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International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A Review of Study and analysis of microplastics pollution in water sediments at various lakes

Satyaprakash Shukla[1] and Prof. Dal Chand Rahi[1]

[1]Department of Civil Engineering, Jabalpur Engineering College, Jabalpur (M.P.)

ABSTRACT -

Microplastics, due to their microscopic size, are a concern for aquatic species as they are easier to consume and the recent discovery of microplastics in human blood shows that they can also have undisclosed effects on human health. Information on the presence of microplastics can be crucial in preventing further pollution and developing management interventions. The pre-treatment of the sample was carried out with a solution of $ZnCl_2$ for separation by density and H_2O_2 for oxidation of the organic material.

Keywords: Microplastics; Pollution; weathering.

1. INTRODUCTION

Environmental pollution is the most horrible ecological crisis that we are subjected to today. It is due to the rapid urban-industrial technological revolution and the rapid exploitation of natural resources by man, and the population explosion. Today the environment has become filthy, contaminated, undesirable, and, therefore, harmful to the health of living organisms, including man. The splendid abundance of nature is a heritage that must never be spoiled. But man's voracious and limitless exploration of nature has upset the delicate ecological balance that exists between the living and non-living components of planet Earth. The root cause of environmental pollution has been man's misbehavior towards nature under the false ego that he is the master of nature.

A pollutant has been defined by the Environmental Protection Act (EPA13), 1986 as "a harmful solid, liquid or gaseous substance present in such a concentration in the environment that it is likely to be harmful to the environment".

In the basic form in which they exist in the environment after their release, pollutants can

be divided into the following categories:

1. Primary Pollutant (SOx, NOx, CO, etc.)

2. Secondary pollutants, ie substances derived from primary pollutants such as Peroxy Acetyl Nitrate (PAN).

3. Biodegradable pollutants whose substance can be decomposed, removed, or consumed and thus reduced to acceptable levels, for example. household waste, heat, etc.

4. Non-biodegradable pollutants: these either do not degrade or degrade very slowly or partially and then pollute the environment.

Thus, we can conclude that when waste produced by human activity is not efficiently assimilated, decomposed, or removed by natural, biological, or physical processes, they cause adverse effects and are called pollutants.

2. TYPES OF ENVIRONMENT

The environment can be divided into two categories, are

a) Natural Environment

b) Artificial or anthropogenic environment

Natural environment

The natural environment operates through a self-regulatory mechanism, that is, any change in the natural ecosystem caused by the natural process is counterbalanced by changes in the other component of the environment. This mechanism is known as the homeostatic environment. Thus, there is a reciprocal relationship between the various components of the environment. These components are water, air, noise, soil, forest, wildlife, flora, fauna, etc.

Man Made Environment

Man is the most important environmental agent, led by modern technologies capable of modifying the environment according to his needs. The man-made environment includes technology transport, housing, etc. Thus, it is concluded that the environment consists of an amalgamation of different systems such as physical, chemical, biological, social, and cultural.

3. LITERATURE REVIEW

Plastic particles <5 mm in size fall into the category of microplastics, which are classified as primary microplastics and secondary microplastics. Primary microplastics are manufactured in microscopic sizes to be used in facial cleansers, scrubs, and other cosmetics and can be easily traced back to their origins. Secondary microplastics are even smaller pieces of plastic formed by weathering or breaking down of larger plastic particles and cannot be easily traced back to their sources [1]. Secondary microplastics are predominant pollutants in the riparian system. Microplastics can enter the riparian system through several sources, including industrial, domestic drainage, or surface runoff due to rain. Extensive use of fishing tackle that is often discarded in water bodies, fibers from washing clothes from polyester, nylon, etc. substantial amount of pollution in rivers and oceans. Microplastics are transported through river water and sediment along shorelines can act as a sink for microplastics [4]. The presence of these microplastics in the riparian system raises serious concerns about the ecological system and human health. Being small in size, microplastics can be easily consumed by aquatic animals and may eventually end up inside humans through the consumption of seafood [5].

4. SAMPLING METHOD

Four samples were collected at random points 1 to 2 meters along the lake bank of each site. Stainless steel spoons and containers were used to collect sediment from an area of approximately 30 cm^2 and approximately 5 cm in depth. Subsequently, the sediment samples collected from each point were mixed into a pooled sample and 1 kg of sediment from the pooled samples was separated as a final sample.

Overall, four of these samples were collected at four different locations, and the collected samples were brought to the laboratory and dried in an oven at 45°C for 72 hours before pre-treatment.

5. PRE-TREATMENT

For pretreatment, 50g of dry samples from each of the samples were taken and subjected to density separation using $ZnCl_2$ solution. $ZnCl_2$ has a density of 1.7 g/cm3 and the density of plastics varies in a range between 0.8 and 1.4 g/cm^3, specifically for polyethylene (0.92-0.97 g/cm^3), polypropylene (0.85-0.94 g/cm3), polystyrene (0.05-1 g/cm^3) and others are also in the same range. After density separation, the floating particles were separated by filtering the supernatant using a 20-micrometer sieve. Subsequently, the oxidation of the organic material was carried out using a 35% H_2O_2 solution in a borosilicate glass beaker for 24 hours. Then, the sample was filtered through the same 20-micrometer sieve. Finally, vacuum filtration was performed on cellulose filter paper (diameter 47 mm, pore size 5 mm) using a configuration consisting of a vacuum pump, a thoroughly washed Buchner flask, and a porcelain Buchner funnel.

6. CONTAMINATION CONTROL

Sediments were collected in stainless steel containers using stainless steel spoons from the sites. When performing the densimetric separation and oxidation of the organic matter, a borosilicate glass apparatus was used, except for the washing bottles, which were made of plastic. The borosilicate glassware was washed twice with distilled water before being used for pretreatment. The filtration setup with a porcelain Buchner funnel was carefully rinsed with distilled water several times to avoid contamination. Fresh filter papers were used for filtration with a 250ml test of distilled water. The filtered samples were then stored in borosilicate glass Petri dishes. The procedure was performed in a dedicated,

clean laboratory with limited access.

7. CONCLUSION

This study concludes that sediments along the shoreline of the lakes act as a sink for microplastic deposition. Secondary microplastics were abundant among all samples, confirming that most microplastics originated from the fragmentation and weathering of older and poorly managed plastic waste. The higher number of particles in the size range from 30 to 1,000 micrometer suggests that as the size of microplastics decreased, the abundance increased.

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