

Micro-plastics In Water

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Abstract - Water is an important part of life. It contains dirt particles, minerals, chemicals and other particles or impurities which need to be separated from water before drinking. These impurities when consumed can cause health issues. Water filtration has always been a major mandate since very long time. Unfortunately drinking water which is meant to be safe to consume can be quite harmful many times. As there is an extensive use of plastics and plastic pollution has increased in water there are chances of having micro plastics in water i.e. micro particles of synthetic polymer. Micro plastics does not affect instantaneously but they act like a gradual poison in human health or any living organisms.

1. INTRODUCTION

Since few years the presence of micro plastics has been conveyed in tap water and drinking water. This presence have been hovering high concerns about the impact of plastics in water. Micro plastics can be found in numeral cosmetics and personal products, washing liquids, soaps, toothpastes and lotions. But there is still a debate that these products contribute towards micro plastic pollution in water. Other than that other plastics like water bottles, coffee mugs, synthetics clothing fibers, grocery bags, etc. break down into tiny particles to get mixed with water. Presence of micro plastics have been reported in lakes, rivers and oceans. These micro plastics enter our body through water we drink or food we eat from that water. Reports of National Geographic says that plastic production increased from 2.3 million tons in 1950 to 448 million tons by 2015. This is expected to dual by 2050. Every year, about 8 million tons of plastic waste escapes into the oceans. These plastics breakdown and moves around the world through a carrier for example fishes. Addiction to the plastics has evolved recently and it has affected many living organisms including humans. "Micro-plastics in drinking water do not appear to pose a health risk at current levels, according to the World Health Organization (WHO)" but it may affect in future and could be a major issue to solve in the upcoming years. Currently there is no adequate data for the presence of micro plastics in water nevertheless it could litter the river beds too.

There are also several studies being carried out on micro plastics and a remedy to this problem has been suggested in certain processes or ways. Objective of this paper to understand the presence of micro plastics on a global level, its impact on living organisms and environment and its possible solutions.

2. Micro-Plastics in Water

Micro plastics contains hydrogen and carbon bound together in polymer chains. Other chemicals like phthalates, polybrominateddiphenyl ethers (PBDEs) and tetrabromobisphenol A (TBBPA) are also present in micro plastics. Once the plastics are exposed to the sun, wind and wave action it leads to the breakdown of the plastics converting them into waste of small particles almost one fifth of an inch known as micro plastics. It measures less than 5 mm in diameters. They are present in every body of water in present. It can be created commercially or wrinkled down by nature. They are present in a variety of products from cosmetics to synthetic clothing to plastic bags and bottles. Many of these products readily enter the environment in wastes.

2.1 Classification Of Micro plastics

2.1.1. Primary Micro plastics

They are already smaller and are produced for external human use. Examples of it are micro plastics used in facial cleansers, exfoliating hand cleansers, toothpastes and synthetic fabrics used in clothing. They are so small that they pass through the water treatment units and they convey themselves to the rivers and oceans.

2.1.2. Secondary Micro Plastics

They occur as a part of large plastic debris breakdown. This happens usually because of the UV radiation from the sunlight which degrades the polymers rapidly. So the plastic bags, bottles and other plastic materials which is left in different places becomes secondary micro plastics.

2.2. Some Major Sources of Micro plastics

1. Tyre's – The tyre dust is created due the friction and it is blown away by air and washed of by water.
2. Industries – Increasing use of synthetic materials with the growing industrialization and wastage dumping it into water bodies.
3. Synthetics – They shred of significant amount of acrylic in laundry which is washed away in the drainage.
4. Road markings – From weathering and abrasion of the paint.

2.2.1. Micro plastics found in sample of tap water around the world

Micro plastics have been found in different countries in following percentages

1. United States - 94.4 % of samples ; 4.8 fibers/500ml
2. Ecuador - 79.2 % of samples; 2.2 fibers / 500 ml
3. Europe - 72.2%; 1.9.
4. Lebanon - 93.8% ; 4.5
5. Uganda - 80.8 ; 2.2
6. India - 82.4 - 4.0
7. Indonesia - 76.2% ; 1.9

2.2.2 Micro Plastic pollutions released into world oceans (Million ton / Year)

- a. North America - 0.14
- b. South America - 0.24
- c. Europe/ Central Asia - 0.26
- d. Africa/ Middle East - 0.13
- e. India/ South Asia - 0.28
- f. China - 0.24
- g. East Asia/ Oceania - 0.23

2.3. Influence or impact of micro plastics

2.3.1. Wildlife

Millions of animals died because of the plastics from birds to fish to other marine organisms. Approximately 700 species are affected by the plastics or its particles. Due to the consumption of micro plastics by turtles and fishes they suffer from block digestive tracks, reduce the desire to eat and change the feeding behavior. Eventually their stomach is filled with plastics so they starve and die.

Fish mistake them from plankton and consume them leading to death due to undernourishment. Micro plastic can sink to the beds of the water body and can cause problems to sediment dwelling species. Micro plastics have been assumed from travelling to upper food chains causing problems to each.

2.3.2. Humans

Micro plastics have been detected in drinking water, food products and even in table salt. Scientists have recovered micro plastics from human stools, tissues and organs. It is inspected that the increasing rate of micro plastic consumption can further lead to harmful effects in future.

Micro plastics have also entered the human food chain. Fishes consume plastics which is consumed by humans leading to the deposit of micro plastics in humans. It is directly or indirectly been affecting humans since a long time.

Studies show that it may damage cells and affect immune system.

3. Treatment

Micro plastics can be treated in the conventional activated sludge system which removes 99% of micro plastics in water. The rest 1% is very small that it passes through the treatment plant. Then further it can be passed through process which are mentioned below.

- a. Disc filter - 40-98.5% removal
- b. Rapid Sand Filtration - 97%
- c. Flocculants and Diffused air floatation - 95%
- d. Membrane bioreactor - 99%

4. Conclusion

There are still some minor percentage of micro plastics entering the streams after the treatment of the water. Thus, a possible solution to the pollution is of reducing the heavy plastic usage which is rapidly increasing with the population growth. In 1950 to 2015 63000 million metric tons of plastics were produced and plastics being non-biodegradable are being disposed of in lands and mainly in oceans. Moreover the use of plastic bottles, bags and synthetic clothes can be reduced. Bans are becoming popular but in developing countries like India it can be a major challenge to stop the usage of plastics.

Eco bricks are also an example to the cure the single use plastic polymers. It is a plastic bottle packed tight with used plastic which can be used in building block. It can also be packed with other non-biodegradable and toxic wastes.

REFERENCES

1. Enders, K.; Lenz, R.; Stedmon, C.A.; Nielsen, T.G. Abundance, size and polymer composition of marine microplastics $\geq 10 \mu\text{m}$ in the Atlantic Ocean and their modelled vertical distribution. *Mar. Pollut. Bull.* 2015, 100, 70-81
2. Horton, A.A.; Walton, A.; Spurgeon, D.J.; Lahive, E.; Svendsen, C. Microplastics in freshwater and terrestrial environments: Evaluating the current

understanding to identify the knowledge gaps and future research priorities. *Sci. Total Environ.* 2017, 586, 127–141

3. Hendrickson E, Minor EC and Schreiner K (2018). Microplastic abundance and composition in western Lake Superior as determined via microscopy, Pyro-GC/MS, and FTIR. *Environmental Science & Technology*, 52(4):1787–96. doi: 10.1021/acs.est.7b05829
4. Strand J, et al. (2018). Analysis of microplastic particles in Danish drinking water. Aarhus: Aarhus University, Danish Centre for Environment and Energy. (Scientific Report No. 291