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ON
Trophic Transfer of Microplastics

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EDITORIAL

Today plastic is one of the most preferred materials in industrial world and it causes pollution not only the environment, but also serious threat to our health and future generations. In the environment it reaches in the form of macro or micro or nanoplastics and it contaminates and accumulates in food chains through agricultural soils, terrestrial and aquatic food chains, and through the water supply. Microplastics entering the human body via direct exposures through ingestion or inhalation and can lead negative health outcomes including cancer, cardiovascular diseases, inflammatory bowel disease, diabetes, rheumatoid arthritis, chronic inflammation, auto-immune conditions, neuro-degenerative diseases, and stroke. Awareness should be created for plastics substitutes and safe disposal of plastic waste. The DESKU EIACP prepared a newsletter on Microplastic and its effect on human being and it contains an article on 'Contaminants in the Food Chain: The Trophic Transfer of Microplastics and Human Health Risk' This article describes how the plastic pollution affect the human being through food web.

The newsletter also covers the activities report on World Environment Day-2024 observed by DESKU EIACP Resource Partner on Environmental Biotechnology.

Prof. Kausik Mondal

IN THIS ISSUE:

Contaminants in the Food Chain: The Trophic Transfer of Microplastics and Human Health Risk

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Abstract

As plastic pollution is on the rise in recent times, attentions are being drawn on understanding the possibilities of health risks of microplastics on human and other animals. Microplastics are less than 5mm diameter size particles that can invade both terrestrial and aquatic ecosystem altering their biophysical and biochemical attributes. It is generally characterized into two categories i.e., primary and secondary microplastics, they are ubiquitously found in every trophic level of both aquatic and terrestrial food web. Palatable crops, many edible fishes, crustaceans, molluscs as well as poultry animals and ruminants are prominently affected by microplastic contamination. Although the immediate impact of microplastic pollution on human health is still not well established, few investigations have indicated the association of microplastics and its chemical additives with that of reproductive health alterations, cardiovascular problems and respiratory illness among others. Because the trophic transfer is already evident in aquatic system, there is a high possibility on the theory of biomagnification of microplastics through food chain in human. To establish accurately the possible health risks and to mitigate the potential negative impacts, effective identification, accurate quantification and dynamic tracing of the microplastics should be of great importance in the current set up.

Keywords: Food chain, Human health, Microplastic, Plastic, Trophic transfer

1. Introduction

Plastics are polymers that find its place in wide range of applications by serving as a barrier against water, oxygen and because of their low density, low thermal and electric conductivity, and resistance to corrosion. Microplastics (MPs) are plastic fragments which are less than 5mm diameter in size. It has been described as water insoluble synthetic solid particles or polymeric matrices, whose size ranges from 1µm to 5 mm with regular or irregular shape who has its origin either from primary or secondary manufacturing process (Frias et al., 2019). Microplastic particles have been found in broad range of concentrations throughout the environment like marine water, freshwater, agro-ecosystems, atmosphere, food and drinking water, biota and many other remote locations. Studies are being conducted on microplastics due to their ubiquitous distributions in the environment to extensively address the sources of these tiny particles and their potential consequences on environment and human health (Campanale et al., 2020).

The prevalence of microplastics in the environment can be in different forms and their characteristics can also vary depending on their source of origin and environmental conditions. Microplastics are mainly characterized under two main categories viz. Primary microplastics and Secondary microplastics. Primary microplastics are tiny plastic particles which are deliberately synthesized in micro-sized form or which are released in the environment as a by-product during manufacturing processes (Emenike et al., 2023; Mahapatra et al., 2024). In addition, primary microplastics are used in cosmetic products and they are also found deposited in the environment along with the household sewage discharge (Fendall et al., 2009) which includes polymeric materials like polyethylene, polypropylene, and polystyrene particles. Secondary microplastics are tiny plastic particles that originate from the degradation of larger plastic items such as bottles, carry bags and packaging materials. Unlike primary microplastics, which are originally manufactured in their micro-sized form, secondary microplastics are a result of continuous process of erosion and depletion of larger plastic objects (Frias et al., 2019).

Microplastics frequently find its place in human body through consumption of food items and beverages such as packaged drinking water, beer, sea food etc **(Fig. 1)**. In addition, exposure of microplastics to human can also occur through inhalation of microplastics contaminated air in an indoor environment as well as through dermal contact by using personal product or direct contact with contaminated surface (Campanale et al., 2020; Enyoh et al., 2020). The human health hazard of plastic contamination has not been completely understood but studies have indicated the potential risks regarding major health issues. There have been reports of inflammation, oxidative stress and tissue damage, as well as adverse effects on the male fertility and sperm quality due to microplastic exposure (D'Angelo et al., 2021). Some studies have also suggested that microplastics may potentially build-up in the body over time and have long-term health effects such as cancer, heart disease and neurodegenerative diseases (Campanale et al., 2020; Zurub et al., 2023). These health effects are typically exaggerated by the chemical additives such as polychlorinated biphenyls and phthalate esters which are used in the production of microplastics (Emenikeet et al., 2023). Microplastics are therefore considered as an emerging environmental and public health issues with the potential to affect both human and natural environment. The trophic level transfer of microplastic is a new concern with regards to microplastic pollution as presence of microplastic is evidently seen throughout the trophic levels especially from plants to human (Enyoh et al., 2020; Mamun et al., 2023).

2. Microplastics in Terrestrial ecosystem and Human food chain

Due to the continuous increase in the production of plastic materials and considering their stability, the number of MPs in the environment escalates globally causing environmental pollutions. The presence of MPs in the physico-chemical environment greatly alters the soil, air and water quality along with their compositions (Wang et al., 2019; Guo et al., 2020; Zhang et al., 2022). MPs contamination in soil system changes soil properties such as structure, performance and microbial diversity. In addition, the soil MPs causes different degrees of damage to the soil-plant system. Since plant can absorb MPs from contaminated soil it acts as a starting point of bioaccumulation which could further migrate and transfer through the food chain, eventually leading to human exposure (Zhang et al., 2022; Mamun et al., 2023; Surendran et al., 2023).

2.1. Accumulation of Microplastics in Terrestrial ecosystem

Soil has been a major depositary of microplastics in terrestrial ecosystems which could affect the growth and development of plants, soil microbiota as well as soil chemistry and structure. The main source of microplastic invasion in soil is sewage sludge which is applied as cheap fertilizer in many developing countries on a larger parameter. The secondary microplastics originated from the degradation of various plastic products are the major component of sewage sludge although presence of primary microplastics is also detected (de Souza Machado et al., 2018; Ali et al., 2024). Soil mulching, sewage sludge, organic manure exposure in soil directly makes an impact on the growth of plants (Jia et al., 2023). Stress generated from microplastic can be imposed on plants affecting their growth and development, directly through physical obstruction or indirectly by reduction in productivity of soil (Jia et al., 2023). Beside changes in physical and physiological growth pattern in plants, studies depicts that stress induced by microplastics has increased the alterations in the level of antioxidant enzymes such as SOD, Catalase, Glutathione reductase etc. in plants (Jia et al., 2023). Table 1 shows list of some plants and reported effects of microplastics exposure.

Table 1: Effects of microplastic exposure on selective plants.

Plants name	Effects of Microplastics Exposure
Oats	Nitrogen release from the tested polyethyleneimines and linear polyethyleneimine. No adverse effect, harmful to plants only at high concentrations (Rychter et al., 2019)
Radish	Similar effect as above (Rychter et al., 2019)
Broad Beans	Biomass and catalase (CAT) enzymes activity decreases while genotoxic and oxidative damages increase. An elevated activities of superoxide dismutase(SOD) and peroxidase (POD) enzymes observed along with blocked cell connections or cell wall pores disrupting the transport of nutrients in roots (Jiang et al., 2019).
Mung bean	Crop dependent water absorption rate alteration with low soil interaction, did not impose adverse effects on the crop (Kim et al., 2019).
Lettuce	Similar effect as above (Kim et al., 2019).
Rice	Similar effect as above (Kim et al., 2019).
Wheat	Vegetative and reproductive growth alteration (Qi et al., 2018).
Maize	Polylactic acid leads to decrease in biomass and chlorophyll content in leaves, polyethyleneimines and polylactic acid caused increase in pH and DTPA (diethylenetriaminepenta acetic acid)-extractable Cadmium concentrations in soil, arbuscularmycorrhizal fungi (AMF) community structure and diversity altered, high dose of polylactic acid cause robust phytotoxicity (Wang et al., 2020).
Lettuce	Adherence, uptake, accumulation and translocation of MPs in the vascular tissues (Li et al., 2020).
Onion	Significant alterations in the plant biomass, root characteristics, tissue elemental composition, soil microbial activity (de Souza Machado et al., 2018).

2.2 Biomagnification and trophic transfer in aquatic organisms

It is reported that large source of waste containing plastic materials is ultimately discarded and deposited into seas by rivers, floods, winds and through various mismanagement in handling of xenobiotic pollutants and waste systems. As sizes of most MPs are similar to sediments as well as few planktonic species, they are available in most of the aquatic settings and therefore they are ubiquitously available to variety of aquatic organisms particularly the fish (Pazos et al., 2017; Barboza et al., 2018; Kumar et al., 2018; Sequeira et al., 2020). Due to their non-selective feeding behaviour, filter and deposit-feeding fishes are thought to be more vulnerable to microplastics ingestion than predator fishes (Wesch et al., 2016; Alberghini et al., 2022). It was reported that omnivore fish could ingest more MPs than plant eating and carnivore fish (Mizraji et al., 2017). Among the aquatic organisms, Crustaceans (45%) were the most commonly studied taxonomic group, followed by fish (21%), molluscs (18%), annelid worms (7%), echinoderms (7%) and rotifers (2%) (de Sa et al., 2018; Foley et al., 2018; Walkinshaw et al., 2020).These organisms occupy various positions in the aquatic food web. Fish are generally placed at intermediate/top predators (de Sa et al., 2018) and may get exposed to microplastics by the consumption of microplastics exposed prey (Wesch et al., 2016; Enyoh et al., 2020; Alberghini et al., 2022). Small crustaceans are often primary consumers like planktonic rotifers, while a number of ecologically and commercially crucial filter feeders are from molluscs groups. Feeding behaviour indirectly affects many benthic organisms like molluscs and annelid worms. As some of these molluscs are also commercially available as food, the accumulated microplastics in molluscs is also one of the route of transfer to human (Barboza et al., 2018; de Sa et al., 2018; Foley et al., 2018; Walkinshaw et al., 2020) **(Fig. 1).**

Microplastic poisoning can cause harm in fishes either by accumulating in gastrointestinal tract to produce physical harm such as blockage and damage, or by distributing inside the body thereby exposing inner organs and tissues to MPs (Alberghini et al., 2022; Subaramaniyam et al., 2023). In addition, MPs release as pseudo feces can cause disruption of energy transfer in organisms. Furthermore, toxicological investigations showed various health impacts in fishes due to microplastic exposure. These symptoms include growth reduction, dysbiosis, breeding impairment, behavioural change, slow down swimming, digestive disruption, increased mortality as well as oxidative stress, DNA damage, neurotoxicity, reproductive organ damage etc. (Khan et al., 2023; Subaramaniyam et al., 2023). Altered gene expression at transcriptome level has been reported in Zebrafish on exposure to microplastic (Zhao et al., 2020). As fish is one of the major sources of protein for humans, consumption of microplastic contaminated edible fishes could bring considerable prospects of trophic level transfer to human (Barboza et al., 2018; Alberghini et al., 2022; Emenike et al., 2023) **(Fig. 1).**

2.3 Poultry foods follow path for microplastic entry into human system

Poultry farming could be one of the routes through which microplastic gets exposed to human food chain. A quantitative study reveals the existence of microplastic in the gizzard and crops of poultry birds. Birds often ingest the microplastic from the plastic litter materials. The contaminated foods and water resources of poultry birds can also be the route for microplastic entry (Wu et al., 2021; Khan et al., 2023; Li et al., 2023).The physical source of microplastic contamination in poultry feeds includes farm building materials, packaging materials, handling containers and vehicles. The chemical contamination includes preservatives, additives of foods, meats and pesticides. Virus, bacteria, parasites and fungus of poultry farm, meat processing, and transportation also act as biological source of contamination of poultry products (Wu et al., 2021; Bilal et al., 2023).The ingestion of microplastic shows potential harmful effect in poultry birds displaying abnormal digestion, gastrointestinal blockage and decrease in the absorption of nutrient and inflammation. It can also lead to oxidative stress, dysregulation of immune system and disrupt the gut microbiota composition when they are chronically exposed to poultry birds (Fackelmann et al., 2019; Li et al., 2023). Microplastic may enter into human system through the consumption of poultry foods like meats, eggs and other poultry products. Human gastrointestinal system adsorbs the microplastic particles and distributes it throughout the body **(Fig. 1).** Studies have indicated the accumulation of microplastic in the tissues and organs of human body causing oxidative damage, inflammation and altered cellular response (Mamun et al., 2023).

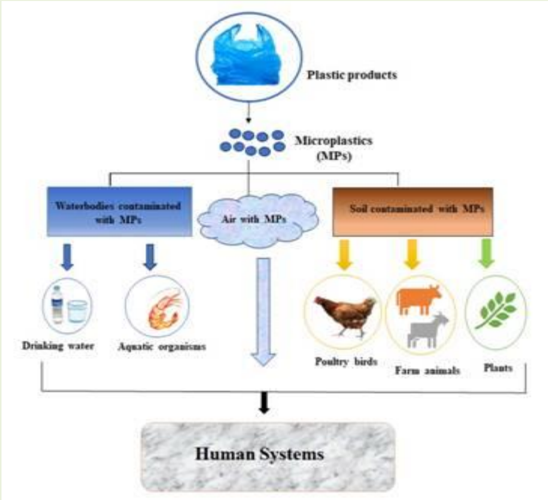

Figure 1: Potential source and transfer of microplastic in human food chain

2.4 Exposure of microplastic to the ruminants

The farm animals are often neglected in the area of microplastic research. These animals act as consumers as well as distributor of microplastic through the food products derived from them **(Fig.1).** Human consume meat, milk of farm animals which are contaminated with microplastics. The ruminants like cow, sheep, and goat consume microplastics at the time of grazing (Omidi et al., 2012; Prata et al., 2023; Urli et al., 2023; Bahrani et al., 2024). The surface freshwater and the grasses which are contaminated with microplastics are also the source of microplastic exposure to the ruminants (Chang et al., 2020).These plastic particles not only harm the human system but also affect the reproductive system of farm animals (Wu et al., 2021; Urli et al., 2023). Investigations have indicated the presence of microplastics in the digestive system of sheep. The microplastics are also found in the blood of cows and pigs, which indicates that these plastic particles can be transported through the gut epithelial barrier after their ingestion (Wu et al., 2021; Prata et al., 2023; Bahrani et al., 2024). A comparative study has indicated that the distribution of microplastic is less in the farms of cow compared to pig and other ruminants because the use of plastic product is low in cow breeding process. It is also proposed that farmyards are more contaminated with microplastics than layer breeding farms because of insufficient number of administrators with professional cleanliness skill in farmyards (Wu et al., 2021; Urli et al., 2023; Bahrani et al., 2024).

3. Human health effect associated with microplastic exposure

Humans are exposed to microplastics mainly through the foods and water contaminated with plastic particles **(Fig. 1).** Another way of plastic entry of human system is inhalation of MPs contaminated air (Cverenkarova et al., 2021). The recent studies on microplastic exposure in mammalian system reveal that the plastic particles accumulate into different tissue and cause toxic effect on reproductive system, intestinal microbiota, kidney and neuronal system (D'Angelo et al., 2021).

3.1 Effects of microplastics on reproductive health

Like other environmental toxicants, microplastic also affects the production of human germ cells. Various studies on animals reveal that microplastic exposure decreases the sperm production and reduces the quality of semen. It also decreases viability of sperms, sperm motility, and ATP- production and thus affects male reproductive system (Hong et al., 2023). It also disrupts epithelium cells of seminiferous tubules and leads to destruction of blood-testis barrier. In vitro studies indicated that microplastic is also associated with oxidative stress and endoplasmic reticulum stress generation and tight junction protein degradation in Sertoli cells (Zurub et al., 2023). The microplastic exposure also leads to reduction in oocyte maturation and germ cell injury in mice model. It causes disturbance in embryonic development and decreases the rate of fertilization. Besides, the study also demonstrated that the viability of superovulated oocytes is also reduced (Hong et al., 2023). On the other hand, the hormones associated with reproductive system of female are also affected by microplastics exposure. The circulating estradiol (E2) and anti-mullerian hormone (AMH) concentration are found to be decreased in MPs exposed patient. However, while very few studies have been conducted on the human reproductive tissue, a recent study on the patient in fertility treatment detected microplastics in follicular fluids (Zurub et al., 2023). The experiment on *ex vivo* human placental model indicated that human placenta takes up polystyrene particles and these particles can easily cross the placental epithelium barrier (Bove et al., 2019).

3.2 Effects of microplastics on intestinal health

Consumption of microplastic contaminated foods lead to significant disturbance in intestinal health. Maximum proportion (>90%) of plastic particles are excreted out through faecal matter and the microplastic with the size of up to 150µm absorb through the intestinal epithelium (Cverenkarova et al., 2021).The microplastic disturbs the intestinal barrier and passes from the intestine to the circulatory system. Studies on mice model indicates that it decreases mucus secretion and downregulates the transcriptional expression of mucus secreting genes (Jin et al., 2019).The microplastic exposure causes systemic inflammation by activating host immune response (Fackelmann et al., 2019).The microplastics accumulate into digestive tract and leads to blockage, physical irritations (Emenike et al., 2023) and finally malnutrition (Fackelmann et al., 2019). The dysbiosis of gut bacteria is also associated with microplastic exposure. A significant reduction in the proportion of Actinobacteria on microplastic exposed mice was also observed. The microplastic accumulation can exert effect on amino acids, lipid metabolism and leads to various metabolic disorders (Jin et al., 2019).

3.3 Microplastic and respiratory problems

Inhalation of plastic particles is associated with inflammation and irritations in respiratory pathway, leading to wheezing, coughing and shortness of breath and enhances the asthma condition. The microplastic related toxicity mostly affects the workers of the industries who manufacture and use the plastic products (Emenike et al., 2023).

3.4 Effect of microplastic on cardiovascular health

The microplastic particles induce oxidative stress, inflammation and damage the endothelial activities thereby affecting the cardiovascular function and increased risk of cardiac failure. It is also associated with exacerbation of atherosclerosis, hypertension condition and abnormal heart rhythm activities (Emenike et al., 2023).

4. Conclusion

Contaminants like microplastics are issues of concern due to their easy availability to various organisms of every trophic level, smaller size and variable buoyancy in both terrestrial and aquatic ecosystems. The organisms of various trophic levels starting from soil microbiota to zooplankton, from wild fishes to poultry animals are affected with direct and indirect exposure of microplastics and their additive chemicals (Barboza et al., 2018; Cverenkarova et al., 2021; Mamun et al., 2023).

Plastic particles and their chemical ingredients can be transferred to human body from the consumption of fish, poultry products and meats as well as through inhalation of particles from various sources. Although some studies depicting the effect of microplastics on human health has just started to be documented, the detailed investigations are required to establish their association on the human health hazards with clarity and detailing (Barboza et al., 2018; Cverenkarova et al., 2021; Mamun et al., 2023). Moreover, critical analysis should be made on the amounts of MNPs (micro-and nano-plastics) absorbed through ingestion, inhalation or dermal exposure as well as the amounts of MNPs accumulated in various tissues over the lifetime of a person to understand the tissue level damage on chronic exposure. In this context, International public health initiatives are intended to manage the production; design and disposal of plastics more responsibly as the global burden of plastics are getting insurmountable. The European Union has therefore restricted the deliberate addition of microplastics to products from October 2023 and has set a target to decrease plastic pollution upto 30% by 2030. In a broader aspect, the UN Environment Assembly in collaboration with 175 nations adopted a resolution on 2022 to develop a global plastics treaty with the target of alleviating the plastic pollution and its subsequent contamination in food chain and environment (Cottom et al., 2024).

While a thorough understanding about the detrimental effects of microplastics on human health and the ecotoxicological challenges in current world is very much essential, it also necessitates the development, adoption and implementations of policies for reducing the global uses and productions of microplastics.

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A Report of the Celebration of World Environment Day (15^{th} May-5^{th} June, 2024)

This year the DESKU Environmental Information, Awareness, Capacity Building and Livelihood Programme (EIACP) PC-RP on Environmental Biotechnology, University of Kalyani, Nadia, West Bengal, Supported by Ministry of Environment, Forest and Climate Change (MoEF& CC), Govt. of India, celebrated the World Environment Day in three parts like **Pre Event** (15.05.2024 to 25.05.2024, social media related activities), **Events** (26.05.2024 to 04.05.2024, activities including vents/Programmes/Competitions) and **Culmination** (05.06.2024, World Environment Day Celebration) as per instruction of EIACP secretariat. The World Environment Day was observed from 15^{th} May, to 5^{th} June, 2024 through following activities.

Pre Event (15.05.2024 to 25.05.2024)

Preparation of infographic on Land Restoration, Seed ball "Through Grow", Land Degradation, Desertification, Celebration of World Environment, Nourishing Earth: The Vital Role of Healthy Soil, Effective Steps to Prevent Soil Pollution, land restoration and food security, Anti Desertification Measures in India, How to Increase drought resilience and Anti Desertification Measures in India **(Plate 1).**

26^{th} May, 2024

A banner on this year's theme "Land Restoration, Desertification and Drought Resilience" was placed in front of the host institution's front gate. A banner on this year's theme was displayed in front of the host institution's front gate (**Fig. 1**).

Fig. 1: Banner displayed in front of University gate

Land Restoration

Seed ball "Through Grow"

Land Degradation

Desertification

Nourishing Earth: Vital Role of Healthy Soil

Effective Steps to Prevent Soil Pollution

Land restoration & food security

Land restoration & food security

How to Increase drought resilience

Anti-desertification Measures in India

Plate 1: Infographics on environmental issues

27th May, 2024

On the occasion of "World Environment Day-2024 DESKU EIACP RP organized a webinar on **Bio-technical Restoration of Degraded Mine Lands** for celebration of World Environment Day-2024. The webinar is mainly intended to spread awareness about this year theme. It is a biggest international day for the environment and held annually since 1973, it has grown to be the largest global platform for environmental outreach. It is celebrated by millions of people across the world. From this special day celebration we enriched about how to restore the degraded mine lands.

Hon'ble Vice Chancellor (Prof. Amalendu Bhunia) of the University was inaugurated the programme through his valuable talk. The EIACP coordinator (Prof. Kausik Mondal) welcomed to speakers and participants. An eminent speaker Dr. Sukalyan Chakroborty, Department of Civil & Env Engineering BIT - Meshra, Ranchi gave the valuable lectures. Dr. Anusaya Mallick, Programme officer gave the vote of thanks to all and Mr. Tanmoya Achrjee conducted the webinar. More than 60 numbers of participants like school, college and university students, research scholars, faculty and staff members were participated in the programme. E Certificates were distributed among the participants (**Fig. 2, 3, 4 & 5).**

Fig. 2: Webinar talk by Dr. Sukalyan Chakroborty

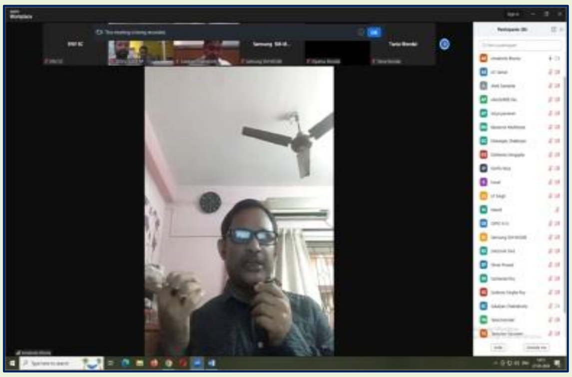

Figure 3: Webinar inaugurated by Hon'ble Vice Chancellor (Prof. Amalendu Bhunia)

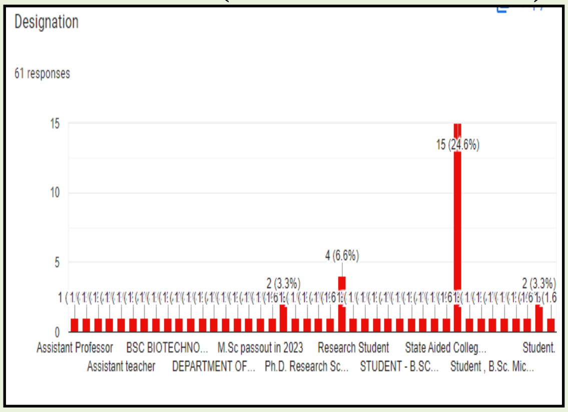

Figure 4: Details of webinar participants

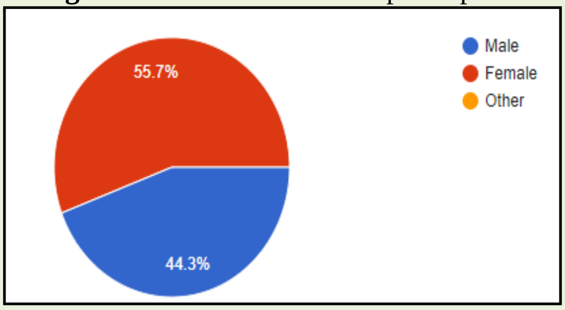

Fig. 5: Details of webinar participants

28th May, 2024

On the occasion of "World Environment Day-2024 DESKU EIACP RP organized a Tree plantation drive at S.N. Bose innovation Building, University of Kalyani on 28.05.2024 at 11.30 A.M onwards along with all university communities. The plantation programme was started with the administration of Honb'le Vice Chancellor Prof. (Dr.) Amalendu Bhunia, University of Kalyani, Nadia, West Bengal. The Hon'ble Vice chancellor inaugurated the world Environment Day by planting the tree saplings. Prof. Kausik Mondal, Coordinator, DESKU EIACP, EIACP staffs, officers, faculties, students and research scholars were participated in the programme and planted the tree saplings. Approximately 50 participants were engaged in the activity (**Fig. 6 & 7).**

Fig. 6: Inauguration of Plantation by Honb'le Vice Chancellor

Fig. 7: Plantation program at S.N. Bose innovation building

29th May, 2024

Plogging

Plogging is an awareness drive on pick up trash and run. On 29th May, 2024 this awareness drive was conducted at Boy's hostels playground, University of Kalyani, Nadia West Bengal along with DESKU EIACP staff (**Fig. 8).**

30th May, 2024

On 30th May, 2024 photography contest was conducted at Dwijendralal Bhawan (PG-1 Hostel), University of Kalyani. Participants submitted their photos through email.

Fig. 8: Plogging drive at Boy's hostels playground, University of Kalyani

31st May, 2024

On 31st May 2024, debate competition on world environment day-2024 theme was conducted at Jagadish Chandra Bhaban (Banyan hostel), University of Kalyani (**Fig. 9 & 10).**

Fig. 9: Debate on world environment day- at PG-1 Hostel, University of Kalyani

Fig. 10: Debate on world environment day at PG-1, Hostel, University of Kalyani

1st and 2nd June, 2024

On 1st and 2nd June, 2024 drawing competition on world environment day-2024 theme was conducted at Ranaghat, Nadia, West Bengal (**Fig. 11 & 12).**

Fig. 11: Drawing competition was conducted at Ranaghat, Nadia, West Bengal.

Fig. 12: Drawing competition was conducted at Ranaghat, Nadia, West Bengal

3rd June, 2024

On 3rd June, 2024 quiz competition on world environment day-2024 theme was conducted at Dwijendralal Bhawan (PG-1 Hostel), University of Kalyani (**Fig. 13 & 14)**.

Fig. 13:.Quiz competition at PG-1, Hostel, University of Kalyani.

Fig. 14:.Quiz competition at PG-1, KU

Culmination of the World Environment Day (5th June, 2024)

The valedictory session of the programme was celebrated on 5th, June, 2024. The EIACP coordinator (Prof. Kausik Mondal) welcomed to speakers and participants and also mentioned that World Environment Day is a global platform for raising awareness and taking action on critical environmental issues. We should take responsibility to protect and preserve the planet. This day aims to inspire positive change and responsibility towards our natural surroundings.

Hon'ble Vice Chancellor, Prof. Amalendu Bhunia, University of Kalyani initially encouraged participants to take photos with selfie point and addressed the session through his valuable speech. He talked about the theme for the World Environment Day 2024, which recognizes the theme for 2024. He also mentioned that the day is mainly intended to spread awareness about the land restoration. This day also celebrated worldwide by various activities and programmes related to the themes. Finally, he wished the programme great success (**Fig. 15 & 20)**.

Then the technical session was conducted by Prof. Sankar Narayan Sinha, Department of Botany, University of Kalyani. He described on the land restoration and conservation.

Fig. 15: Address by Hon’ble Vice Chancellor, Prof. Amalendu Bhunia, KU.

Fig. 16: Group photographs of participants

Figure 17: Distribution of certificates and prize to the participants

Fig. 18: Group photographs of participants with prizes and certificates

Fig. 19: Hon’ble Vice Chancellor and coordinator with selfie point

Fig. 20: Group photographs of participants with selfie point

FORTHCOMING EVENTS

Event	Date	Place & Correspondence
International Conference on Environmental Biotechnology and Sustainability (ICEBS-24)	18th-19th Nov. 2024	Dubai, UAE https://iser.org.in/conf/index.php?id=2563635
International Conference on Biotechnology and Bioengineering	6th Dec. 2024	Mumbai, Maharashtra, India https://unitedresearch.org/Conference/31050/ICBB/
International Conference on Environmental Biotechnology and Genetic Manipulation	10th Dec. 2024	Beijing, China https://conferencealerts.co.in/event/2536018
An International Conference on Environmental Challenges, Opportunities and Sustainable Solutions	9th-11th Dec. 2024	IIT, Guwahati, Assam, India https://event.iitg.ac.in/env2024
World Congress on Industrial Biotechnology	12thDec. 2024	Oran, Algeria https://conferencefora.org/Conference/47305/WCIB/
National Conference on Advances in Science, Agriculture, Environmental & Biotechnology	31st Dec. 2024	Madurai, Tamil Nadu, India https://nationalconferences.org/Conference/17371/NCASAEB/

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