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Environmental Fate and Impacts of Microplastic Pollutants in Sediments, Fishes, and Human – An Outlook

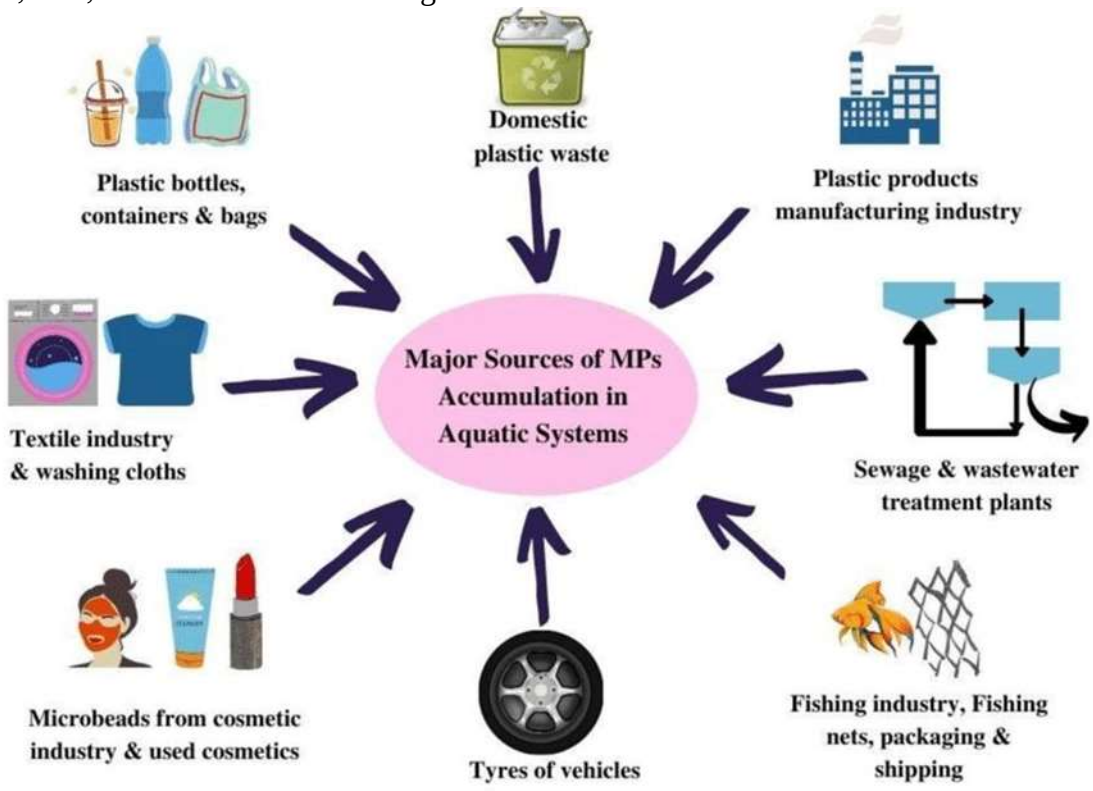
S.Manickavasagam[1], G.Shalini[2], and M.Ponmani[3]
[1]Assistant Professor, TNJFU-DSA, Thanjavur Centre for Sustainable Aquaculture, Thanjavur, Tamil Nadu
[2]M.Sc. Biotechnology, Bon Secuors College for Women, Thanjavur, Tamil Nadu
[3]Ph.D. Research Scholar, Department of Aquatic Environment Management, TNJFU - Fisheries College and Research Institute, Thoothukudi, Tamil Nadu

SUMMARY

The presence of micro plastics in the environment is increasingly reported and has been recognized as a potential pollutant that may adversely affect aquatic environment and cause potential risk to the health of aquatic ecosystems. Micro plastics contain a mixture of chemicals added during manufacture, the so-called additives, and efficiently sorb (adsorb or absorb) persistent bio accumulative and toxic contaminants (PBTs) from the environment. Micro plastic contamination in aquatic environments will tend to increase in the future because at present there is a huge knowledge gap on the occurrence of micro plastic pollution in aquatic environments and their possible effects on the ecosystem. Currently there are no reliable methods available for the observation and quantification of micro or nano plastics in aquatic environments and organisms. Micro plastic contamination of aquatic environments will continue to increase in the foreseeable future and at present there are significant knowledge gaps on the occurrence in aquatic environments and organisms of the smaller sized micro plastics (less than 150 µm), and their possible effects on seafood safety.

INTRODUCTION

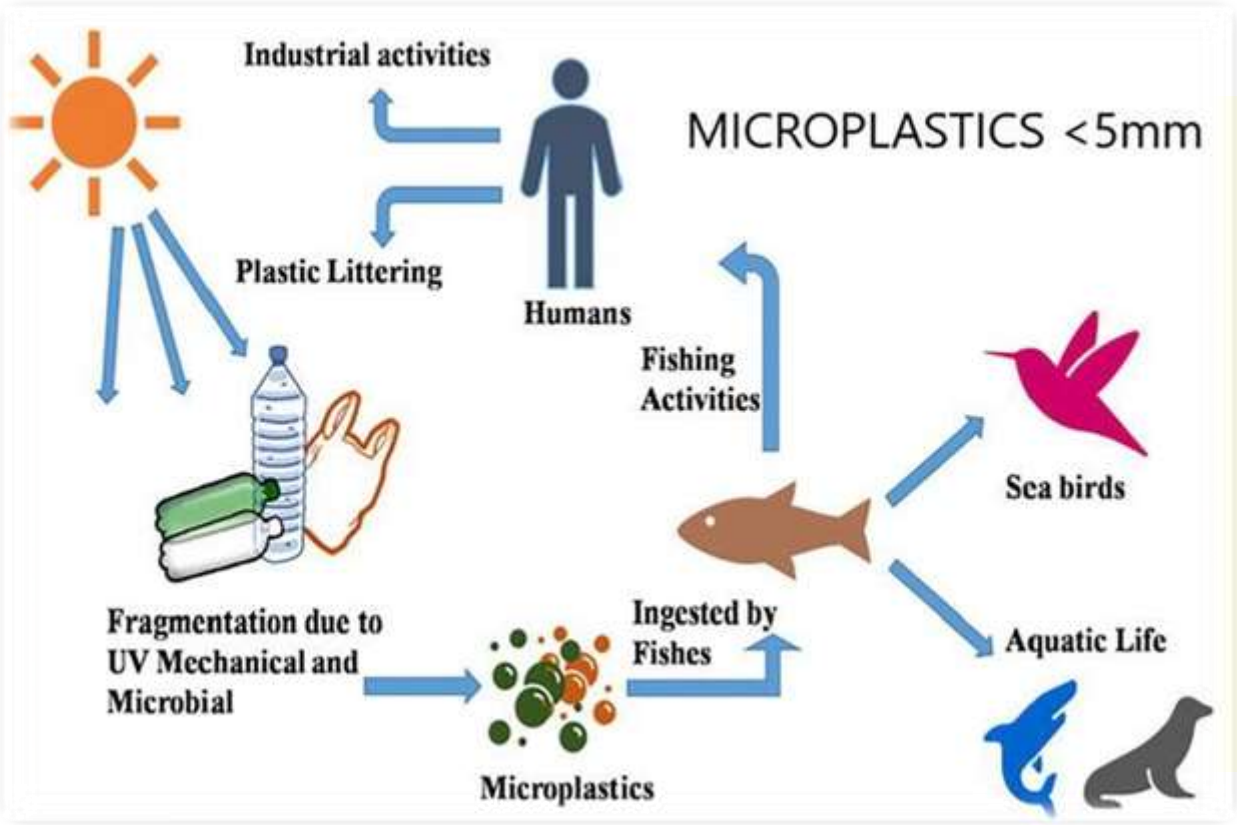
Microplastics as the name implies, are tiny plastic particles. Officially, they are defined as plastics less than five millimeters (0.2 inches) in diameter—smaller in diameter than the standard pearl used in jewelry. There are two categories of microplastics: primary and secondary microplastics is an umbrella term and encompasses different categories, e.g., polymer types, shapes (amorphous, fibres, spheres, films, and foams) and origins (primary and secondary microplastic). While primary microplastics are intentionally produced, for example as spheres for industrial purposes, secondary microplastics originate from fragmentation of macroplastic objects by exposure to light, heat, mechanical friction or organisms.



Primary microplastics are tiny particles designed for commercial use, such as cosmetics, as well as microfibers shed from clothing and other textiles, such as fishing nets. Secondary microplastics are particles that result from the breakdown of larger plastic items, such as water bottles. This breakdown is caused by exposure to environmental factors, mainly the sun's radiation and ocean waves. Microplastics are microscopic plastic pieces with diameters of 5 mm found in marine environments. These microscopic plastics can be ingested by a variety of marine living organisms, including corals, planktons, marine invertebrates, fish, and whales, and are then passed through the food chain. These biodegradable plastics directly endanger marine species and have an indirect influence on the ecosystem by decontaminating other marine pollutants. Microplastics accumulate hydrophobic contaminants from the aquatic environment due to their huge surface area-to-volume ratio. Thus, microplastic contamination is becoming a source of concern due to its negative impact, particularly on marine life.

Source of microplastics in water

Microplastic pollutants enter the water through various pathways. They can pollute the water due to erosion of different plastic products. When waste water having microplastic debris is discharged into surface water, these particles accumulate in aquatic environments.Besides, decay of plastic wastes present in the environment can also lead to microplastic deposition in water. Rivers transport microplastics to the oceans and an estimated 80% of marine plastic debris originates from inland sources. Several studies have identified urban regions and most notably industrial areas as major sources of microplastic pollution in rivers. Plastic litter from land [terrestrial] sources contributes 80% of the plastics found in marine litter. Such plastics include primary microplastics used in cosmetics and air-blasting, improperly disposed "user" plastics, and plastic leachates from refuse sites. With approximately half the world's population residing within 50 miles away from the coast, these kinds of plastic have a high likelihood of entering the marine ecosystem via rivers and wastewater systems, or by being blown off-shore. Plastics that enter river systems—either directly or indirectly—will then be transported out into the ocean. A couple of studies conducted have shown how the high single-directional flow of freshwater systems drives the movement of plastic debris into the oceans. Plastic pollution and microplastics can be transported over long distances by ocean currents, winds, river outflow, and drift, including mid-ocean islands poles, and ocean depths.

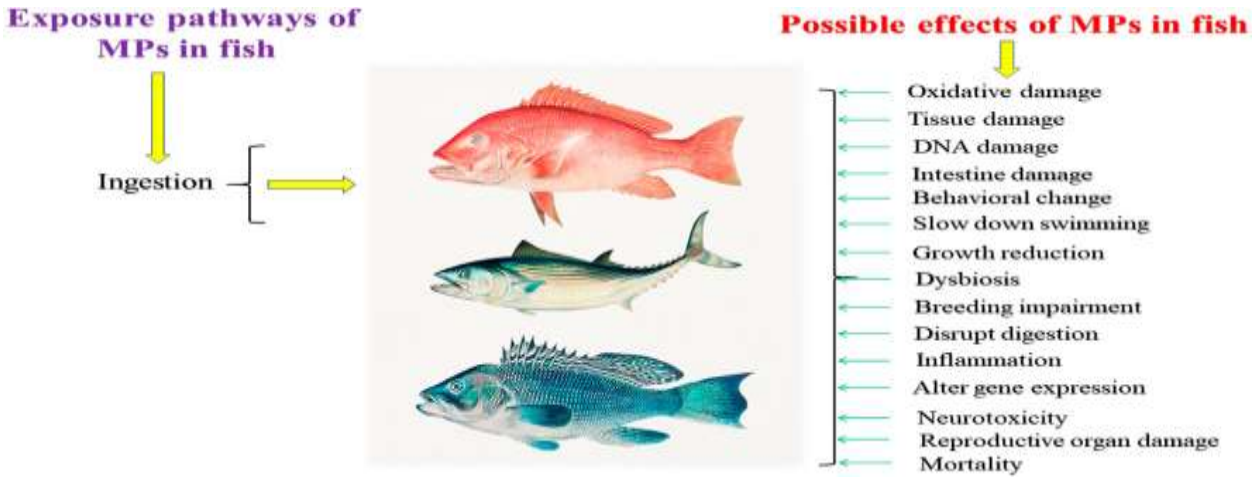


Risks of microplastic pollution in the aquatic ecosystem

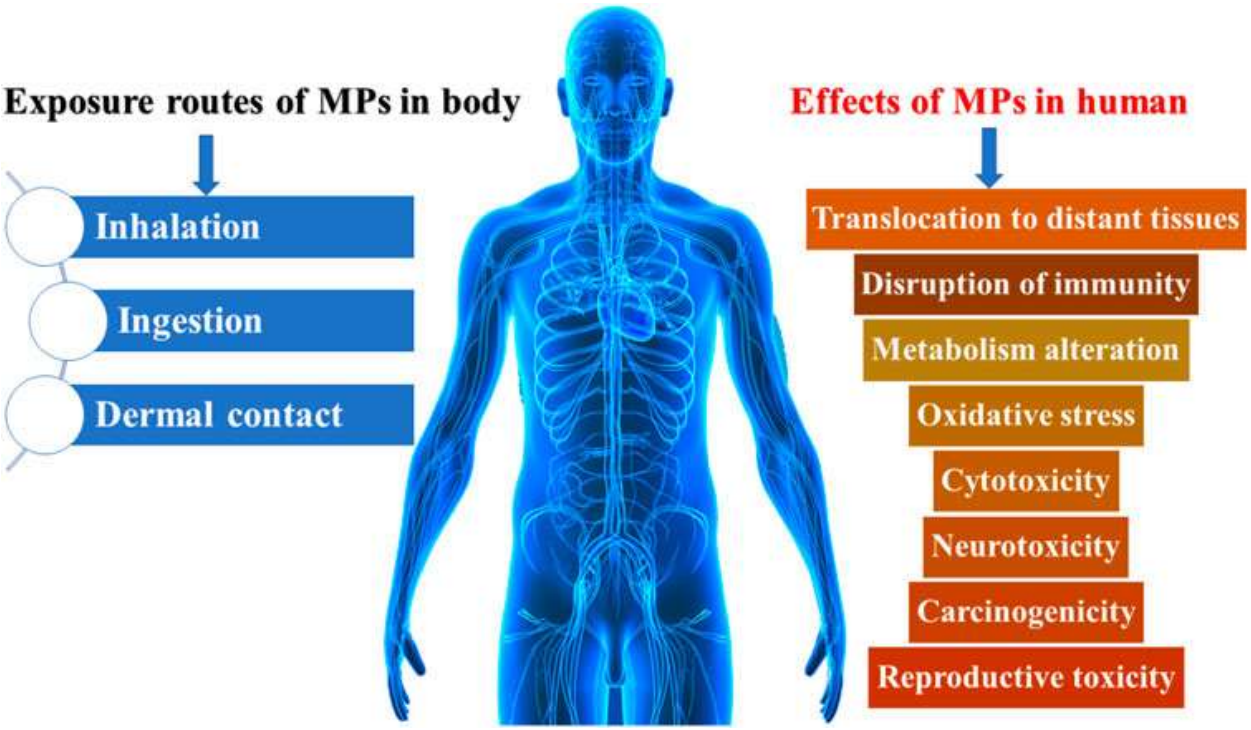
They are found in their highest concentrations along coastal lines and within mid-ocean gyres. In marine environments, microplastics are a threat to marine organisms, as they are often in the same size range as prey and are mistaken as food. When ingested can have a deleterious range of effects on marine organisms, a

process which may facilitate the transfer of chemical additives or hydro-phobic waterborne pollutants to aquatic lives. In this chapter, we looked at the risk of microplastic pollution and its impact on marine organisms and humankind. The study shows that consumption of microplastics has led to ingestion of chemical toxins in aquatic fish, which leads to damage of digestive organs, choking of marine organisms, channel for the spread of microbes, and a reduction in growth and reproductive output. These threats increase the risk to aquatic fishes and human survival. Hence, the need to educate the public on the dangers of using products that pose an immediate and long-term threat to the marine ecosystem and the health of its organism, and the food we eat by marine scientists.

Microplastics in Fish



Microplastics in Human



CONCLUSION

Microplastic pollution has become a serious global issue that has a detrimental effect on the food chain in the marine ecosystem. The main sources of microplastic pollution in the marine ecosystem have been identified to result from general littering, plastic waste mismanagement, fishing gears, synthetic textiles, marine coatings,

personal care products, plastic pellets, city dust, and release of wastewater from sewage treatment plants. This is the outcome of indiscriminate waste dumping, which is either directly or indirectly transmitted to our seas and oceans. Because microplastics are the same size as prey and are mistaken for food, they pose a threat to many marine organisms. When swallowed, it has a negative impact on marine organisms, facilitating the transmission of artificial chemicals or hydrophobic watery toxins to aquatic life. Microplastic pollution has contaminated various drinking sources, salt water, and other regularly consumed foods. Chemical toxication, indigestibility, choking of marine ecosystems, and a pathway for microbial propagation are all negative effects of microplastic contamination on the marine environment. Furthermore, the effects of microplastic pollution vary from the molecular level of an organism to its physiological mechanisms and include bad organism health and poor economic services. These threats increase the risk to aquatic fish's and human survival. Significant awareness about the harmful effects of microplastics has prompted some regions of the world to take action.

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