Environmental Information System (ENVIS), with the purposes of collection, collation, storage, retrieval and dissemination of information relating to a variety of themes associated with Environment Sector. ENVIS was set up as a Central Scheme in December 1982 (6th Five year Plan).

ENVIS is a decentralized system, a web-based distributed network of subject-specific databases. Its purpose is to integrate country-wide efforts in environmental information collection, collation, storage, retrieval and dissemination to all concerned. ENVIS, by providing scientific, technical and semi-technical information on various environmental issues, serves as the backbone of policy formulation and environment management at all levels of Government as well as decision-making aimed at environmental protection and its improvement for sustaining good quality of life of all living beings. Its major users also include institutes and individual scientists carrying out research projects and agencies carrying out environmental impact assessment of projects as well as public.

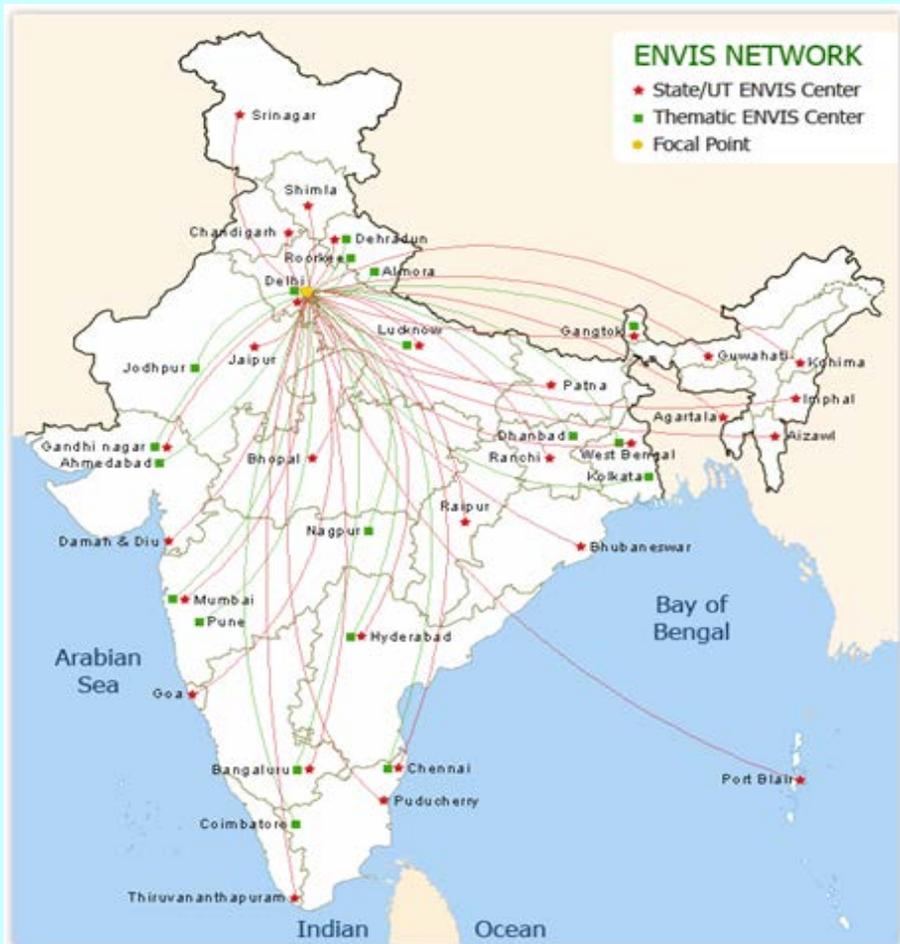
ENVIS is continuously producing value-added information products relating to Environment, Forest, Wildlife and Climate Change. This includes theme based newsletters, special publications, e-newsletters, thematic bulletins, technical reports, discussion forum, mobile apps, directories of information at state/regional/national level, bibliography, information products developed on parks and sanctuary, desertification maps, flora and fauna species distribution maps. All these information are readily available on ENVIS websites (<http://www.envis.nic.in>) which are dedicated to different interesting themes. The network presently consists of 69 Centres (Map-1), of which 29 Centres which deal with “State of the Environment and Related Issues” are hosted by the Environment/ Forest Department of State Governments/ UT Administrations. Remaining 40 Centres, hosted by environment-related governmental and non-governmental organisations/ institutes of professional excellence, have a thematic mandate. During the year 2015-16, the ENVIS Centres put together, witnessed over 1,40,00,000 hits and it is growing.

Each ENVIS Centre will update and maintain an information database that includes descriptive information and numerical data for suitable dissemination. Descriptive information will be maintained in the form of bibliographies, libraries, copies/



ENVIS Centre on Environmental Biotechnology

reprints/ abstracts of reports, articles, and research notes, and links to other databases/ networks, while numerical data on the subject/ theme assigned to the Centre will be collected, collated, compiled, processed and analyzed, and information products will be developed for online dissemination or in the form of publications and reports. All information thus compiled will be made available on the Centre's website, which can also be accessed through the ENVIS Portal.



Map: 1 All ENVIS Centres in India

ENVIS Centre on Environmental Biotechnology

ENVIS Centre on Environmental Biotechnology at the Department of Environmental Science, University of Kalyani, Nadia-741235, West Bengal (<http://www.deskuervis.nic.in>) was established in June, 2002. This is supported by Ministry of Environment, Forest and Climate Change, Government of India, New Delhi. The ENVIS was established in the year 1984 as a network of Information Centre. This network gives primary emphasis on the management of natural resources and abatement of pollution as well as hazardous waste management and also emphasis on databank development about 'Pollutant Biodegradation and its allied aspects.



VISION

- ✓ The vision of the centre is to maintain the environmental biotechnological data bank through systematic collection and compilations of information on Environmental Biotechnology in documentation and also providing information services.
- ✓ Publication of Newsletter, Abstract volumes, and Special books on the thematic area and also arrange for sensitization and training programme.
- ✓ Special day celebration on the thematic area, and allied environmental issues.
- ✓ The numerical data on environmental issues were compiled and interpreted.



MISSION

- ✓ The mission of the ENVIS Centre is to develop a dynamic website which is very useful, helpful, user friendly & highly demandable for the researchers, industry personals, NGOs and public who are interested in the field for accessing information through internet.



ENVIS Centre on Environmental Biotechnology

- ✓The centre provides query services to researchers, scientific communities and other concerned people. In most of the cases replies to the specific queries are given and in a few specific cases some relevant references are provided for better information support.
- ✓Establishment of liaison with various Institutes of India and abroad, working on the field of Environmental Biotechnology and also establishment of environmental data bank and documentation centre on the subject concerned.
- ✓ Prepared and circulate theme based information and documents on regional language, Bengali.

Biotechnology is the third wave in biological science and represents such an interface of basic and applied sciences, where gradual and subtle transformation of science into technology can be witnessed. Biotechnology is defined as the application of scientific and engineering principals to the processing of material by biological agents to provide goods and services. Biotechnology comprises a number of technologies based upon increasing understanding of biology at the cellular and molecular level led to the development newer areas like, cellular engineering, biochips and biomaterial science and nano-biotechnology etc.

Environmental Biotechnology is a sub discipline of biotechnology is the application of biotechnology to solve the environmental problems. It can simply be described as "the optimal use of nature, in the form of plants, animals, bacteria, fungi and algae, to produce renewable energy, food and nutrients in a synergistic integrated cycle of profit making processes where the waste of each process becomes the feedstock for another process". It is applied and used to study the natural environment and helps to develop, efficiently use and regulate the biological systems and prevent the environment from pollution or from contamination of land, air and water.

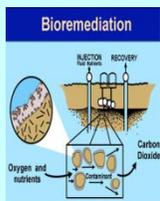
Environmental biotechnology helps for remediation of the pollutants generated by the industrial organizations and improving the infrastructure of the chemical industries to reduce and control pollution in chemical industries. To solve the current environmental

problems and use of sustainable natural resources, research and development on environmental biotechnology is going on day by day. We are collecting and compiling the data on research & application on various theme areas of environmental biotechnology like, Biofertilizer, Biopesticide, Bioenergy, Bio-composting, Bioaccumulation, Agricultural Biotechnology, Bio-sensor, Biodegradation, Bio-remediation, Bio-marker, Biotransformation, Pollen biotechnology, Bioengineering, Policy Issues, Nano biotechnology and Biomimicry etc. A number of such theme areas are yet to be incorporated.

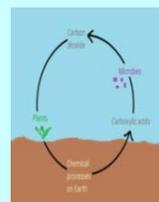
Bioaccumulation: An increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted.



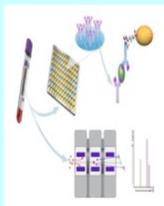
Bio-remediation: It is a clean-up technology that uses naturally occurring microorganisms and plants to degrade hazardous substances into less toxic or nontoxic compounds. The microorganisms may ingest and degrade organic substances as their food and energy source and degrade organic substances that are hazardous to living organisms and natural environment.



Bio-transformation: This is a process of Biological changes of complex compound to simpler toxic to non-toxic or vice-versa. Several microorganisms are capable of transforming a variety of compound found in nature but generally with respect to synthetic compound they are unable to show any appropriate action.



Bio-marker: Biomarker or biological marker generally refers to a measurable indicator of some biological state or condition. The term is also occasionally used to refer to a substance, the presence of



which indicates the existence of a living organism. It often measured and evaluated to examine normal biological processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention. The environmental monitoring and quality assessment also measured through use of different biomarkers.

Bio-energy: It is energy derived from the conversion of biomass where biomass may be used directly as fuel, or processed into liquids and gases. Bioenergy also include energy derived from biological agents through microbial and biotechnological processes.



Bio-fertilizer: Biofertilizer is a substance that contains living microorganisms of bacterial, fungal and algal origin which, when applied to seeds, plant surfaces, or soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant and restore the soil's natural nutrient cycle and build soil organic matter. Microorganisms like, Rhizobium, Azospirillum, Azotobactor, Phosphobacteria, Mycorrhiza and some BGA that play crucial role in the fertility management are either free living or having symbiotic association with plants. The pteridophytic plant *Azolla* also used as biofertilizer by fixing atmospheric nitrogen in agricultural field.



Bio-composting: Composting is the process of converting all biodegradable wastes into organic manure. It is the natural process of microbial and biological decomposition and recycling of organic material into a humus rich substance. Vermicompost is a composting technology that convert all biodegradable waste into nutrient rich organic manure with the help of composting earthworm.



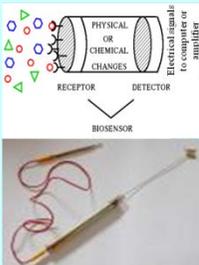
Bio-pesticide: Bio-pesticides control pests that include naturally occurring substances (biochemical pesticides), microorganisms (microbial pesticides), and pesticidal substances produced by plants containing added genetic material (plant-incorporated protectants). A biopesticide technology develops by transfer of gene from *Bacillus thuringiensis* for biological control of insect and pests in crop plants.



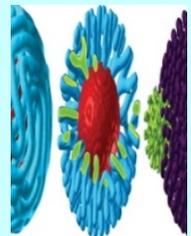
Bio-degradation: Biodegradation is nature's way of recycling wastes, or breaking down organic matter into nutrients that can be used by bacteria, fungi, or other biological means. By applying these natural forces of biodegradation, people can reduce wastes and clean up some types of environmental contaminants. Through degradation, we accelerate natural biodegradation and convert organic wastes to a valuable resource.



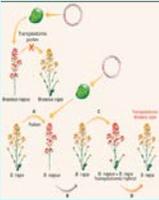
Bio-sensor: Biosensor represents biophysical devices which will detect the presence and measure the quantities of specific substances like sugars, proteins, variety of toxins and pollutants in industrial effluents from the environments. In designing a biosensor an enzyme or an antibody or even microbial cells are associated with microchip devices which are used for quantitative estimate of a substance.



Bio-engineering: It is a developing multidisciplinary approach to the solution of problems in environment, medicine and biology, based on the application of advances in science, engineering and technology. A major focus for bioengineering is to improve the quality of life of people with medical and social conditions that restrict independent living and integration within the community.



Pollen biotechnology: This is a new field of science dealing with the pollen chemistry allergenicity of aerospora. This also covers genetic manipulation of pollen development of haploid culture. Such haploid plant has remains values in genetic research.



Biotechnology policy issue: Biotechnology appears to be an emerging science in present decades. Genetic manipulation and development of genetically modified organism (GMOs) in human welfare is now showed a potential prospect and risk. Thus researches and application of Biotechnology in diverse field is a major policy issue in the recent time.



Agricultural biotechnology: Over the years tremendous success was made in diverse field of agriculture by applying biotechnology. It includes development of genetically modified crops, genetically improvement in sericulture practices, improvement in biofertilizer development and similar other aspects. Crop production against pest and disease stress resistance of crops also considered to be an emerging area of Agricultural Biotechnology.



Nanobiotechnology: Nanobiotechnology is the branch of nanotechnology with biological and biochemical applications or uses. Nanobiotechnology often studies existing elements of nature in order to fabricate new devices. Nanobiotechnology is applied for biological and biochemical activities from elements of nature to fabricate new devices like biosensors. Nanotechnology has also potential for applications under various environmental monitoring and remediation.



Biomimicry: Biomimicry, the discipline of applying nature's principles to solve human problems, provides the means to achieve both environmental and economic goals. Many of the mechanisms and systems found in nature are highly efficient, eschew waste, and are sustainable in a virtually closed system. Biomimicry could be a major economic game changer.



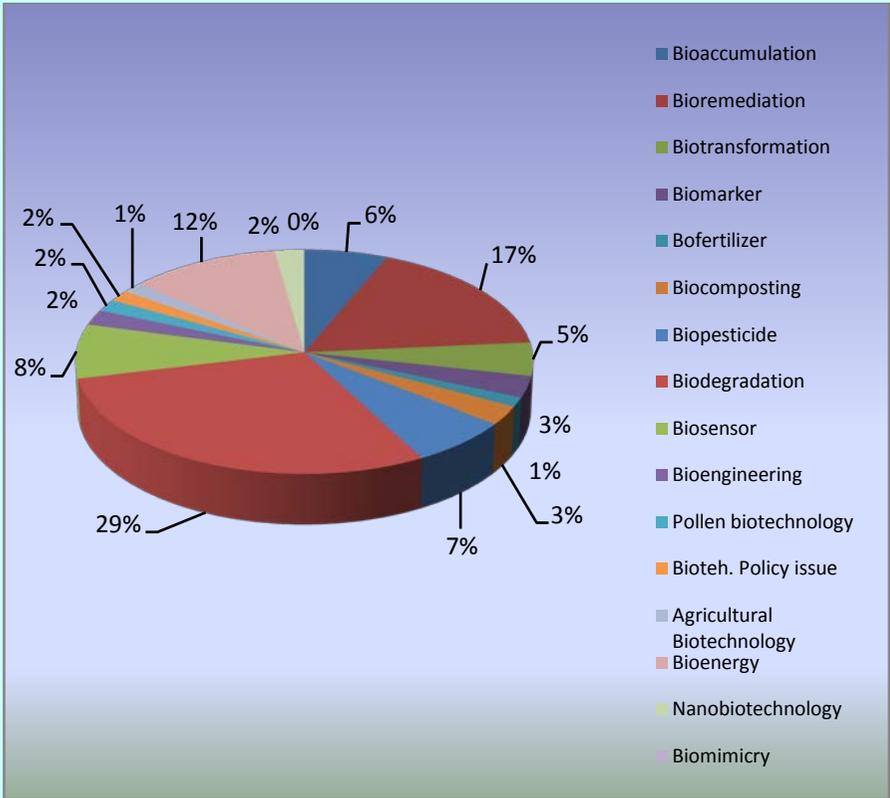
For centuries humans have used micro-organisms to produce foods and drinks without understanding the microbial processes underlying their production. In recent years the understanding of the biosynthetic pathways and regulatory control mechanisms used by micro-organisms for production of several metabolites has been increased by developing the knowledge of biochemistry of industrially important organisms. Notable biotechnologies for food processing include fermentation technology, enzyme technology and monoclonal antibody technology etc. Beneficial microbes participate in fermentation processes, producing many useful metabolites such as alcoholic beverages, dairy products, enzymes, organic acids, solvents, vitamins, amino acids, antibiotics, growth regulators, flavours and nutritious foods which have very high market value.

One of the best known applications of genetic engineering is that of the creation of genetically modified organisms (GMOs). There are potentially biotechnological applications of GM, e.g. oral vaccines produced naturally in fruit at very low cost. This represents, however, a spread of genetic modification to medical purposes and opens an ethical door to other uses of the technology to directly modify human genomes. A genetically modified food is a food product derived in whole or part from a genetically modified organism (GMO) such as a crop plant, animal or microbe like yeast. The other areas of biotechnology are the important of live stock, improvement of diseases control, efficiency of reproduction, improvement of environment etc.

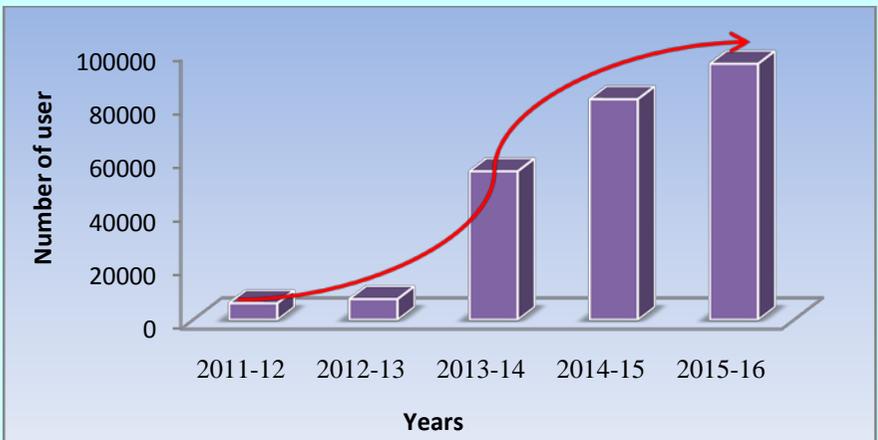
Biotechnology has a promising future. Moreover, biotechnology will be accredited for some revolutionary technology. Recent advances in bio-energy, bioremediation, synthetic biology, DNA computers, virtual cell, genomics, proteomics, bioinformatics and bio-nanotechnology have made biotechnology even more powerful. Recent discovery of conduction of electricity by DNA and its behaviour as a superconductor has opened a new realm in modern science. Biotechnology will have profound impact in world economy. Biotechnology is a golden tool to solve some of the key global problems like global epidemic, fatal diseases, global warming, rising petroleum fuel crisis and above all poverty. Among all of our development in day to day we should be keep in mind for sustainable use of our nature and natural resources and take care of the natural environment.

The path from a test tube to the field is not a straight highway. Both intellectual and financial resources should be realized before new discoveries pave their way to industrial applications. In conclusion, biotechnology has also proved to be extremely productive and innovative and 21st century should be the century of biotechnology.

The ENVIS Centre on the theme area Environmental Biotechnology was established in 2002. This is a unique theme area for data collection and dissemination with respect to biotechnology related to environmental aspects. For last 14 years we have compiled over **7,500** abstracted data relating to environmental biotechnology research and application. We have maintained a website (<http://www.deskuenvis.nic.in>) which is very useful, user friendly and highly demandable for the public, researchers, industry personals, NGOs who are working in this related field. The centre provides query services to researchers, scientific communities and other concerned people. The website is regularly updating with newer information and the numerical data are statistically incorporated in the website time to time.



Theme wise abstract uploaded from 2002-2016



Website user statistics (last 5 year)

Objective

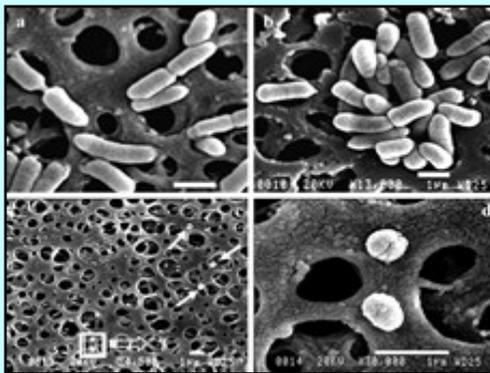
The general objective of this centre is to collect data, related to the above mentioned subject, from different major libraries mainly in West Bengal and also from other states in India, consult with different journals, Annual reviews, Internet and to generate a database and create a website with this information. View point of this journal abstract is to help the interested research workers, scientist, administrator and the public. The site is very useful, helpful, user friendly & highly demandable for the public, researchers, industry personals, NGOs who are working in this related field.

- Establishment of liaison with various Institutes of India and abroad, working on the field of Environmental Biotechnology
- Establishment of environmental data bank and documentation centre on the subject concerned
- Publication of regular "News letter" on the subject for wide dissemination of information to all concerned
- Establishment of advance training cum demonstration centre on some selected areas
- Development of a website in the field for accessing information through internet.

ENVIS Activities 2002-2015

Our ENVIS center has created a website (www.deskuenvis.nic.in) having related information on Environmental Biotechnology and regularly reformed and modified the website.

- Our ENVIS Centre has designed the website with several web pages with our brief Introduction, about our staff and contact details, current news on



biotechnology, current activities in environmental biotechnology in national and international organizations related to our theme area.

- According to ENVIS, MoEF format our website (www.deskuervis.nic.in) was reframed/restructured for more user friendly with easy navigational options and with uniform header and footer section.
- The database page contains thousands of recent abstracts published in different national and international journals on different aspects on environmental biotechnology. The abstracts were regularly uploaded into the webpage.
- A page on Microbes in Application having different groups of microbes and their application. Different microbial culture centers have been included with their total number of microbial species present. Also links have been given with different national and international microbial culture centers. Effective Microorganisms (EM) page was also included.
- Our ENVIS Centre has published **28** volumes of abstracts and **28** volumes of newsletters till date with **2** books on '*New Frontiers of Environmental Biotechnological Application*' and '*Recent Biotechnological Applications in India*'.
- We have various library facilities consists of e-books, journals, newsletters, abstract volumes, research publication and thematic based video clipping. The books are mainly of Environmental Biotechnology and related subjects from national and international publication. Several national and international journals and reprints are collected in our library.
- Our thematic area center has developed a separate web page. The web page contains different useful key items like Emerging issues, Database, Organizations, Government departments, Policy matters, Universities/Institutes offering the Biotech courses, Biotech parks and Incubators etc.
- Universities and Institutes offering the courses on the subject area.
- List and CVs of National and International Experts on Environmental Biotechnology were uploaded in the website.

- Hazardous waste, disposal, management, E-Waste disposal and handling, environmental standards *i.e.* Air, Drinking water, Noise and Industrial discharge were added in convention and treaties page.
- New State biotech policies were added.
- Technologies transferred uploaded.
- GMOs- GMO Golden Rice in Asia with enhanced Vitamin A benefits for consumers.
- Current research on subject areas.
- National research organizations and their activity were added.
- Glossary on the subject area.
- Report on web users and ENVIS centre service.
- Environment Calendar with their themes updated regularly.
- Video library was established on Algal fuel, Biodiesel from *Jatropha*, Introduction to biotechnology, Saving the environment and Educational environmental video.
- Bhuvan portal was added in front page.
- We established links with different national & international research institutes related to environmental biotechnology.
- Links with other Institutions/Universities/ Organizations (National / International) working in similar fields.
- We have established linkages with Government, academic, non-governmental organizations, and with all ENVIS Centre in India.
- We have now more linkages with information sources and are increasing the information content of our web site and our newsletters.
- Attend and participate in all meetings & conference organized by the Ministry.
- All the data & information stored in our website are reliable & relevant.
- Continuous efforts are made in maintaining the reliability and relevance of all the data & information stored in our website.

- In the major activity page, we have uploaded a regional language interface on different major issues of biotechnology, extension activities in our website.
- Our Centre has also organized training programme, seminar, workshop and on techniques and applications of biotechnology in Department of Environmental Science, University of Kalyani. We have regularly put forthcoming information on seminar/conference/symposia to be held related to biotechnology and environment.
- Our site is very useful, helpful, user friendly & highly demandable for the researchers, industry personals, NGOs who are working in this related field and it has been designed in such a way that usages of very simple hyperlinks have made it possible for users to get an easy access to the links with minimum time investment.
- The web-page of 'database' has been made more informative with more linked pages like 'Sub thematic Areas' details, 'Application case studies' and 'Patents in Thematic Areas' containing information on Indian and other patents.
- The centre provides query services to researchers, scientific communities and other concerned people in two ways. In most of the cases replies to the specific queries are given and in a few specific cases some relevant references are provided for better information supports.
- Identification of information/data gaps in the web site was carried out and suitable corrective action was undertaken to fill these gaps, namely: More Indian journals were added to the database; More search criteria were introduced (eg. Year , Author and Journal name etc)

Performance of our ENVIS Centre (grading by ENVIS Cell, MoEF & CC)

2015-16		2014-15		2013-14		2012-13		2011-12	
Marks	Grade								
80	A	72	B	80	A	78	B	81	A

Workshop, Seminars and Trainings

Regularly organizing outreach programmes, workshops, seminars and trainings on the thematic area, Environmental biotechnology.

1. Workshop on Environmental Biotechnology was organized on 21st March 2003. A total of 21 participants took part in the workshop.
2. Training cum Workshop on 'Modern Biochemical Techniques in Environmental Biotechnology' was held on June 11, 2004.
3. Two days of seminar cum workshop on Industry-Institute Partnership and Environment Protection was held on 9-10 January, 2006 in University of Kalyani.
4. Two day National conference on "Solid Waste Management" was organized on 18- 19th March, 2008.
5. Seminar cum workshop on the topic of Chronic Arsenicosis- a public health concern in West Bengal was organized on 12th January 2010.
6. Round table discussion on "Prospect of Biofertilizer and Biopesticides in Indian Agriculture" on March 23, 2011.
7. Interactive workshop on "Food security, GM crops, GMO and Biosafety Issues" was organized by ENVIS Centre on Environmental Biotechnology, University of Kalyani, Nadia, West Bengal on March 19th, 2013.



8. Seminar lecture cum discussion on Bioremediation and Biodegradation aspects was held at the ENVIS Centre on December 12, 2013.
9. Seminar lecture cum discussion on Urban Water Scarcity, Climate Change, Water Recycling, Energy and Greenhouse Emissions was held on January 2nd, 2014.
10. Workshop on “Agrobiotechnology Promotion: Prospects and Constraints” held at Usha Gram Trust, Birnagar, Nadia on 10th January 2015.
11. **Display of ENVIS Publications in 40th Kolkata International Book Fair:** The ENVIS centre participated in Kolkata (International) Book Fair, held at Kolkata from January 26th – 7th February, 2016 for displaying ENVIS activities & publications of centre in Kalyani University Stall (No-274).
12. **Display of ENVIS Activities in Science Express Climate Action Special (SECAC):** The ENVIS Centre participated in the exhibition of Science Express Climate Action Special (SECAC), held at Barrackpore railway station, West Bengal from 18-21 January, 2016. During the visit of SECAC we have displayed activities of our ENVIS centre to the school children, research students, NGOs and academicians and public.



Publications

Publishing Newsletter, Abstract volumes, leaflet and Special books on the thematic area in regular basis.

The centre biannually published **Newsletters (ISSN: 09742476)** and **Abstract volumes** of research papers collected from the various areas of Environmental Biotechnology from different journals. The abstract volume covers various topics like Bioenergy, Bioengineering, Biodegradation, Bio-remediation, Bio-transformation, Biomarker, Biofertilizer, Biocomposting, Biopesticide, Biosensor, Bioengineering, Pollen-Biotechnology, Agricultural Biotechnology, Nano Biotechnology and Biomimicry etc.

We also publishing the theme based **edited books** regarding some Recent Biotechnological Applications in India and their feasibility for solving the environmental problems. The Chapters deal with different aspects of environmental problems and their solution through using biotechnological process. An integrated process of biotechnological application has also been emphasized in different chapters.

1. News letter

The centre published **Newsletters (ISSN: 09742476)** twice a year. From fourth issues of news letter we are publishing on special theme based topics.

Vol 1 (September, 2002): EMCB-ENVIS on Environmental Biotechnology

Environmental biotechnology means the specific application of biotechnology to the management of environmental problems. This news letter covers-

- the introduction & activities about ENVIS.
- Inaugural news of ENVIS node.
- Article on 'Bioremediation in the perspective of environmental pollution abatement'.



Vol 2 (June, 2003): World Bank Assisted Environmental Management Capacity Building Technical Management Project (ENVIS -EMCBTAP)



This volume covers-

- ▶Profile of EMCB-ENVIS Centre,
- ▶Campus News,
- ▶Biotechnology in West Bengal- vision 2002,
- ▶Works on Environmental Biotechnology in West Bengal,
- ▶ Focus on current problems - Arsenic Bio-accumulation in Rice Field Ecosystem.

Vol 3 (December, 2003): EMCB-ENVIS node on Environmental Biotechnology

This news letter contain -

- ▶Ecofriendly solid waste management in leather industry,
- ▶Slaughterer house waste utilization,
- ▶Microbial population and nitrogen fixing power of landfill soils contaminated with heavy metals,
- ▶Institution News,
- ▶Conference News,
- ▶Science News update.



Vol 4 (June, 2004): Activities of Indian Institutes Engaged in Environmental Biotechnological Research



The Institute was established in the year 1958, as Central Public Health Engineering Research Institute(CPHERI). The Institute was renamed in 1974 as National Environmental Engineering Research Institute (NEERI) by Late Smt. Indira Gandhi, the then Prime Minister of India and President, CSIR. The main campus at Nagpur is spread over 108 acres where the laboratory buildings and demonstration plants are located. Green stretches of land are liberally scattered over the campus and nearly 40 percent of the land is under forest cover.

Vol 5 (December, 2004): Special Issue on Biopesticide

Recent development in pest control research have proved the urgent need for developing biological control methods with use of microbial pathogens in the control of several pests that cause serious crop degradations year after year. Among microorganism, entomopathogenic fungi constitute the largest single group of insect pathogens. Such insect killing fungi are very fast micro-organisms to be recognized as disease causing agent in insects. Entomogenous fungi are promising bio-control agent for a number of crop pests.



Vol 6 (June, 2005): Biosensor

Biosensors are devices incorporating a biologically active element in intimate contact with a physico-chemical signal transducer and an electronic signal processor. The goal of this combination is to utilize the high sensitivity and selectivity of biological sensing for analytical purpose in various fields of research and technology. Recent developments give information on the function of the biocomponents used in biosensors, primarily enzymes, and kinetics of enzyme activity.



Vol 7 (December, 2005): Biofuel

In recent decades, energy crisis became more prominent through out the world. Biofuel promotion appears to be one of options for harvesting renewable energy for multipurpose use in future. Biofuels are fuels like ethanol and biodiesel that are made from biomass materials, oil seeds. Biofuel is environmental friendly, *i.e.* renewable, non toxic and biodegradable and significantly cleaner burning compared to diesel & petrol. It produces less air pollutants like, particulates, carbon monoxide, hydrocarbons and toxic aerosol.



Vol 8 (June, 2006): Biotechnology for Sustainable Development



The status of India's biodiversity, discussing several key development priorities. It shows how these could be addressed through wider use and industrial applications of genetic resources specifically biotechnology and increased trade in products derived from them. The country's present scientific and technological capacities in the public and private sectors as well as the community level in this context agreed obligations to reduce the barriers. The Government is encouraging national firms to increase their participation in foreign trade including science based industries, such as pharmaceuticals and biotechnology.

Vol 9 (December, 2006): Biofertilizers

Agriculture is getting more and more dependent upon the steady supply of synthetic inputs (mainly fertilizers), which are products of fossil fuel. Adverse effects are being noticed due to the excessive and imbalanced use of these synthetic inputs. This situation has led to identifying harmless inputs like biofertilizers. Biofertilizers are most advanced bio technology practices necessary to develop organic agriculture, sustainable agriculture, green agriculture, and non-polluting agriculture.



Vol 10 (June, 2007): Waste Management



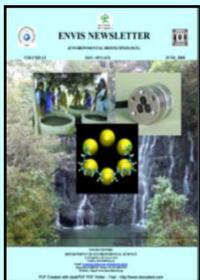
Waste management has become a global concern since the early eighties of last century. The alarm rang with the changing types of wastes, from biodegradable market wastes to the e-waste of today. Recent developments in biotechnology are providing new ways towards waste management to make wealth from the waste. The energy recovery from wastes is another flourishing aspect of waste management, which is being advocated in developing countries now days.

Vol 11 (December, 2007): Marine Biotechnology

Oceanic resources are vast. We have very limited knowledge about the quantity of biological resources, minerals and also natural oil and gas deposits. Within the general field of biotechnology as an applied science that seeks to enhance human life and environmental quality, the newer field of “Marine biotechnology” has established. Simply marine biotechnology seeks to develop goods and services from the organisms and processes of the ocean.



Vol 12 (June, 2008): Environmental Nanotechnology: An Emerging Science



With the passage of time the relevance of Environmental Biotechnological application emerges as a very potential technology for grass root level application. Thus there is a great need for popularization of various technologies and subsequently their field applications. In coming decades the usefulness of nanomaterials in various fields of environmental application should be a major thrust area. The applications of environmental nanotechnology fall into three categories. 1) Pollution Prevention/ Environmental Protection, 2) Environmental Remediation, 3) Environmental Sensors.

Vol 13 (December, 2008): Waste Water Treatment Biotechnology

During the last decade, there has been growing concern that the world is moving towards a water crisis. It is estimated that, within the next 50 years, more than 40% of the world's population will be invariably facing water stress or water scarcity. Applications of biotechnology tools (including genetic modification) can help developing countries to cope with growing water scarcity.



Vol 14 (June, 2009): Biotech Industry - An Emerging Sector



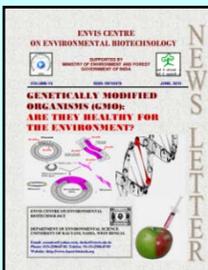
The biotechnology sector is one of the fastest growing knowledge-based sectors and is expected to play a key role in shaping rapidly developing economy. Indian biotechnology industry is increasing in its size on a global biotech industry map. India is emerging as a biotechnology hub in recent times and is demonstrating to be a perfect location for manufacturing as well as high-level biotech research programmes.

Vol 15 (December, 2009): Biotech Products in Environmental Management

Major new technologies are seldom understood – biotechnology is no exception. While it promises a cornucopia of products, that may enhance human life, there are perceived risks as well. Moreover the public policy and regulatory processes involved in assuring the safety of the products of biotechnology are to be examined.



Vol 16 (June, 2010): Genetically Modified Organisms (GMO)

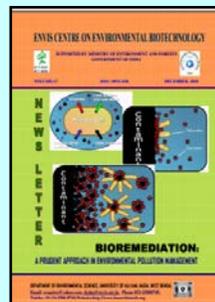


GMOs are just one product of the rapidly growing field of biotechnology. New techniques have been developed that make it easier for plant breeders to monitor the outcomes of conventional crossing and selection; allow useful genes to be identified and cloned; and make it possible for genes from the same species to be utilized more quickly and precisely than do the methods of traditional plant

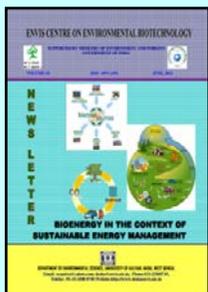
breeding. GMOs incorporate genes from another plant, animal, bacterial or viral species. GMOs are one product of a remarkable expansion in agricultural biotechnology. They offer the possibility of addressing some difficult problems but they also present a number of uncertainties. Their development has sparked debates about the direction of agriculture and the control of technology.

Vol 17 (December, 2010): Bioremediation

With advances in biotechnology, bioremediation has become one of the most rapidly developing fields of environmental restoration, utilizing microorganisms to reduce the concentration and toxicity of various chemical pollutants, such as petroleum hydrocarbons, PAH, PCB, phthalate esters, nitroaromatic compounds, industrial solvents, pesticides and metals. A number of bioremediation strategies have been developed to treat contaminated wastes and sites. Environmental biotechnology employs the application of genetic engineering to improve efficiency and cost, which are central to the future of widespread exploitation of microorganisms to reduce the environmental burden of toxic substances.



Vol 18 (June, 2011): Bioenergy in the Context of Sustainable Energy Management



In a world facing growing energy demand, high oil prices and an urgent need to reduce greenhouse gas emissions, bioenergy is an essential energy option for a range of applications as part of a mix that includes energy efficiency, renewable energy, and changed patterns of production and consumption. This news letter provides an in depth analysis of Bioenergy issues in global context.

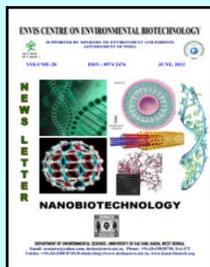
Vol 19 (December, 2011): Biopiracy

The issue of biopiracy has become highly contentious and seems to have played a catalyzing role in the introduction of access legislation in some developing countries. The word 'biopiracy' is applied somewhat loosely to the extent it is not always clear who the victims actually are, or it indeed there are any. But is normally refers either



to the unauthorized extraction of biological resources and/or associated traditional knowledge from developing countries, or to the patenting of spurious inventions based on such knowledge or resources without compensation. In this newsletter, an attempt has been made to discuss the biopiracy related issues with respect to India.

Vol 20 (June, 2012): Nanobiotechnology



Over the past 20 years, toxicology research has suggested complex and previously unrecognized associations between material physicochemistry at the nanoscale and biological interactions. With the rapid rise of the field of nanotechnology and the design and production of increasingly complex nanoscale materials, it has become ever more important to understand how the physical form and

chemical composition of these materials interact synergistically to determine toxicity. As a result, a new field of research has emerged nanotoxicology. In this newsletter, attempted to discuss the nanobiotechnology related issues with respect to India.

Vol 21 (December, 2012): Biomining

Biomining is the extraction of specific metals from their ores through biological means usually bacteria. Although it is a new technique used by the mining industry to extract minerals such as copper, uranium and gold from their ores but now days, biomining occupies an increasingly important place among the available mining technologies. Today biomining is no longer a promising technology but an actual economical alternative for treating specific mineral ores. Traditional extractions involve many expensive steps such as roasting and smelting, which requires sufficient concentrations of elements in ores while low concentrations are not a problem for bacteria because they simply ignore the waste



which surrounds the metals, attaining extraction yields of over 90% in some cases.

Vol 22 (June, 2013): Waste-to-Wealth: Biotechnological Application

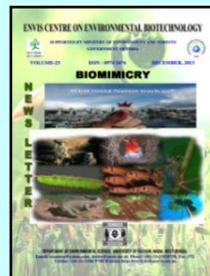


Waste management is recognized as having the dual functions of resource recovery and final disposal. People all over the world are earning revenue from both stages through recovery of recyclable materials and to some extent, conversion of waste to energy. Waste is no longer something that is unwanted. It is now regarded as resources for businesses that generate income.

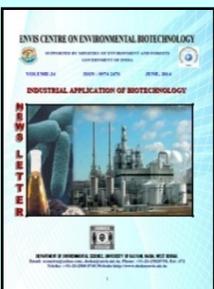
Turning waste into wealth not only makes good environmental sense, but also turns “trash” into “cash”.

Vol 23 (December, 2013): Biomimicry

Biomimicry is an emerging design ethic that consciously observes and emulates nature’s forms, processes and systems. It is based on the understanding that for four billion years organisms in nature have been evolving and refining solutions to universal problems, e.g. packaging, adhesion, climate control, benign manufacturing, etc. They achieve these feats within the same context and boundary conditions as humans.



Vol 24 (June, 2014): Industrial application of Biotechnology

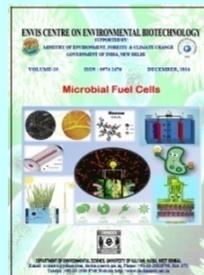


Industrial biotechnology also referred to as White Biotechnology. It holds immense promise for transforming a wide variety of industrial processes by preventing pollution, reducing costs, conserving natural resources, and delivering innovative products to improve our quality of life. It applies the techniques of modern molecular biology to improve the efficiency and reduce the

environmental impacts of industrial processes.

Vol 25 (December, 2014): Microbial Fuel Cells

Microbial fuel cells (MFC) use the power of bacteria and convert energy released in metabolic reactions into electrical energy. This environmentally-friendly process produces electricity without the combustion of fossil fuels. Using microbes to generate electricity implies that the processes in an MFC are self-sustaining; the bacteria replicate and continue to produce power indefinitely as long as there is a food source to nourish the bacteria. Moreover, MFCs are very efficient, do not rely on fossil fuels, and can run effectively on sources like food waste and sewage.



Vol 26 (June, 2015): Integrated Pest Management



Integrated Pest Management (IPM) is a program of prevention, monitoring, and control which offers the opportunity to eliminate or drastically reduce the use of pesticides, and to minimize the toxicity of and exposure to any products which are used. It is an effective and environmentally sensitive approach to pest management that relies on a combination of observation and common practices.

IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment.

Vol. 27 (December, 2015): Nano Tree for Novel Energy Harvesting Technology

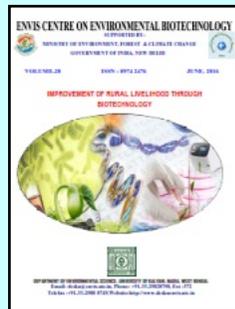
Nano tree is an artificial tree which makes use of renewable energy from sun, wind and collecting solar and wind energy. This is possible by the use of nature design with synthetic trees, shrubs, plants and flowers. Energy harvesting trees are super ecofriendly synthetic trees will make use of renewable energy from the sun along with



wind power, which are an effective clean and environmentally sound medium of gathering solar radiation and wind energy. Leaves are distributed throughout artificial trees and plants and can supply entire household with maximum efficiency.

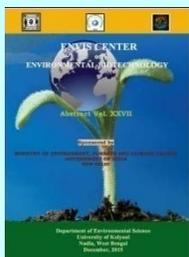
Vol. 28 (June, 2016): Improvement of rural livelihood through Biotechnology

Biotechnologies have played an important role in the development of food products over many centuries. In recent years the "modern biotechnologies" of molecular biology and gene technologies have gained a significant role in the cereals sector, sustainable development goals that embody ecological, social, and economic requirements. Applications of modern biotechnology show a significant contribution to sustainable gains in agricultural productivity, reducing poverty, and enhancing food security in developing countries.



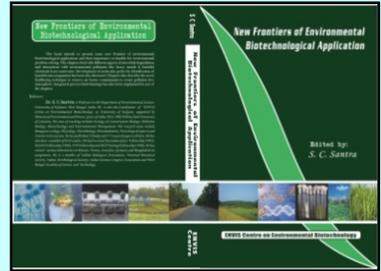
Abstract volume

There are **28** numbers of **abstract volumes** on thematic area were published upto June 2016. Abstract Volume of ENVIS Centre contains the abstracts of research papers collected from the various areas of Environmental Biotechnology from different journals. The abstract volume covers various sub-thematic topics like Bioenergy, Bioengineering, Bio-degradation, Bio-remediation, Bio-transformation, Biomarker, Biofertilizer, Biocomposting, Biopesticide, Biosensor, Bioengineering, Pollen-Biotechnology, Agricultural Biotechnology, Nano Biotechnology and Biomimicry etc. For last 14 years we have compiled over **7,500** abstracted data relating to environmental biotechnology research and application.



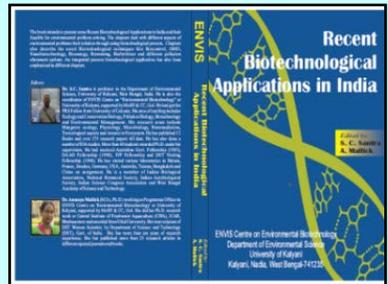
2 Special Book

- **New Frontiers on Environmental Biotechnological applications:** An edited book has been published from this centre during 2006-07. This book contains 9 chapters over 200 pages from eminent persons all over the country.



- **Recent Biotechnological Applications in India** (ISBN 978-93-5254-907-8(PB) & 978-93-5254-908-5 (HB))

This edited book has been published in 2015-16. This book was released in the Brain Storming Session for Eastern and North-Eastern ENVIS Centres of India May 06, 2016, by Dr. Thomas Chandy (Pr. Secretary cum PCCF), Mr. Amit Vashishtha and Mr. Abhay Kumar (Dy. Director, MoEF & CC). This book intends to present some Recent Biotechnological Applications in India and their feasibility for solving the environmental problems. The chapters deal with different aspects of environmental problems and their solution through using biotechnological process. An integrated process biotechnological application has been emphasized in different chapters. There are 10 chapters describe the novel Biotechnological techniques like Biocontrol, Bioremediation, GMO, Nanobiotechnology, Bioenergy, Biofertilizer and different pollution abatement options. The articles are very much informative and collected from India and abroad.



Mobile Apps: (Android Apps)

We have prepared the mobile Apps on 'Economic Algal materials', 'Important Fungi and their applications' and 'Important Bacteria and their applications' which are launched by Shri Prakash Javadekar, Hon'ble Minister of State, Environment, Forests and Climate Change, Govt. of India in ENVIS Workshops 17-19th February, 2016, New Delhi.



1. Economic Algal materials

- ✓ Agriculture/Industrial/Food and medicinal application of Algae with photographs.
- ✓ This is specially designed for students, researchers, scientist, and the general who are interested to know about the economic importance of Algae by ENVIS Centre on Environmental Biotechnology.

<https://play.google.com/store/apps/details?id=com.envis.envis&hl=en>

2. Important Fungi and Their Applications

- ✓ This apps contains Important Fungi and their Applications with photographs.
- ✓ There are four categories of application, Industrial/Food/Pathogen/ and Pollution abatement of Fungi

<https://play.google.com/store/apps/details?id=com.fungi&hl=en>

3. Important Bacteria and their Applications: Android Apps

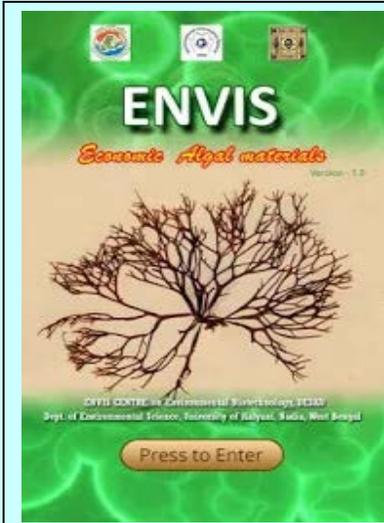
- ✓ This apps contains information about Important Bacteria and their Applications

<https://play.google.com/store/apps/details?id=com.yourapp.yourapp&hl=en>

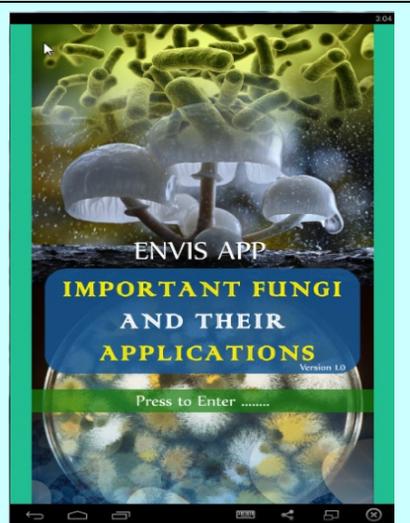
4. GM, Crops: Android Apps

- ✓ This apps contains information about GM, Crops

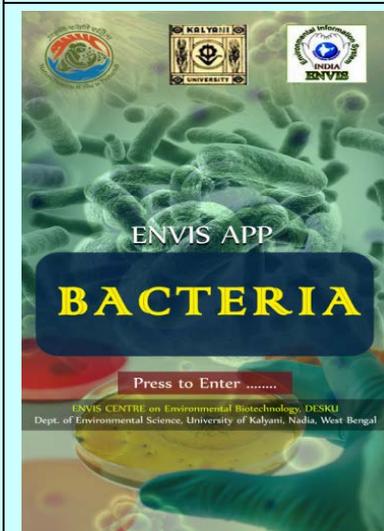
<https://play.google.com/store/apps/details?id=com.pathak.pathakmachines&hl=en>



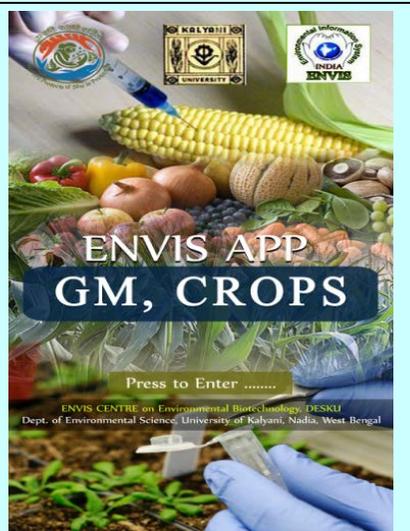
Economic Algal Materials



Important Fungi & their Applications



Important Bacteria & their Applications



GM Crops



The purpose of environmental biotechnology is used to study the harmful substances which are containing the environment and discovering and inventing such process which can be beneficial for the environment. Environmental Biotechnology, a sub discipline of Biotechnology is the application of biotechnology used to study the natural environment. It is useful in treating waste water and preventing pollution. Environmental biotechnology is more efficient in cleaning up wastes than conventional methods. Environmental Biotechnology utilizes the biochemical potential of microorganisms and plants for the preservation and restoration of the environment. It promotes sustainable and efficient use of natural resources like fungi, plants, algae, and bacteria in the industrial processes. It plays in every sector, whether it is industry, agriculture or environmental biotechnology. The study of natural environment and its applications is called environmental biotechnology. There are many pollutants which affect the atmosphere and make it polluted. It plays an important in the sense that some of the micro-organism is isolated from oil wastes or from the other places and will applied for cleaning the pollutants.

Bioremediation is another process which is very much useful and provides healthy environment. This technique cleans the pollutants from the environment and from water. In this technique Micro organisms are used which have special qualities of degrading waste materials and recycling them. The centre introduces various environmental applications such as bioremediation, phytoremediation, microbial diversity in conservation and exploration, sustainable production of biofuels from microalgae using a biorefinery approach, bioelectrochemical systems (BES) for microbial electro remediation and oil spill remediation.



Goals and Targets

Considering the environmental challenges and operating the centre the following goals and targets have been set:

- This Centre will increasing its website linkages with information sources within the country & abroad for increasing the information content.
- Attempt should to be made popularise Environmental Biotechnological aspects in research area and also among the commercial entrepreneurs.
- We will tie up with more industries to solve their problems regarding waste disposal, treatment and recycling, greenbelt development through different biotechnological strategies.
- More emphasis will be given on database generation on success stories of application carried out by various institutions and documentation of Environmental Biotechnology data bank.



Focus (2016-2025)



Planning for outreach activities

Organize outreach activity like School sensitization programme and training on thematic subjects training on thematic areas will be conducted in school and village levels for better understanding of environmental biotechnology. Awareness and motivation are pre-requisites to economic development, so the ENVIS personnel and eminent experts will give the information's about the biotechnological applications. Special day like Environmental Day, Aranya Saptaha etc will be organised.



Information Exchange of environmental biotechnology

We will contact international institutes and also some experts for better exchange. International Information Exchange of environmental biotechnology is a valuable tool for enhancing global transparency and cooperation. The current international standard,

exchange of information on request, allows the institute or organization for getting the better information. Research and appropriate technologies with development is essential for progress. It helps in future



Emphasis on success stories of application

During the current decades biotechnology paid a significant role in various sectors of our daily life. Our website can able to provide information relating to R&D development and their field of applications – through presentation of success stories. So More emphasis will be given on database generation on success stories of application carried out by various institutions to develop and documentation of environmental biotechnology data bank.



Web linkages with information sources within the country & abroad

Centre can also make liaison of information between the R&D institute and various policy making bodies, in the matter relating to Biotechnology and Environmental Biotechnology. Establishment of liaison with various concerned institute and departments of India and abroad, working on the field of Environmental Biotechnology. We will consult the various environmental experts/ stake holders regularly for better improvement of our website and planning better service of the centre.



Quality publications on thematic areas

The Centre will publish more Newsletters, Abstract volumes, books, leaflet, reports, documents, abstracts & research papers on the subject for wide dissemination of information.



Regional language activity

Prepare more theme based information documents on regional language, Bengali (hard copy and in website) for the common people.



Data collection, analysis and development of value added knowledge product (Application/process)

Development of more value added information products will be taken up from Biotechnological companies and information will be given in the website regularly. We will build up a strong inventory of information related to environmental biotechnology, data bank on Microbial Application potential in various fields, industrial linkages in various application areas. So we need assessment to prioritize areas and parameters of environmental biotechnology for tracking/reporting.



Bhuvan portal development on thematic area

By using the Bhuvan portal we will added more information related to Environmental Biotechnology.



Institute & Industrial links

Interaction with the farmers about their problems and suggestion and linkage with some local industries about their problems and prospects. Networking with Industry who deals with biotechnological industries negotiation will be made.



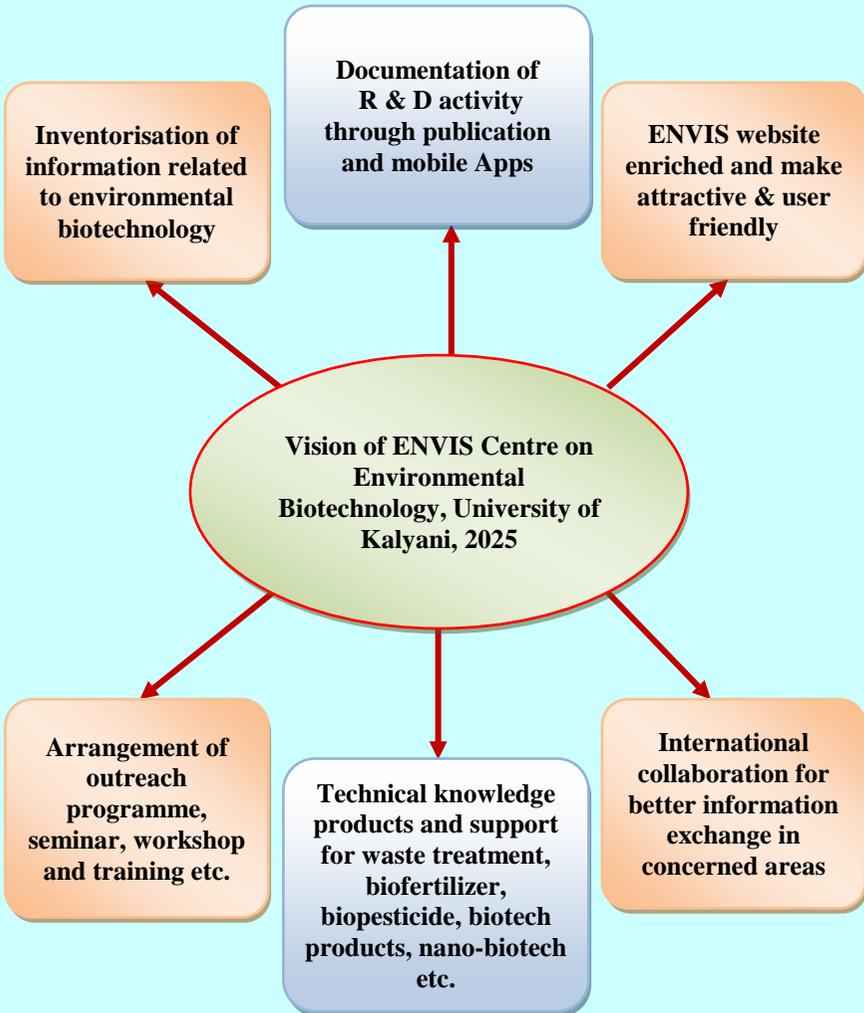
Inventorisation of information related to environmental biotechnology

The inventory information related to environmental biotechnology viz. cleaner technology, hazardous & toxic waste management etc were incorporated time to time in our website.



Biotechnology policy issues

Department of Biotechnology already constituted several high power committees for framing biotechnology policy of the country and also various guidelines for implementation at National and State Level. Our centre can promote in disseminating the Biotechnology Policy through our website/publications. We also can provide platform for public opinion display through feedback sheet.





Contact:

ENVIS Centre on Environmental Biotechnology

Department of Environmental Science

University of Kalyani, Kalyani

Nadia, West Bengal-741235, India

E.mail: desku@envis.nic.in

www.deskuenvis.nic.in