THE ENVIRONMENT MANAGEMENT

A Quarterly E- Magazine on Environment and Sustainable Development

पर्यावरणो रक्षति रक्षितः

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Newsletter Theme: Sustainable Environment Management

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From Director's Desk

As we usher in the new year 2023, the reminiscence of 2022 in the areas of environment and sustainability gives us a hope towards better, safe and transformative future. In the 50th year of Stockholm Conference the World Environment Day reminded us that we have only one earth that requires our focus towards climate action, nature action and pollution action. The breakthroughs on structural reforms in finance for loss and damage in COP 27 of UNFCCC was an encouraging step. The COP 15 to UN CBD adopted the Kunming Montreal Global Biodiversity Framework with 23 targets that the world needs to achieve till 2030 provides a new commitment to countries to work towards biodiversity conservation after the failure of Aichi Biodiversity Targets.

The sustainable management of environment is possible if we integrate all the policy frameworks together and take transformative actions towards pollution management, nature conservation and climate resilience that is not possible without the active and harder participation of all the countries together.

Let's march ahead in 2023 with commitment to serve environment through our sustainable actions for transformed society and empowered nation.

On behalf of all the members of SIES IIEM, we wish you, your family and friends the very best for 2023!

Happy Reading!

Dr. Seema Mishra

India's Take on Climate Change: Perspective and Actions

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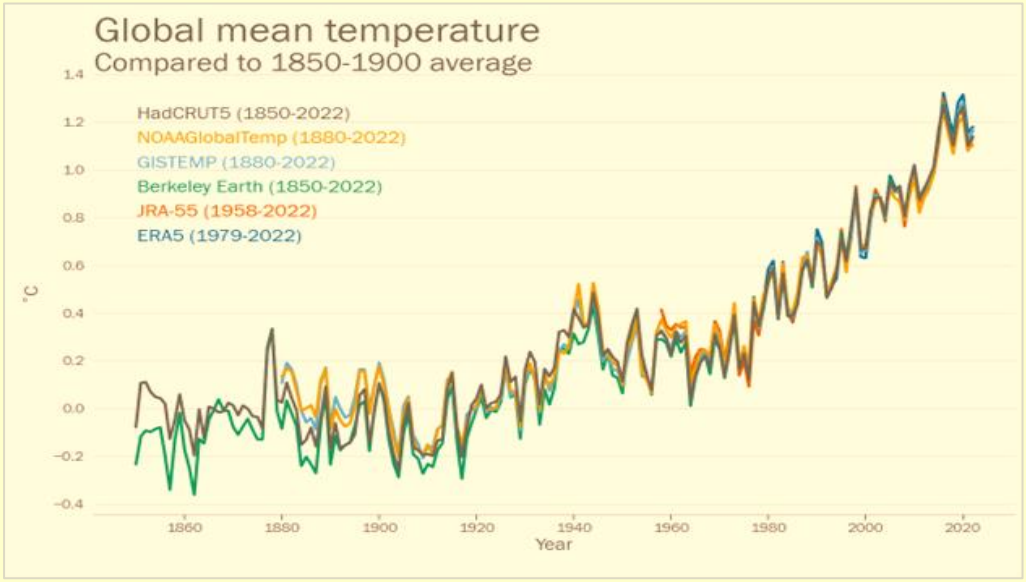
At the beginning of the 21st century, humans started witnessing climate change turning into fact. Although the global population is aware of the consequences of changing climate, the intensity and frequency of impacts are unexpectedly early. The past eight years are on track to be the eight warmest on record, fueled by ever-rising greenhouse gas concentrations and accumulated heat. Extreme heatwaves, drought, and devastating flooding have affected millions and cost billions this year, according to the World Meteorological Organization's provisional State of the Global Climate in 2022 report (Sharm-El-Sheikh, Egypt, 6 November).



Low-income countries are much more vulnerable to the impacts of climate change. Last year, India had torrential rains and floods that left thousands of people homeless and took a toll on hundreds of lives. This was not climate change; it was merely a benign seasonal change. We can expect future impacts by having an idea of this natural trailer of climate change.

Experiencing Extreme impacts has forced our climate experts to think of a way to control the progression of changing climate, though all countries are already involved in making policies and rules to combat the varying climate scenarios. Switching to renewable resources is a critical doorway to step into a sustainable future, in addition, the conservation of basic resources will prove sole support to the survival of mankind.

India has been hatching various action plans to adapt and mitigate the impacts for more than a decade in responding to climate change A year ago, at Glasgow, we responded to the call of science and came forward with important pledges and commitments. the biggest and most important move by Indian Prime Minister Narendra Modi on behalf of India committed.

1. To take India's non-fossil fuel energy capacity to 500 GW by 2030.

2. To bring down the carbon intensity of India by more than 45% by 2030.

3. India will achieve the target of net zero carbon emissions by 2070.

Within one year, India has submitted its Long-Term Low Emissions Growth Strategy indicating low carbon transition pathways in key economic sectors. Responding to the call for increased ambition in our 2030 climate targets, India updated its Nationally Determined Contributions in August 2022. We have embarked on far-reaching new initiatives in renewable energy, e-mobility, ethanol blended fuels, and green hydrogen as an alternate energy source.

The Union Minister for Environment Forest and Climate Change Shri Bhupender Yadav delivered India's National Statement at COP 27 along with India's motto "One Earth, One family, One future"

India's Impressions through Actions

Under the leadership of Prime Minister Narendra Modi, many initiatives have been taken. A few national and international initiatives are listed here to exhibit the Indian take on climate change:

1. National Clean Air Programme

The Central Government launched National Clean Air Programme (NCAP) as a long-term, time-bound, national-level strategy to tackle the air pollution problem across the country in a comprehensive manner with targets to achieve 20% to 30% reduction in Particulate Matter concentrations by 2024 keeping 2017 as the base year for the comparison of concentration. The Centre has set a new target of a 40% reduction in particulate matter concentration in cities covered under the National Clean Air Programme (NCAP) by 2026, updating the earlier goal.

According to the Union Environment Ministry, 95 of the 131 non-attainment cities covered under the NCAP have witnessed an "overall improvement" in PM10 levels in 2021 as compared to 2017 levels.

2. Pradhan Mantri Ujjwala Yojana (PMUY)

PMUY was launched by Prime Minister of India Narendra Modi on 1 May 2016 to distribute 50 million LPG connections to women of Below Poverty Line (BPL) families for accessing cleaner fuel. It is one of the primary steps by the Indian government toward providing cleaner environment to its citizens.

3. International Solar Alliance (ISA)

ISA is an alliance of 123 signatory countries, most being sunshine countries, which lie either completely or partly between the Tropic of Cancer and the Tropic of Capricorn. The primary objective

of the alliance is to work for efficient consumption of solar energy to reduce dependence on fossil fuels. This initiative was first proposed by Indian Prime Minister Narendra Modi in a speech in November 2015 at Wembley Stadium (London HA9 0WS, United Kingdom), in which he referred to sunshine countries as Surya Putra ("Sons of the Sun"). The alliance is a treaty-based inter-governmental organization. Countries that do not fall within the Tropics can join the alliance and enjoy all benefits as other members, except voting rights.

4. One Sun, One World, One Grid Project (OSOWOG)

OSOWOG is based on the vision of building and scaling inter-regional energy grids to share solar energy across the globe. It can be the solution to most of our global problems in the energy sector. The One Sun One World One Grid Declaration (OSOWOG) was jointly released by Prime Minister Narendra Modi and UK Prime Minister Boris Johnson at the COP26 Climate Meet in Glasgow. Realizing the vision of OSOWOG through interconnected green grids can be transformational, enabling all nations to meet the targets of the Paris Agreement to prevent dangerous climate change, the declaration said. These efforts can stimulate green investments and create millions of good jobs. By sharing the sun's energy, one can help to build a more peaceful and prosperous world, the declaration added.

5. The Energy Conservation (Amendment) Bill, 2022

The Energy Conservation (Amendment) Bill, 2022 came into force after the Winter Session of Parliament, in New Delhi on December 12, 2022, under the Union Minister of Power and New & Renewable Energy. This is claimed as the futuristic bill concerning the actions against climate change.

Key features of the Bill:

- The Bill amends the Energy Conservation Act, 2001 to empower the central government to specify a carbon credit trading scheme.
- Designated consumers may be required to meet a proportion of their energy needs from non-fossil sources.
- The Energy Conservation Code for buildings will also apply to office and residential buildings with a connected load of 100 kilowatts or above.
- Energy consumption standards may be specified for vehicles and ships.

Analysis of Indian outlook against climate change

Placing climate change at the centre of its environmental policies, India is, indeed, committed to maintaining a wholesome global climate asserting at the crucial international climate summit COP 26 and COP 27 that it is the only country delivering in "letter and spirit" the commitments under the Paris Agreement. From pledging to become a net zero emitter of carbon by 2070 to achieve 500 gigawatts of non-fossil energy capacity by 2030, India led from the front on environmental issues this year, grabbing eyeballs across the world.

The initiatives that the Indian government is going ahead with, will prove to be key to success in achieving the bigger goal of global environmental sustainability and

can set an example that a holistic approach to sustainability can be achieved along with industrial and technical development, despite being a developing country.

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Report on Graduation Ceremony

The graduation ceremony of M. Sc. SDEM students of academic year 2020 – 2022 and Post Graduate Diploma in Sustainable Environment Management (PGDSEM) batch 2021- 2022 were conducted in September and October 2022. Mr. Prathmesh Raichura, Partner KPMG has presided over the graduation ceremony as a chief guest. He emphasized on the relevance of skill sets required for professional journey in the areas of environment management and sustainability. Mr. Vinod Sant, Ex. DG, National Safety Council and Dr. C. Srinivas, Ex. Chief Scientist, BARC, highlighted on the current sectors offering job opportunities in environment management and sustainability and importance of sincerity and timely knowledge upgradation in professional development. The students have reflected on the time they have spent at the institute with faculties and junior students.

PRE-COMBUSTION CO_2 CAPTURE TECHNOLOGIES

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The term pre-combustion capture has come into use relatively novel in the context of gasification-based power plants, particularly integrated gasification combined cycle (IGCC), where, in anticipation of requirements to limit CO_2 emissions, plant designs have been developed to convert the gas produced from gasification (i.e., referred to as 'syngas') to hydrogen and CO_2 and to remove the CO_2 from the syngas stream prior to the combustion of the hydrogen rich gas. The H_2 rich syngas is then used as fuel to generate electricity in a combustion turbine.

Pre-combustion capture technology is a method where, the fuel is converted into syngas, composed primarily of carbon monoxide and hydrogen, through two main routes: the addition of steam, called steam reforming, and the addition of oxygen, whose reactions are specified below (equations i, ii and iii) Godin et al. 2021. The syngas can be further reformed by a water-gas shift reaction in a catalytic reactor where steam reacts with the CO to produce CO_2 and more H_2. The incorporation of oxygen to liquid and gaseous fuels is referred to as partial oxidation, and gasification when incorporated to solid fuels.

i. *Steam-reforming:* $C_xH_Y + XH_2O \leftrightarrow XCO + \left(\frac{X+Y}{2}\right) H_2$

ii. *Partial oxidation:* $C_xH_y + \frac{X}{2O_2} \leftrightarrow XCO + (\frac{Y}{2})H_2$

iii. *Water-gas shift:* $CO + H_2O \leftrightarrow CO_2 + H_2$

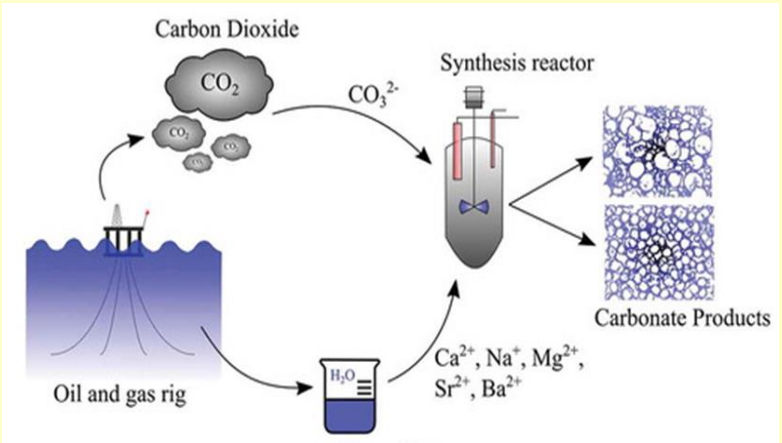

Fig:1 CO2 to carbonated product (Kholi et al. 2021)

A chemical or physical absorption process is typically applied, to separate the CO_2 from the product stream, resulting in a stream rich in H_2. The hydrogen can then be used as a fuel and combusted in a gas turbine for power generation.

Benefits of pre-combustion capture:

There are various benefits from pre-combustion capture when compared with other capture technologies. For example, in gasification processes a feedstock (such as coal) is partially oxidized in steam and oxygen/air under high temperature and pressure to form synthesis gas. This synthesis gas, or syngas, is a mixture of hydrogen, carbon monoxide, CO_2, and smaller amounts of other gaseous components, such as methane. The syngas can then undergo the water-gas shift reaction to convert CO and water (H2O) to H2 and CO_2, producing a H_2 and CO_2-rich gas mixture. The concentration of CO2 in this mixture can range from 15-50%. The CO_2 can then be captured and separated, transported, and ultimately sequestered, and the H_2-rich fuel combusted.

Benefits:

Both the combustion of H_2 and the heat recovered in the flue gas via a device called a Heat Recovery Steam Generator are used to generate electricity.

H_2 rich gas may be used to power fuel cells. The Department of Energy is currently investigating this possibility (Massachusetts Institute of Technology.

The high pressure of CO_2 makes capture chemically favourable. Pre-combustion capture may also reduce emissions of certain air pollutants

Drawbacks of pre-combustion capture:

According to some research articles, main drawback is overall capital cost of the base gasification process exceeds conventional pulverized coal power plants, and the cost of the adsorption processes required to capture CO_2 generated by an IGCC power plant ranges up to $60/tonne. Other key disadvantages of pre-combustion capture include limited IGCC plants, decay issues with utilizing hydrogen-rich fuel, and heat transfer challenges. This technology cannot be added to existing plants (retrofitted).

Pre-Combustion Capture Applications in industry

Current pre-combustion capture plants capture 91.6% of the average plant's CO_2 emissions (Olabi et al. 2022). This technology used for the CO_2 Capture from Natural Gas, CO_2 Capture from Natural Gas Reforming and Partial Oxidation, CO_2 capture from Coal Gasification Plants, IGCC Design Options for CO_2 Capture etc.

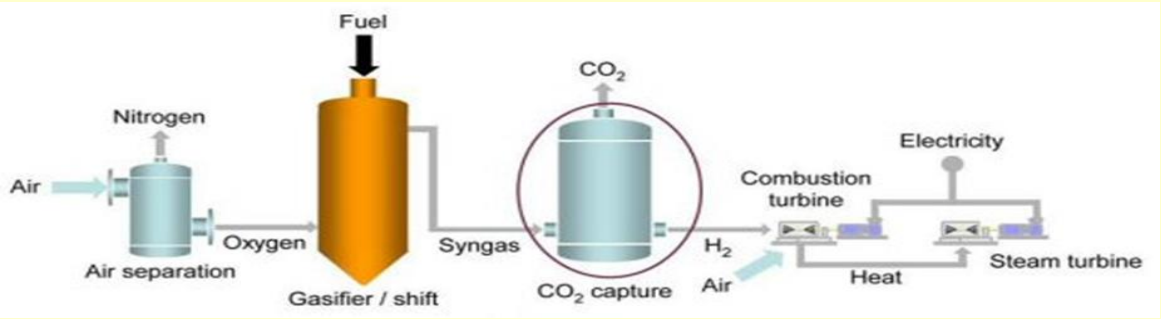

Fig 2. Industrial application

Conclusion:

Pre-combustion Carbon capture is one of the most efficient methods of reduction of CO_2 emissions permanently from the environment even before getting diluted with other flue gas components. The numerous advantages of Pre-combustion Carbon capture include social, and environmental, and a massive impact on a global and local scale. Pre-combustion CO_2 capture improves the concentration of syngas, thus the fuel efficiency. Pre-combustion carbon capture is often more efficient and effective compared to other carbon capture technology. The equipment is more expensive than other processes. The hydrogen can be utilized for other energy generation operations.

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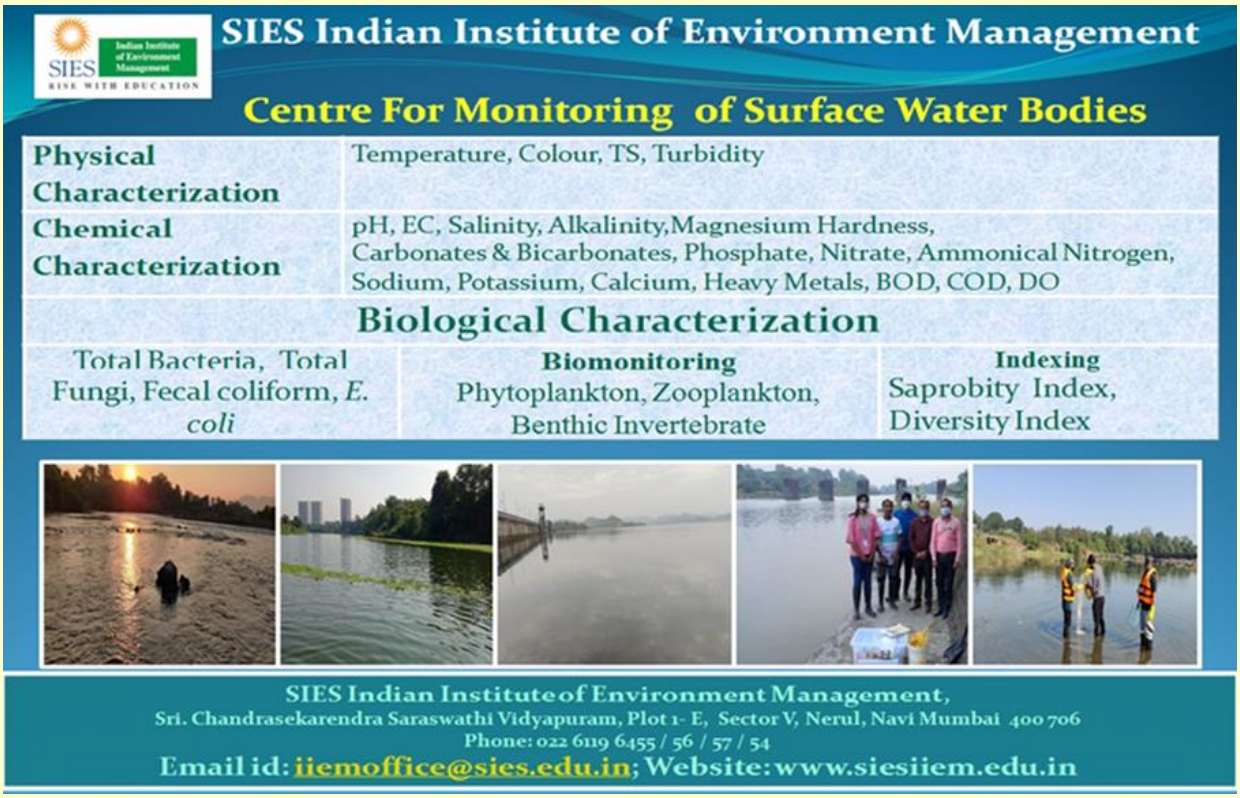

Report on Plastic Waste Collection and Sensitization on its Management

The students of M. Sc. SDEM have conducted a drive in Sector V and IX markets in Nerul on plastic waste management. Students have sensitized shopkeepers about the implementation of Plastic Waste Amendment Rule, 2020 under that some plastic items are banned their substitutes and process of their disposal. The plastic waste was collected from the market and handed over to Bisleri India Ltd. through Stree Mukti Sangthan for recycling.

Mr. Mahesh Subramanian, alumnus PGDSEM batch 2016- 2017 represented our country at UN International Maritime Organization, London. Mahesh is expert in compliance related to shipping and environment. currently, Mr. Mahesh is working with Anglo Eastern Maritime Academy.

Sustainable Conversion of Agricultural Waste to Useful Products

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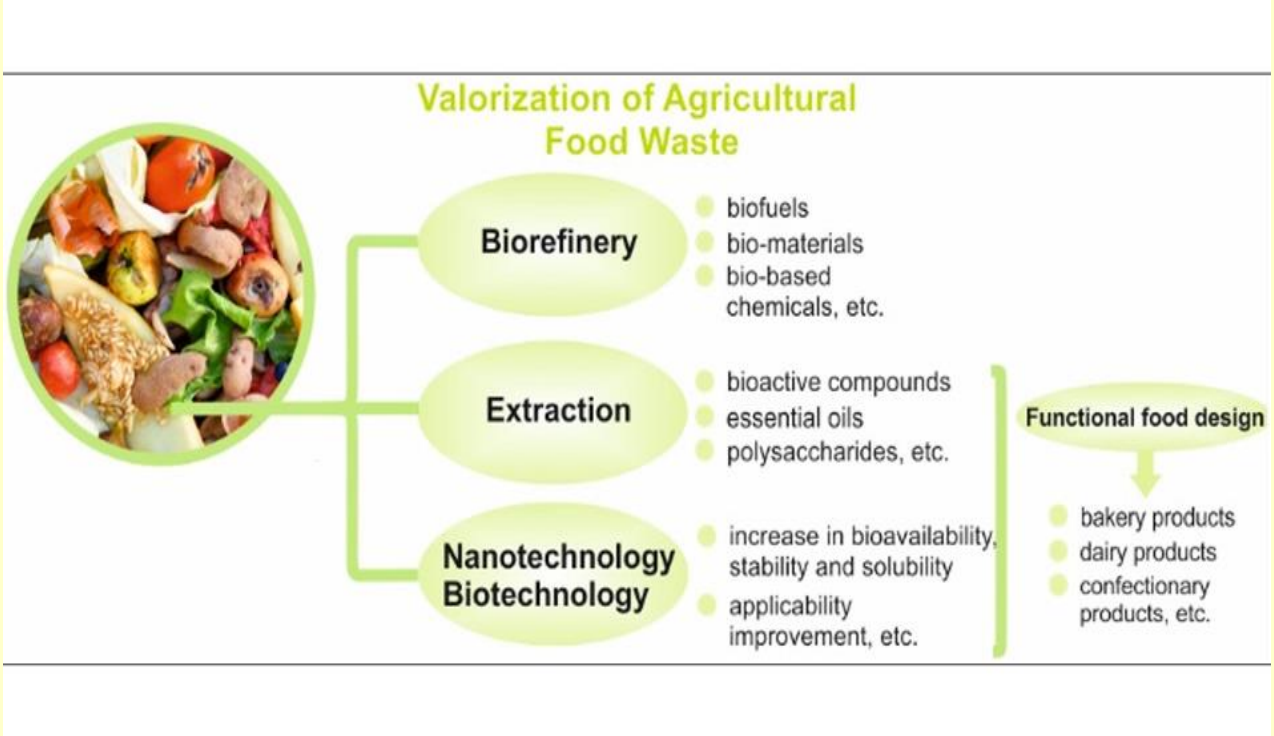
Annually, India produces a bulk of solid waste in which agricultural waste stays at the top with approx. 350–990 Mt/y. After China, India is the world's second-largest producer of agricultural waste and produces over 130 million tonnes of paddy straw out of which half is used as fodder and the other half is discarded. Moreover, the rice residue burning (parali) practise in the northwestern region creates substantial air pollution and raises public health concerns. Improper disposal of crop residue leads to generation of greenhouse gases (GHGs) like carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4), which poses a threat to the human and the natural environment. The agricultural wastes are very rich in different nutrients and have good calorific values that makes it suitable for many industrial applications.

The agricultural wastes consist of mainly lignocellulose, starch, and a few proteins. Through green chemistry and bioprocess approach these wastes can easily be converted to bio products such as biofuel, enzymes, organic acids, metabolites etc. The green chemistry and bioprocess engineering have significant potential to convert agricultural waste to useful products by mitigating the negative effects in sustainable manner with opportunities to generate innovative economy based on renewable feedstock's, where toxicity is deliberately prevented at the molecular level. It ensures safe products, healthy people, a clean environment, green jobs, and most importantly, a systemic approach to sustainable solutions to many problems.

Types of Agricultural Wastes

Sr. No.	Category of Agricultural Wastes	Types
1.	Crop residue	Stalk, stem, leaf, root, seed pod, husk, litter etc.
2.	Waste from animal husbandry	Urine, dung, residual milk, waste feed etc.
3.	Poultry waste	Spilled feed, droppings, feathers, bedding material etc.
4.	Slaughterhouse waste	Blood, hair, bone, hides, flesh etc.
5.	Agro industrial waste	Bagasse, mollases, peels & pulp of fruits and vegetables etc.
6.	Oil seed waste	Kernel and oil seed cake
7.	Aquaculture waste	Uneaten feed, fecal waste



Conversion of Agricultural Waste to Useful Products

The agricultural wastes consist of several bioactive compounds that may be converted to biogas, biofuel, enzymes, vitamins, antioxidants, animal feed, biofertilizers, biopesticides, and other chemicals through solid state fermentation by utilizing beneficial microorganisms under controlled conditions for getting low-cost useful byproduct with less pollution load. Some of the potential by product from agricultural waste are discussed in the article:

i. **Biofuel:** Waste with high lignocellulosic content can be easily converted to biofuel by chemical and solid-state fermentation process. They are cheap and easily available in comparison to oil seeds viz. rape seed, palm oil, sunflower, soyabean etc. The waste materials viz. rice straw, wheat straw, husks, corn cob and stalk, bagasse etc. can be converted to biofuel by slow heating or in the presence of oleaginous microbes. They have a capacity to accumulate lipid more than 20% of their dry weight under stress conditions that may reach up to 70% by modifying the conditions. The microalgae, filamentous fungi, mucor, yeast bacterial etc. have been reported to have potential to accumulate lipid that can be converted to biofuel by transesterification. This process is having low incubation time as well as it has specific requirement of climatic conditions etc. The steps involved in the bioconversion of lignocellulosic waste to biofuel are – lignin depolymerization, saccharification of lignocellulosic biomass, lipid biosynthesis and lipid extraction and transesterification. The glycerol can be obtained as a byproduct of this process; however, its purity level may be low.

ii. **Antibiotic Production**: From agricultural waste several antibiotics can be produced by using beneficial microorganisms. Agro wastes viz. coconut oil cake, groundnut shell showed maximum antibiotic production. Neomycin, rifamycin, oxytetracycline are effectively produced from agro wastes.

iii. **Antioxidants**: Wastes from fruits and vegetables consist of several antioxidants that can be extracted, purified, and valorized into value added products and indirectly will reduce solid waste from dumping sites.

iv. **Useful Chemicals**: Biorefining process is gaining momentum wherein agricultural wastes are converted to useful products. In one of the project scientists have converted wheat straw to hydrolysate that was further fermented to isobutane into oligomers and then polymers with application as synthetic rubber, lubricant, cosmetics, solvents, plastic etc. The conversion of ethanol to ethylene is also reported in some studies. The extraction of nano cellulose is reported from agricultural waste that have several

biomedical applications. These nano cellulose materials are carbon neutral, sustainable, recyclable, and nontoxic that is why it is being utilized in cosmetics applications also.

Challenges in the Conversion of Agricultural Waste to Useful Products

The technical and economic challenges are some of the biggest hurdles in upscaling the production of by products from agricultural wastes. The cost involved in the collection, transportation, processing of waste is very high with huge energy consumption. Further, the pretreatment, process conditions and suitability of appropriate microorganisms are some recurring processes for optimizing the product outcomes.

Conclusion

The fossil fuel crisis and environmental concerns have encouraged scientist to explore new resources and pathways for chemicals production. Low cost and sustainability, together with chemical compositions similar as fossil feedstocks, render agricultural waste as a promising raw material for production of biochemicals. Technological advancements, including biorefineries, heterogeneous catalysts and genetic engineering, guarantee development of green chemicals from biomass. Very soon biochemicals will share markets with petroleum-based chemicals and ultimately replace them as biochemicals become price competitive.

Report on Training Programme on the topic, 'Solid Waste Management' Conducted by Students of M. Sc. SDEM

The students of M. Sc. SDEM have conducted a training programme on solid waste management at SIES College of commerce and Economics, Sion (E), Mumbai wherein students and staff of environment committee with housekeeping staff have participated to learn the process of solid waste management. The participants were sensitized on different categories of waste, process of their segregation, disposal, and management. The composting process was explained to the participants to properly management the wet waste at their campus.

Themes of Previous Issues of Quarterly Newsletter 'The Environment Management'

Volume I: Issue- 1 **Environmental Monitoring and Assessment for Pollution Control**	**Volume IV: Issue- 2** **Beat Plastic Pollution**	**Volume VI: Issue- 4** **Emerging Opportunities in Environment Management in Post Covid- 19 Era**
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HEARTIEST CONGRATULATIONS!!

Ms. Neha Dovari

B.Sc. Botany

M.Sc. Sustainable Development and Environment Management (2021-23 Batch)

On receiving Pre-placement offer through SIES IIEM at L&T Financial Services

Environment in News Headlines

Global Treaty is Required to Solve Plastic Pollution

Plastic accounts for 85% of the marine litter that is expected to increase by three times by 2040. The cost of plastic pollution to society raises up to US$100 billion / year that includes environmental cleanup and environmental degradation cost also. It is expected that the cost of inaction against plastic waste would be higher than this. In March 2022 the UN Environment assembly took a decision to create a legally binding treaty to consider lifecycle of plastic from production through to innovative packaging, products, and business models. The treaty is expected to be finalized by 2024 before that policy planners should come up to a common rules and strategy for plastic waste management for all the countries of the world.

Nature, November 2022

Air Pollution is Rising in Northwest India due to Pushing Back Paddy Sowing

Collaborative research conducted by Harvard University, University of Michigan and Public Health Foundation of India reported that a change in policy by Government in north- west India during 2008 to shift the paddy sowing dates as per the arrival of monsoon to reduce the dependency on ground water for irrigation has resulted in enhancing air pollution in northern India because farmer's prefer to clear their land for next cropping season by burning the agro - residues.

Environmental News Network, December 2022

To Protect 30% Land and Water by 2030: A Pledge at COP 15

In UN Biodiversity COP 15 under CBD, 196 countries signed on the historical deal to protect 30% of the world for nature by 2030, reduce environmentally harmful subsidies by at least US$ 500 billion / year, and restore 30% of degraded ecosystems. Global Biodiversity Framework is released during the conference that contain 4 goals and 23 action-oriented targets for biodiversity conservation. The cutting of subsidies and reducing environmental pollution to zero by 2030 was opposed by many countries including India.

The Hindustan Times, Dec. 2022

Five New species of Black Corals Discovered Near Great Barrier Reef

Five new species of black corals are discovered below 2500 feet in Great Barrier Reef by using a remote-controlled submarine. Earlier corals were explored by dredging and trawling methods that would often destroy the corals. This study will help in understanding evolutionary history.

The Hindustan Times, Dec. 2022

Forthcoming Event

Prof. Purushottam Khanna Memorial Talk

Prakkathan: An ecofest on sustainability will be organized in February 2022

Articles, photos etc. are invited for next issue (January-March, 2023) of the Newsletter on the theme "Lifestyle for Environment (LIFE): A Step Towards Sustainable Future ".

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