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*Corresponding author

Mukesh Nitin, Department of Tech Biosciences, Digianalix, South Samaj Street, Tharpakhna, Ranchi-834001, Jharkhand, India

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Review Article

Influential Impact of Micro Plastic Distribution in the Environment

Bharti Kumari Bauri[1,2], Saurabh Kumar Gupta[1,2], Priyangulta Beck[1,3], Shristi Kumari[4] and Mukesh Nitin[1]*

[1]*Department of Tech Biosciences, Digianalix, India*

[2]*Department of Data Sciences, Digianalix, Tharpakhna, India*

[3]*Department of Botany, Department of Biotechnology, Ranchi University, India*

[4]*Department of Biotechnology, Marwari College, India*

Abstract

Micro plastics are minute particles of plastic found in rivers, seas, soil, and other ecosystems all over the world. Plastic particles with a diameter of less than 0.2 inches (5 mm) are classified as micro plastics. They are either formed when bigger plastics are broken down in the environment, such as microbeads added to toothpaste and exfoliants, or when smaller plastics are broken down in the environment. Micro plastics are found in abundance in seas, rivers, and soil, and are frequently eaten directly by animals. Micro plastic has been detected in significant concentrations in rivers and oceans across the world because of increased plastic use. Plastic trash is expected to reach the ocean at a rate of 8.8 million tons (8 million metric tons) every year. 2, 76,000 metric tons (2, 50 metric tons). The present paper reviews about the impact of micro plastic in the environment and food chain.

Introduction

Micro plastic pollution has been the burning topic in present days. Day by day micro plastic became a havoc issue in our environment, it is now a global concern. Small pieces of micro plastic with diameter 5 mm or less than termed as micro plastic [1 and 2], these small pieces are the fragmented part of plastics these are get fragmented by mechanical abrasion, ultraviolet radiation [3 and 4] by the action of microorganisms [5 and 6]. In many industries micro plastics are produced to make various products like scrubber, exfoliates and food packaging [7 and 8], wastewater [9 and 10], sludge [11 and 12], agricultural soil etc. [13 and 14], and then these micro plastics end up in water bodies like marine environments [15-17] and soil via run-off [18 and 19], once they enter the water body it gets decompose. In aquatic body when it enters into the water it stratified into the water body according to their size [20] and density, due to this it effects the different parameters and organisms of the water body for instance its organisms like phytoplankton and zooplanktons found in benthic and upper surface of water region [21]. Micro plastic detected in marine organisms' tissues and digestive tracts example crustaceans and fish, turtles [22], Seabirds [23]. The most vulnerable species are those found in surface as well as benthic region of the aquatic water body and they can be consumed by humans and other organisms [24]. Micro plastic consumed by Aquatic Organisms is a major concern. There is a lack of information on microplastic contamination in our environment. In recent studies, types of plastic pollution according to their size and ranges are being discovered by scientists. It is found in terrestrial as well as aquatic environments. The ultimate concern is our organisms and human beings [25], because it is getting circulated in our ecosystem via our food chain [26] and our nutrient cycle. In organisms micro plastic are entering by inhalation and ingestion are reported but the effects are unknown, much research is being done in scientific aspects. Contamination of micro plastic in human health is becoming a major concern [27]. First micro plastic was found in placenta detected by Raman spectroscopy [28] substances [29] of micro plastic were found in maternal, fetal, amniochorial, and membranes. It also causes effects on human lungs [30]. Micro plastic contamination in soil is caused by tire wear, it is noted that micro plastic particles reached >40000 particles kg-1, fibers are up to 92%, and plastic fragments are 4%. [31]. In soil different type of micro plastic pollution sources are wastewater treatment plant sludge's [32], which is used for manure in agricultural practices [33], runoff, domestics practices, mulching [34, 35] and via atmosphere etc. [36,37], Micro plastic pollution effects physical and chemical characteristics of soil [38]. The properties of microplastics for instance, fibers plastic due to their shape, size, they destabilize the properties and structure of soil [39], and the different and dynamic properties of micro plastic their polymer type and their function group, get react with heavy matels and other nutrients found in the soil ecosystem [40]. Studies found that different of plastics such as (PE, PP and PVC) shows the ability of sorption capacity of some chemical [41], but still there is very few findings have done in micro plastic effect in pH of soil [42]. Few research has done regarding PE contamination in soil ph [43]. For instance, Low Density Polyethylene (LDPE) may increase the soil ph [44], and High Density Polyethylene (HDPE), have reverse pattern [45], the study of other micro plastics properties effect on soil is still unknown [46-48]. Recent studies found that soil microbial communities could be altered by types of micro plastics contamination [49 and 51]. Since we know that our atmosphere is a big platform of different kinds of pollutants entire globe [52], because current studies on micro plastics found that micro plastics accumulation in Oceans [53], Rivers [54] and terrestrial ecosystem also [55], various parameters that is turbulence, wind speed, and flux mechanism etc. are responsible for atmospheric deposition of micro plastic in all over the globe [56], very few studies have been done in atmospheric microplastic pollution, there are still very few studies are published regarding micro plastic deposition in atmosphere [57], but in urban and remote area studies on micro plastic pollution have been done according to their different parameters like shape and sizes etc. [58].

Potential Effects of Micro plastics and Additives of Concern on Human Health

One of the major concerns about micro plastic contamination is whether it poses a threat to ecosystems and human health. However, there is a lot of ambiguity around this topic. To assess the danger of micro plastics to the environment and human health, data on exposure and impact levels of micro plastics is necessary. The negative impacts of micro plastics on organisms may be divided into two categories: physical effects and chemical effects. The former is concerned with micro plastic particle size, shape, and concentration, whereas the latter is concerned with harmful compounds linked with micro plastics. Even though data on micro plastic exposure levels in ecosystems and organisms has quickly grown in recent decades, there is little information on the chemicals linked to micro plastics. Chemicals absorbed from the surrounding environment and additives and polymeric source materials (e.g., monomers or oligomers) coming from the plastics can both be found in micro plastics. Additives are chemicals that are added to plastic during the manufacturing process to give it qualities like color and transparency, as well as to improve its resistance to ozone, temperature, light radiation, mould, bacteria, and humidity, as well as mechanical, thermal, and electrical resistance. The combination of various types of polymers of various sizes and shapes, combined with the action of many additives derived from plastics, results in a cocktail of contaminants that not only change the nature of plastic but can also leach into the air, water, food, and, potentially, human body tissue during use or disposal, exposing us to multiple chemicals at once. (Figure 1) illustrates the source of micro plastic in food chain.

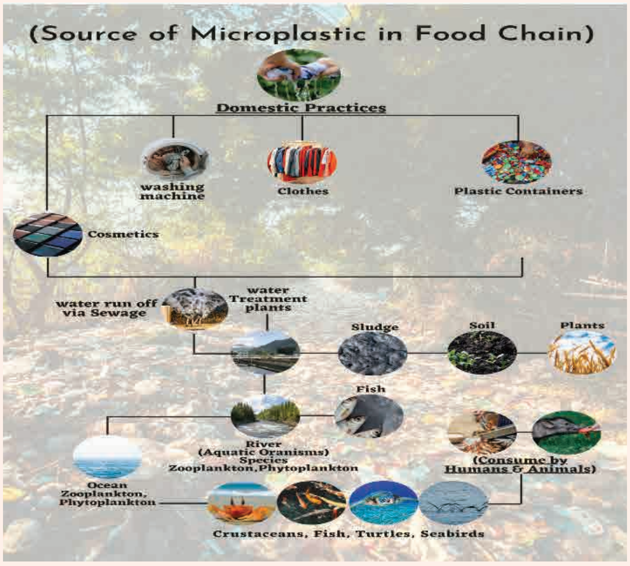

Figure 1: Transportation of micro plastic in our ecosystem.

Micro Plastic in Aquatic Environment

Industrial, home cleaning products, and synthetic textiles are the most common sources of primary micro plastics, but secondary micro plastics are generally separated from larger plastic debris by weathering, UV degradation, or biodegradation. All around the world, micro plastics have been identified in open-sea, deep-sea, and coastal sediments. Micro plastics have been found across Europe, Asia, America, India, and even the Polar Regions, with East Asia identified as a potential hotspot. Micro plastics can persist and build in the marine environment due to their biodegradation-resistant characteristics. As a result, following ingestion, it can have physical and chemical impacts on a variety of marine species. Micro plastics may act as a vector for the absorption of hydrophobic organic contaminants and heavy metals, as well as their potential transmission across the food web. Finally, to restrict the sources of plastic entering the marine ecosystem, solutions such as law reinforcement, education, and a micro plastic remediation strategy using microorganisms were proposed. [Table 1] represents the type of micro plastic consumption in aquatic environments.

Table 1: Types of micro plastic consumption of organism.

Class	Species	Habitat Location	Micro plastic Consumption	Reference
Turtle	Caretta Caretta	South-West Indian Ocean	96.2% of the plastics were ingested by turtle	[61]
Fish	Galeus Melastomus	Western Mediterranean Sea	Per individual 0.34+0.07 particles found	[62]
Crustecia	Neocalanus Cristatus	Notheast Pacific Ocean	1 particle per 34 copepods	[63]

Micro Plastic in Air

Plastic textile fiber output has risen by more than 6% each year, reaching 60 million metric tons, or around 16% of global plastic production. Fibrous micro plastics are formed as these fibers degrade. Atmospheric fallouts, as well as interior and outdoor settings, have been shown to include such MPs. Inhalation of fibrous plastic is possible. Most of them are expected to be cleared by *mucociliary* action; nevertheless, some may remain in the lungs, producing localized biological reactions such as inflammation, particularly in those who have impaired clearance systems. Polycyclic Aromatic Hydrocarbons (PAHs), for example, might desorb and cause genital warts.

Micro Plastic in Soil

The impact of plastics on soils, especially soil biota and the processes that they drive, is largely unclear. This is especially true in the case of micro plastic. On the influence of micro plastics on critical soil processes, such as soil aggregation, there is very little information. As predicted, soil biota addition had a substantial beneficial influence on both the formation and stability of soil aggregates, whereas wet-dry cycles only affected aggregate formation. The formation and stability of aggregates were not affected by polyester microfiber contamination. Microfibers, on the other hand, lowered soil aggregate stability in the presence of soil biota. Polyester microfibers can change soil structure, and these effects are mediated at least in part by soil biota. The bulk density, water holding capacity, and functional connection between microbial activity and water stable aggregates were all altered by micro plastics. If peculiarities of particle type and concentrations are ignored, the impacts are underestimated, implying that solely qualitative ambient micro plastic data may be of little utility for assessing effects in soil. Microfibers, on the other hand, lowered soil aggregate stability in the presence of soil biota. Polyester microfibers can change soil structure, and these effects are mediated at least in part by soil biota. The bulk density, water holding capacity, and functional connection between microbial activity and water stable aggregates were all altered by micro plastics. If peculiarities of particle type and concentrations are ignored, the impacts are underestimated, implying that solely qualitative ambient micro plastic data may be of little utility for assessing effects in soil. If the mechanisms described here are applied to different soils and plastic types, they imply that micro plastics are long-term human stressors and drivers of global change in terrestrial ecosystems.

Conclusion

Investigations investigating the fate and impacts of micro plastics in the environment are gaining traction. Scientists have implicated small, insoluble polymeric particles in several studies that show a potential for extensive consequences in freshwater and marine pelagic and sediment ecosystems. There has been an exponential surge in scientific publications, as well as an increase in regulatory attention. Despite these attempts, the environmental threat posed by these particles remains unclear. We need a mechanism to assess the quality of experimental research to estimate the danger of micro plastics in a risk assessment framework. We must analyze the quality and emphasis of environmental micro plastic research to comprehend the techniques used and how this may help or hinder environmental risk assessors' abilities to evaluate micro plastics. Eco toxicological research must be made more reliable and relevant for regulatory and broader environmental evaluations.

Conflict of Interest

The authors declare no conflict of interest.

Author's contribution

BB, SG, PB did research on various 'microplastic' topics developed; BB, SG, SK contributed in writing the manuscript; Scientist MN designed and supervised the present review article and assisted in writing the paper.

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