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# A REVIEW ON DEVELOPMENT OF MEMBRANE FOR REMOVAL OF MICROPLASTICS FROM RIVER

**[1]Prof. Supriya. B. Shinde, [2]Mr. Shreyash. A. Battul, [3]Mr. Nakshatra. D. Dange, [4]Mr. Kunal M. Dongare, [5]Mr. Kshitij R. Yewale**

[1]Assistant Professor, Department of Civil Engineering [2,3,4,5] Students of Civil Engineering, APCOER, Parvati, Pune

[1]Anantrao Pawar College of Engineering and Research, Pune, India.

***Abstract:*** Microplastics pollution has emerged as a pervasive / comprehensive environmental challenge, posing significant threats to aquatic ecosystems, wildlife, and human health. This abstract provides an overview of the sources, distribution, and adverse impacts of microplastics pollution in river systems. It emphasizes the urgent need for effective removal strategies to mitigate the escalating environmental and health risks associated with microplastics contamination. Various methodologies for microplastics removal from rivers are discussed, including physical, chemical, and biological approaches, each with distinct advantages and limitations. The abstract highlights the importance of considering factors such as efficiency, scalability, cost- effectiveness, and environmental sustainability when evaluating removal techniques. Furthermore, it underscores the interconnectedness of river ecosystems with larger marine environments, emphasizing the role of rivers as conduits / channels for microplastics transport. By prioritizing the development and implementation of innovative removal technologies, alongside comprehensive waste management and pollution prevention measures, this abstract advocates for a proactive approach to address microplastics pollution in rivers. Ultimately, concerted efforts from stakeholders across sectors are crucial to safeguarding freshwater resources and mitigating the broader impacts of microplastics contamination on global ecosystems and public health.

***Index Terms*** - Microplastics, Plastics, Plastics Removal, Membrane, Filtration, River Pollution.

## I. INTRODUCTION

Plastics have become a significant part of everyday life, with world plastic production reaching 359 million metric tons in 2018. Plastics have significant societal benefits, but their increased use and rapid disposal has led to serious consequences. A significant negative impact of the increasing use and production of plastic items is microplastics (MPs), which are small plastic particles. MPs can vary from 1 μm to 5 mm in size. Plastic particles smaller than 1 μm are often referred to as nano plastics (NPs), though the characterization of NPs has not formally been recognized as they are difficult to detect in water and soil samples. There is also no standard technique for the detection of MPs which allows for significant variation in the sizes of MPs collected between

studies. MPs can have a wide variety of properties specifically in terms of size, shape, and chemistry. Microplastic pollution is a major environmental issue that affects people all over the world. Microplastics (MPs) including primary MPs and secondary MPs are defined as plastic particles, fibers, fragments, and films that are typically less than 5 mm in size.

Microplastics (MPs) are emerging environmental contaminants that are ubiquitous found that the primary MPs were formed directly from the industrial disintegration of larger plastic debris. The fragmentation of larger plastic debris disposed on land that eventually flows into freshwater sources (river) is the most common source of microplastics in rivers. Freshwater in both densely urbanized and rural areas have been identified as sinks of MPs (MPs, 5 mm in size). MPs are often characterized in terms of their shape such as fragments, fibers, films, foams, granules, and microbeads.

**Current Scenario**

The increased production and consumption scale of plastic items has led to the generation of microplastics (MPs), an emerging class of contaminants, in our environment. Microplastics (MPs) are one of the major emerging pollutants, but there are many unknowns about the fluxes, transport pathways, and fate of these pollutants, including the effects on human health and other life forms. Urban areas were found to be the main sources of plastic on land, rivers, and lake shores. Floods, storm events, and human travel were identified as major drivers of plastic transport. Large portions of plastics accumulate along roadsides, on riverbanks, and in the sediment. Here they degrade and fragment, but the extent and effects remain unresolved. Unmanaged and littered plastic waste including plastic packaging waste has adverse impacts on terrestrial and aquatic ecosystems. As per the Annual report of Central Pollution Control Board (CPCB) on the implementation of Plastic Waste Management Rules, 2016, the plastic waste generated in the country during the last seven years are given below in Chart No.1.1.

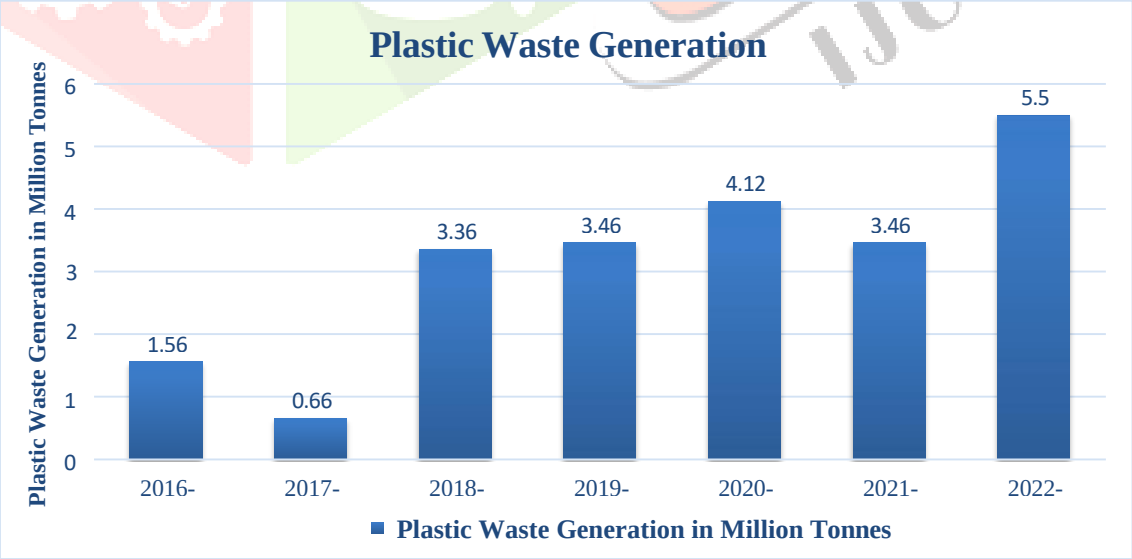


**Chart No. 1.1**

## II. LITERATURE REVIEW

**General:**

The literature review is based on identifying sources of microplastics in rivers, collection methods, assessing potential impacts of microplastics on human and aquatic life, removing microplastics from Wastewater.

**Review of Research Papers:**

**Prata et al. [2019]**

Authors studied that microplastics were widespread contaminants, virtually present in all environmental compartments. However, knowledge on sources, fate and environmental concentration over time and space still was limited due to the laborious and varied analytical procedures currently used. In this work authors critically review the methods currently used for sampling and detection of microplastics, identifying flaws in studied design and suggesting promising alternatives. This work provides insights on bulk sample collection, separation, digestion, identification and quantification, and mitigation of cross-contamination. The sampling of microplastics would improve in representativeness and reproducibility through the determination of bulk sample volume, filter' spore size, density separation and digestion solutions, but also through used of novel methods, such as the enhancement of visual identification by staining dyes and the generalized used of chemical characterization.

**Shadia et al. [2020]**

Authors determined that microplastics (MPs) were prevalent in nature due to the proliferation of plastic in the environment. However, the presence of microplastics in lakes was largely unknown in comparison to other aquatic bodies. This studied was performed to evaluate the abundance and characteristics of MPs in watered, sediment, and fish from three major urban lakes in Dhaka, Bangladesh, namely Dhanmondi, Gulshan, and Hatir Jheel lake. The highest concentrations of microplastics in surface watered (36 items/l), sediment (67 items/kg), fish (17 items/individual), and the gastrointestinal tract (4. 88 items/gm) was observed. Highest abundance of microplastic in an individual fish was observed in Oreochromis mossambicus from Dhanmondi lake. The samples were visually examined using stereomicroscope and SEM, which revealed that films were the most prevalent kind of microplastics in both the watered and the sediment samples, whereas pellets and foams predominated in the fish samples. Visual observation also revealed MPs dominated by <100 μm in size and transparent in color. According to the Fourier transform infrared (ftir) analysis, the dominant polymers in the analyzed samples was high-density polyethylene, low-density polyethylene, ethylene vinyl acetate, polyvinyl chloride,
polycarbonate, cellulose acetate, and polypropylene. Mps was relatively higher in the watered and sediment samples of Gulshan Lake, and fish samples of Dhanmondi lake.

**Adewuyi et al. [2021]**

Authors studied that the presence of microplastics in water was a serious environmental problem. Although several approaches have been employed to tackle the problem, the used of membrane technology in addressing this problem remains encouraging but with limitations such as fouling and chemical instability which could

been circumvented. This review identifies the presence of microplastics in water and the role of membrane technology in tackling the removal of microplastics in water. The study revealed the presence of microplastics in different watered sources as well as the negative impact of microplastics on aquatic animals. Unfortunately, lack of proper management of plastic wastes had led to an increase in the presence of microplastics in the environment. Despite the profound performance by membrane technology towards the removal of microplastics in watered, there was needed to further improve on the limitations exhibited by this technology. However, there was no doubt that membrane technology remains an outstanding technology for the removal of microplastics in water.

**Nabi et al. [2022]**

Authors investigated that the world was facing a severe issue regarding microplastics (MPs) pollution, which was ascribed to its small micron size, low captured, and difficulties in removing it from the environment. The MPs' pollution control and removal policies throughout the world were a pioneering subject of plastics waste, but also a crucial problem that needed have been addressed by the governments and the communities. Considering MPs pollution as a main scientific problem, this review summarized the conducted studied for MPs separation from environments including soil, water, and sediments, along with their removal performance, advantages, and limitations. Existing removal methods were synoptically presented. The main challenges of existing MPs removal methods were discussed, and future worked recommendations were proposed. Meanwhile, there was no standardized method for MPs extraction from different environmental media. From soil, oil-based extraction or filtration could been used for easy separation of MPs while still there was a need to propose an effective standardized method. Watered or sediments samples with low organic content could been filtered or sieved but stepwise methods needed digestion or density separation before filtration.

**Ashrafy et al. [2023]**

Authors concluded that microplastics (MPs) were a continuous and subtle environmental problem; they had already been identified as a significant issue in aquatic habitats as well as in human health. Although MP contamination was pervasive throughout land, sea, and air, these habitats were often thought of as separate entities; nevertheless, they were intertwined. This review aims to provide a comprehensive overview of pollution-causing MPs, their prevalence, and the potential pathways for these contaminants and to identify researched gaps so that future researched priorities may been determined. According to the research, UV radiation and low temperatures aid in the degradation of typical plastic into tiny particles, known as MPs, which then enter the marine ecosystem via runoff. Furthermore, recent research had revealed that the aquatic ecosystem near urban centers had greater levels of MPs and that aquatic organisms from these locations had significant MP buildup in their bodies. In addition, other watered pollutants, such as dyes, heavy metals, and other chemicals, had been observed to adhere readily to MPs, and so these MPs serve as a transporter of many other pollutants in the bodies of aquatic species.

## III. CONCLUDING REMARK

The literature reviews highlight the severe issue of microplastics (MPs) pollution, emphasizing the need for standardized methods for extraction and removal across different environments. Current methods show potential but require uniformity for broader application. Rivers are significant transport routes for MPs, particularly in areas with high human activity. MPs also act as carriers for other pollutants, posing risks to aquatic ecosystems and human health. Overall, the studies call for more data collection, standardized procedures, and targeted research to effectively address MPs pollution. MPs are difficult to capture and remove due to their small size. There is no standardized method for extracting MPs from soil, water, and sediments. Rivers play a crucial role in transferring MPs from upstream to downstream areas and seas. Human activities increase MP contamination in river sediments. They can carry other pollutants, such as heavy metals and chemicals, into aquatic ecosystems. Urban areas have higher MP levels, affecting aquatic organisms. Different sampling and processing methods make it hard to compare studies. Standardized methodologies and reporting are needed for better understanding and risk assessment of MPs. More comprehensive data collection is necessary to understand MP distribution and its influencing factors. Recently there have been a few studies on Microplastics pollution in India, but most of these studies are on coastal or marine sediments or on WWTPs i.e., Wastewater Treatment Plants, and studies on freshwater environments are almost non-existent. Thus, we suggest more extensive research on Microplastics in river water or freshwater and removal of microplastics from river water or freshwater.

## REFERENCES

1. Adewuyi, Adewale, Abisola Joan Campbell, and Olalere G. Adeyemi. "The potential role of membrane technology in the removal of microplastics from wastewater." Journal of Applied Membrane Science & Technology 25, no. 2 (2021): 31-53.
2. Ashrafy, Asifa, Afroza Akter Liza, Md Nazrul Islam, Md Morsaline Billah, Shaikh Tareq Arafat, Md Moshiur Rahman, and Sheikh Mustafizur Rahman. "Microplastics pollution: a brief review of its source and abundance in different aquatic ecosystems." Journal of Hazardous Materials Advances 9 (2023): 100215.
3. Bonyadi, Ziaeddin, Zeinab Maghsodian, Mohammad Zahmatkesh, Javad Nasiriara, and Bahman Ramavandi. "Investigation of microplastic pollution in Torghabeh River sediments, northeast of Iran." Journal of Contaminant Hydrology 250 (2022): 104064.
4. Coppock, Rachel L., Matthew Cole, Penelope K. Lindeque, Ana M. Queirós, and Tamara S. Galloway. "A small-scale, portable method for extracting microplastics from marine sediments." Environmental Pollution 230 (2017).
5. Handique, Sumi. "Microplastics in Freshwater Environments–With Special Focus on the Indian Scenario." Plastic and Microplastic in the Environment: Management and Health Risks (2022): 18-33.
6. Klein, Sascha, Ian K. Dimzon, Jan Eubeler, and Thomas P. Knepper. "Analysis, occurrence, and degradation of microplastics in the aqueous environment." Freshwater microplastics: emerging environmental contaminants? (2018): 51-67.

7. Li, Heng-Xiang, Li-Sha Ma, Lang Lin, Zhi-Xin Ni, Xiang-Rong Xu, Hua-Hong Shi, Yan Yan, Guang-Ming Zheng, and Daniel Rittschof. "Microplastics in oysters Saccostrea cucullata along the Pearl River estuary, China." Environmental Pollution 236 (2018): 619-625.
8. Liu, H. M., Eric PM Grist, X. Y. Xu, Hoi Shing Lo, A. C. Y. Wong, and Siu Gin Cheung. "Microplastics pollution in the rivers of a metropolitan city and its estimated dependency on surrounding developed land." Science of the Total Environment 880 (2023): 163268.
9. Matjašič, Tjaša, Nataša Mori, Irma Hostnik, Oliver Bajt, and Manca Kovač Viršek. "Microplastic pollution in small rivers along rural–urban gradients: variations across catchments and between water column and sediments." Science of The Total Environment 858 (2023): 160043.
10. Nabi, Iqra, and Liwu Zhang. "A review on microplastics separation techniques from environmental media." Journal of Cleaner Production 337 (2022): 130458.