International Journal of Research Publication and Reviews, Vol 4, no 9, pp 3291-3293 September 2023

International Journal of Research Publication and Reviews

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

A Review of Analysis and Sampling of Microplastic Pollutants and their Impact in Nala's of Jabalpur City.

Mukesh Chouhan[1] and Prof. R.K. Bhatiya[1]

Department of Civil Engineering, Jabalpur Engineering College, Jabalpur (M.P.)
DOI: https://doi.org/10.55248/gengpi.4.923.92521

ABSTRACT –

Microplastics were detected in all sampled Nalas, with varying concentrations and polymer types. The predominant sources of microplastic pollution were identified as domestic wastewater, urban runoff, and industrial discharges. Characterization of microplastics revealed a diverse range of shapes, sizes, and polymer compositions, including fragments, fibers, and microbeads. The pre-treatment of the sample was carried out with a solution of ZnCl2 for separation by density and H2O2 for oxidation of the organic material.

Keywords: Nalas; Microplastics; Pollutants; Contamination control method.

1. INTRODUCTION

Microplastics, defined as plastic particles measuring less than 5 millimeters in size, have become a pervasive and alarming global environmental issue over the past few decades. These minute plastic fragments originate from a variety of sources, including the breakdown of larger plastic items, industrial processes, and the release of micro beads from personal care products. Due to their small size and widespread distribution, microplastics have infiltrated aquatic ecosystems, posing significant threats to both the environment and human well-being.

Jabalpur, a city situated in the central Indian state of Madhya Pradesh, is not exempt from the challenges posed by microplastic pollution. As an urban center with growing industrial and residential activities, Jabalpur's Nalas, or urban drainage channels, play a crucial role in managing rainwater runoff and wastewater discharge. However, these Nalas also serve as conduits for the transport of microplastic pollutants into surrounding water bodies, ultimately affecting the health of local ecosystems.

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 surroundings and conditions in which life on Earth exists and evolves without significant human influence. It encompasses all living organisms, their habitats, and the physical elements of the Earth, including air, water, soil, and climate. The natural environment is essential for the survival and well-being of all species, including humans, as it provides vital resources and ecosystem services such as clean air, fresh water, fertile soil, and a stable climate.

Built Environment

The human-made or constructed surroundings and infrastructure that people create to meet their societal, economic, and cultural needs. It is a contrast to the natural environment, which exists without significant human intervention. The man-made environment encompasses a wide range of elements and structures, including buildings, roads, bridges, transportation systems, cities, towns, and various forms of infrastructure.

3. LITERATURE REVIEW

Microplastics are defined as primary microplastics and secondary microplastics and include all plastic particles smaller than 5 mm. Primary microplastics can be easily identified since they are produced in miniscule sizes for use in facial products and Teflon coated cooking utensils[1] Even smaller fragments of plastic called secondary microplastics, which are very difficult to link back to their original sources, are created when bigger plastic particles deteriorate or weather from different weathering agencies [2]. The riparian system's main contaminants are secondary microplastics. Microplastics can enter into human or animal life cycle from a number of places, including surface runoff from rain, home drainage, and huge domestic and industrial waste, i.e., unprocessed waste water present in Urban rivers pointing a good possibility of Microplastic presence that is frequently dumped, as well as clothing fibers made of polyester and nylon, etc. which are not visible through our naked eyes impacting a serious threat to every single life present on our planet Earth [3]. Due to the small size of microplastic, there are serious ecological and health concerns due to transportation of the microplastic in the human body.

4. SAMPLING METHOD

Laboratory impurity was minimized by irrigating the teacups several times with distilled water before use and keeping the samples covered. White cotton lab fleeces and nitrile gloves were worn at all times when handling and transferring samples to reduce and regularize any impurity from processing. To measure any impurity introduced by the laboratory air, three sludge papers were left exposed for 24 h near the spots used for filtration, oxidation processing way, and counting. Five samples were collected at arbitrary points 1 to 2 meter,

Measures along the nala reinforcement of each point. Stainless sword ladles and holders were used to collect deposition from an area. Latterly, deposition samples collected from each point were mixed into a nala sample and 1 liter of deposition from nala samples was separated as a final sample. Overall, five of these samples were collected at five different location, and the collected samples were taken to the laboratory and dried with maintained temperature of 45 °C during 72 hours before pretreatment.

5. PRE-TREATMENT

For pre-treatment, 50ml of samples from each of the samples were taken and subordinated to densimetric separation using ZnCl2 result. ZnCl2 has a viscosity of 1.7 g/ cm^3 and the viscosity 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/ cm^3), polystyrene (0.05- 1 g/ cm^3) and others are also in the same range. After viscosity separation, the floating patches were separated by filtering the supernatant using a 20- micrometer sieve. Latterly, the oxidation of the organic material was carried out using a 35. H2O2 result in a borosilicate glass teacup for 24 h

Also, the sample was filtered through the same 20- micrometer sieve. Eventually, vacuum filtration was performed on cellulose sludge paper(periphery 47 mm, severance size 5 mm) using a configuration conforming of a vacuum pump, a well- washed Buchner beaker and a demitasse Buchner channel. The pre- treatment system used in this study has possible excrescencies that can beget an overestimation and underestimation of microplastics in nalas. For illustration, microplastics attached to biofilms may have been discarded during viscosity separation, or microplastics may have been introduced into samples during the slice crusade, sample pretreatment, and analysis, despite strict impurity control procedures along the way.

6. CONTAMINATION CONTROL

Water samples were collected in pristine sword holders using pristine sword ladles from the spots. When performing the densimetric separation and oxidation of the organic matter, a borosilicate glass outfit was used, except for the washing bottles, which were made of plastic. The borosilicate dinnerware was washed doubly with distilled water before being used for pretreatment. The filtration setup with a demitasse Buchner channel was precisely irrigated with distilled water several times to avoid impurity. Fresh sludge papers were used for filtration with a 250 ml test of distilled water.

The filtered samples were also stored in borosilicate glass Petri dishes. The procedure was performed in a devoted, clean laboratory with limited access. Dinnerware was rigorously used throughout the sample pretreatment, except plastic marshland bottles (PE body and PP cap/ cap). Cotton lab fleeces and nitride gloves were worn throughout pretreatment and analysis. The mugs were washed with cleaner and irrigated three times with ultrapure water before being used for pretreatment.

7. CONCLUSION

This study concludes that plastic contaminants along the props of nalas act as a Gomorrah for microplastic deposit. The advanced number of patches in the 20 to 1,000- micrometer size range suggests that as the size of microplastics decreases, the cornucopia increases. This study concludes that the sediments along the different nalas act as cesspools for the deposit of microplastics. Secondary microplastics were abundant among all samples, attesting that outmost microplastics began from the fragmentation and riding of aged and inadequately managed plastic waste. The advanced number of patches in the size range from 20 to 1,000 micrometer suggests that as the size of microplastics dropped, the cornucopia increased.

References

[1] Nisha singh, Arijit mondal, Amarjeet bagri (2020) “Characteristics and spatial distribution of microplastics in the lower Ganga River water and sediment.”Science direct, 111960.

[2] Tenzin Tsering ,Mika Sillanpaa, Markus Sillanpaa,mirka Viitala,Satu-Pia Reinikainen (2021) “Microplastics pollution in the Brahmaputra river and Indus River of the Indian Himalaya” science direct 147968.(www.elsevier.com/locate/scitotenv)

[3] Simone Lechthaler, kryss Waldschlager, Chavapati Gouse Sandhani, S.A.Sannasiraj, V.Sundar, Jan Schwarzbauer and Holger Schuttrumpf (2021) “Baseline Study on Microplastics in Indian rivers under Different Anthropogenic Influences.10.3390/w13121648.

[4] Ahmet H. lri ,Malek H.A. Shahrah ,Ali M.Ali ,Sayed A. Qadri,Talha Erdem ,Ibrahim T.Ozdur ,Kutay Icoz “Optical detection of microplastics in water.(2020),http://doi.org/10.1007/s11356-021-12358-2

[5] Joana Correia Prata, Joao P.da Costa, Armando C. Duarte, Teresa Rocha-Santos (2019), “Methods for sampling and detection of microplastics in water and sediment: A critical review”, Trends in Analytical Chemistry 110(2019)150-159.