

Chapter 6

“Microplastics”: The Next Threat to Mankind?

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ABSTRACT

Microplastics are plastics with smaller than 5mm particle size and they originate from sequential degradation of larger plastic molecules or are manufactured, and they have found use in many realms of life. Their gradual degradability and ingestion by aquatic organisms have become an environmental concern. Microplastics are regarded as a “tiny problem” requiring massive attention. Occurrences of microplastics have been detected in almost all environment matrices. Although several committees have taken steps towards handling the menace, most of the regulations’ guidelines refer to “all wastes” in general, leaving many loopholes. This chapter views microplastics, occurrences, detection, and existing policies. The roles of industry and individuals in preserving the ecosystems are deliberated. In summary, emphasis on the bottom-up strategy to curb the escalating amount of plastics waste in our environment is sought and adoption of the “avoid the avoidable” attitude for a more holistic approach in tackling the severity of the impending threat.

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INTRODUCTION

Occurrence of Microplastics

Plastics are undeniably a key component of our contemporary world, confronted every day at home, offices, grocery shops to the hospitals, schools and almost everywhere. However Fendell and Sewell, (2009) observed that unfortunately, over 50% large plastic items culminate in the oceans and over the course of time form macroplastic debris.

Global plastic production in 2017 according to Statistica (2017), was estimated at a whopping 348 million metric tonnes. This trend is still likely to rise as depicted in Figure 1.

Sources of Microplastics

Microplastics are defined as plastic fragments with the size of less than 5 mm. Browne et al., (2015) had however proposed that the definition should take into account smaller fragments as well (<1 mm). Their gradual degradability, ingestion by aquatic organisms and carriers of persistent organic pollutants from environment to aquatic organisms has become a major source of growing environmental concern.

Figure 2 illustrates the classification of microplastics based on shape, size and polymer type. Generally, microplastics in the marine environment are typically found as pellets, fragments, or fibers and are composed of diverse polymers (Smith et al., 2018, Galgani et al., 2013). Denser particles such as PVC, polyester, polyamide tend to settle at the bottom of the ocean bed while the lighter (polyethylene, polypropylene, and polystyrene) are found floating on the surface of the oceans.

Mega debris fall in the 100 mm range while micro-debris is below 5 mm (Ryan et al., 2009; Thompson et al., 2009). Also, they are categorized based on their production. Primary microplastics are produced for direct consumption which is found in our everyday lives whereas the secondary microplastics occur as a result of the degradation of larger plastic molecules. Table 1 shows a compilation of the worldwide production of plastic polymers in million tonnes, estimated decomposition rate and recyclability. It reveals that production of LPDE (used in production of containers for milk, cleaning agents, shampoo, boxes) is 57 million tonnes yearly, closely followed by PP (55 million tonnes). However, a good reprieve is that they are recyclable and can be used for other things long after their primary uses are over. It is alarming to know that polyamide polymers take an estimated time of 600 years to degrade and is not recyclable.

Microplastics in Fresh Water Ecosystems

Thompson et al. (2009) observed that there is limited documentation on the accumulation of plastics in freshwater organisms unlike in marine systems. Eleven streams in France were reported to have microplastics in the digestive tracts of gudgeon fish (Sanchez et al., 2014). A study conducted in the Mongolian lakes, revealed that the lakes were heavily polluted with microplastics (Christopher et al., 2014) with fragments and films as the most abundant microplastic type. Moore et al. (2005) discovered that in three Californian rivers, an average of 30-109 items m^{-3} microplastics particles were found. Even though Africa is a continent with largest and deepest freshwater lakes, till 2017 there has been no reports on studies with regards to microplastics (Khan et al., 2017). Racchid et al.'s study (2017) in the Metropolis of Paris, revealed the heavy presence of fibers which include plastic fibers as well as also other

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