# Identification and analysis of Microplastics in Riverine Environment in Kannur, Kerala

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**Abstract -** *Microplastics are fragments of plastic that are sized less than 5 mm. This study aims at quantifying the microplastic pollution of a small section of a major river in the Kannur district. The study is done in samples collected from banks of Anjarakandy river. The study involved collecting samples from site and then analyzing it in lab. Along the banks 3 samples were collected. The processing was done according to NOAA protocol. The microplastic was analyzed using FT-IR spectroscopy.*

***Key Words***: Microplastic

### 1.INTRODUCTION

Plastic a type of synthetic polymer is a versatile and widely-used material, with applications in various fields such as kitchenware, toys, packaging, textiles, and more. But with the increase in plastic usage, the amount of plastic waste has increased exponentially, leading to a significant environmental problem.

One of the most critical concerns related to plastic waste is the emergence of microplastics, which are small pieces of plastic debris less than five millimetres in size. Microplastics are a result of direct use or degradation of larger plastics, and they pose a significant threat to marine ecology. Due to tidal actions, density of microplastics, wind distribution, and other atmospheric parameters, microplastics get distributed in the marine environment globally, and they can be found in marine surface waters, deep sediments, and beach sediments.

Ingestion of microplastics by marine species, from zooplankton to larger animals like sharks and whales, is one of the most concerning effects of this substance. When marine, terrestrial, and freshwater species that have already consumed microplastics are preyed upon by other animals, the microplastics may move through the food web. Laboratory research suggests that the amount of microplastics in the environment and how much they resemble food both have an impact on the likelihood that they will be consumed. In addition, microplastics tend to act as adsorbents for other harmful chemicals and toxins, leading to further negative impacts on biological life.

### 1.1 Microplastics

According to the European Chemicals Agency and the U.S. National Oceanic and Atmospheric Administration (NOAA), microplastics are plastic fragments that are fewer than 5 mm (0.20 in) in length. Microplastics are small plastic particles that have become a major environmental concern in recent years.

They are found in oceans, rivers, lakes, and other bodies of water around the world. Microplastics can come from a variety of sources, including the breakdown of larger plastic items, microbeads in personal care products, and fibers from synthetic clothing. Despite their small size, microplastics have the potential to cause significant harm to ecosystems, wildlife, and human health. They enter natural environments via a number of sources, such as cosmetics, clothing, food packaging, and industrial processes, and create contamination.

Microplastics are a pervasive environmental pollutant that can be found in various ecosystems, including the atmosphere, fresh water, and oceans. Based on morphological analysis, MPs can be categorized into six types: fiber, sphere, foam, sheet, fragment, and film. Fiber-shaped MPs are the most commonly found type of MP in the environment. The garment industry is the primary source of microfibers in the environment, with washing processes during manufacturing being a key contributor. Foam-type plastic particles are formed through the fragmentation of different plastic-based products. Items such as foam packaging and disposable food containers can break down into smaller pieces over time, contributing to the accumulation of foam-structured MPs in the environment. Similarly, plastic synthetic bags and packing materials can contribute to the formation of film-structured MPs through fragmentation. Sphere-type particles originate from resin pellet leakage of the transportation system, abrasive blasting media, and different abrasive products. Both transparent and colored MPs are available in the environment.

### 1.2 Sources

Microplastics can come from a variety of sources, both human-made and natural. Some common sources of microplastics include:

- Plastic products: Microplastics can be generated during the production, use, and disposal of plastic products, such as plastic bags, bottles, and packaging materials.

- Synthetic textiles: Synthetic fabrics, such as polyester and nylon, shed microfibers when laundered or worn. These microfibers can contribute to the accumulation of microplastics in the environment.
- Tires: Car tires are made of synthetic rubber and can shed tiny particles of microplastics during use.
- Personal care products: Microbeads, which are tiny plastic particles used in some personal care products like exfoliating scrubs and toothpaste, can enter the environment through wastewater discharge.
- Fishing gear: Abandoned or lost fishing gear, such as nets and lines, can break down into microplastics in the ocean.
- Industrial processes: Microplastics can be generated during industrial processes, such as abrasive blasting, plastic pellet production, and sandblasting.

It is important to note that microplastics can also be generated naturally, such as from erosion of rocks and soil. However, the majority of microplastics found in the environment are human-made. To reduce the presence of microplastics in the environment, it is necessary to address the sources of plastic pollution and promote sustainable alternatives to plastic products through atmospheric deposition, which occurs when airborne microplastics settle on land or water.

## 2. STUDY AREA

The study is conducted along the banks of Anjarakandy river which is a significant watercourse that traverses the Kannur District of Kerala, India. The river drains into the Arabian sea. Samples are collected from three locations along the bank.

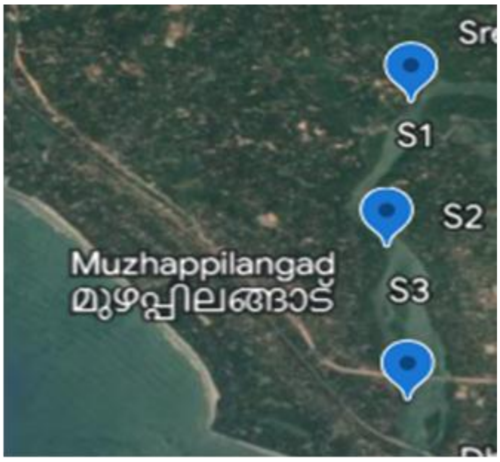


**Fig -1:** Sampling sites

## 3. METHODOLOGY

The process of analyzing MPs typically involves several procedures such as collecting, preparing, extracting, and identifying samples. To successfully detect MPs in complicated soil matrices, it is important to effectively separate them. Extraction is a crucial step that follows sample collection and pretreatment, as it aims to isolate MPs for later quantification and identification. The objective of this project is to separate MPs from their environmental matrix in order to obtain them for further analysis

### 3.1 Sample collection

Samples were collected from the study area. Overall 3 samples were collected (Fig 1). The samples are collected within less than 5 cm from the ground.

For preventing contamination , the samples were stored in glass jar.

The samples are dried and were sieved through 2 mm sieve for homogenizing as well as for separating larger debris. 100 g of sieved sample was further used for analysis

### 3.2 Digestion of organic matter

NOAA guidelines were followed for wet oxidation. The sample was treated with Hydrogen peroxide and Ferrous Sulphate solution to digest organic matter.

### 3.3 Density separation

The process of separating MPs from complex samples often involves the use of density separation, which takes advantage of differences in particle densities and surrounding environments. One such method involves using a Sodium Chloride solution, where particles with a lower density than NaCl will float in the supernatant. To create the solution, 6g of NaCl is added to every 20ml of solution. The supernatant is then collected in a beaker and left to settle for 24 hours.

### 3.4 Filtration

The supernatant after density separation was then subjected to filtration. The sample was filtered on to Whatmann filter paper (No.42).This membrane with the particles collected was then allowed to dry for 24 hrs at room temperature

### 3.5 Identification of Microplastics

To confirm the composition of the MPs, a chemical analysis of the contents in the dried filter paper was performed. The contents from the filter paper are carefully removed and is observed under microscope, Then the particles are sent for FT-IR analysis

### 3.6 Quantification

100 gm of samples are sieved and the count of microplastics is obtained.

## 4. RESULT AND DISCUSSIONS

From the 3 soil samples, 100 grams of soil was analyzed and the microplastic was counted and quantified per weight.

An average of 20-22 particles were found per 100 gm of soil samples. The sample S1 has the least number of particles where as S3 have a higher count of 25. S3 is a location which is approaching to the draining site.

FT-IR analysis is done for samples collected from filter paper. The wavenumber range of 4000 -500 $cm^{-1}$ was taken

**Table -1:** Count and Weight of plastics

| Samples | Top Soil | | |
|---|---|---|---|
| | Count | Weight of plastic (gm) | % Weight of plastics to weight of soil |
| S1 | 17 | 0.022 | 0.022 |
| S2 | 20 | 0.029 | 0.029 |
| S3 | 25 | 0.038 | 0.038 |

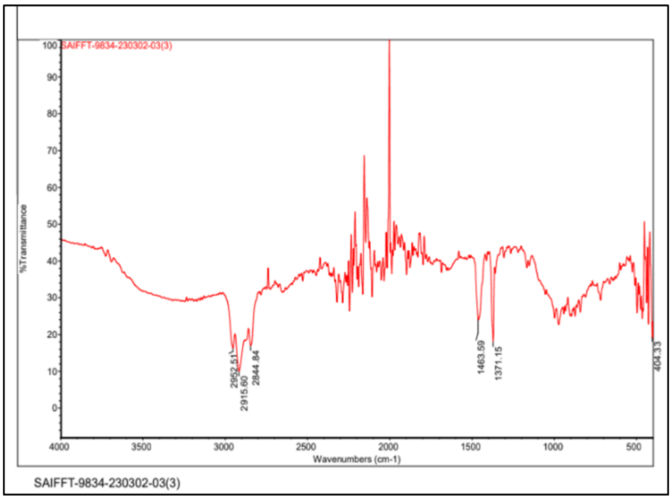


**Fig -2:** FT-IR spectrum of Sample 1

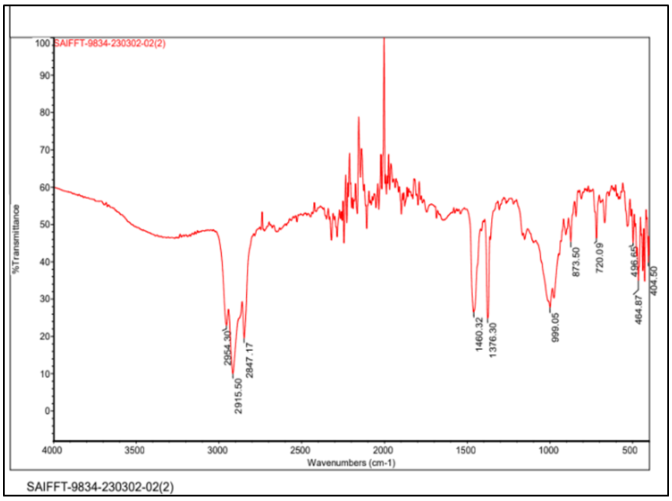


**Fig -3:** FT-IR spectrum of Sample 2

Microplastic from Sample 1 and Sample 2 are analysed using FT-IR and they are referenced with library. The peaks interpret to polyethylene and polypropylene. Various forms of both these polymers are seen. Chlorinated and oxidized forms of polyethelene were found.

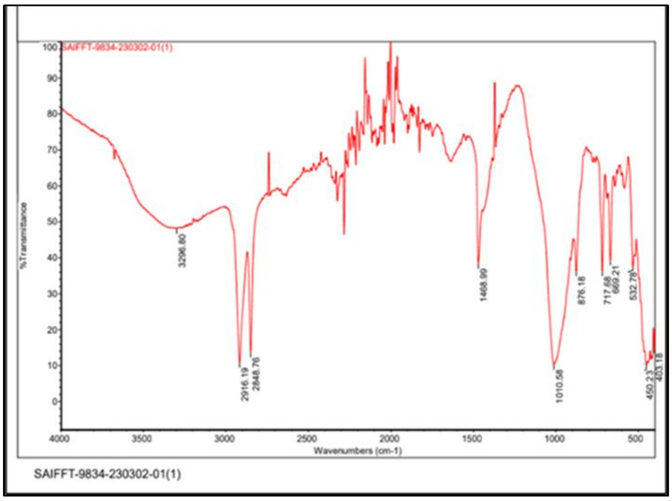


**Fig -4:** FT-IR spectrum of Sample 3

Fig 4 shows FT-IT analysis of Sample 3 which is taken from river bank. The graph was referenced with library and found that the major compound present is polyethylene. Polyethylene is a commonly used polymer in the production of plastic products, such as bags, packaging, and bottles.

Polyethylene microplastics in riverine sand can come from a variety of sources, such as plastic litter on land or from plastic products that break down over time. It is also known to be a major component of microplastics found in the environment, including in riverine sand.

Like polyethylene, polypropylene is also used in production of variety of common goods and hence when these product from residential and commercial area breaks down , gets end up in riverine deposits.

## 5. CONCLUSIONS

The accumulation of microplastics in the environment is a growing concern and efforts are needed to reduce their release into the environment and to remediate the existing accumulation. Further breakdown can lead the plastic size range to nano ranges which is even more harmful to the ecosystem

This study was conducted to quantify and analysis the microplastic content in a riverine environment. It as found that polypropylene and polyethylene were predominant in riverine samples.

These findings are concerning, as microplastics can have detrimental effects on the environment and marine life. Therefore, remediation methods are necessary to reduce the accumulation of microplastics in the environment.

## REFERENCES

[1] V. Anu Pavithran(2021) "Study on microplastic pollution in the coastal seawaters of selected regions along the northern coast of Kerala, southwest coast of India " Journal of Sea Research

[2] Ashwini Suresh Kumar and George K. Varghese (2021) "Microplastic pollution of Calicut beach - Contributing factors and possible impacts " Marine Pollution Bulletin

[3] K Gowda et al (2022) "Identification of Microplastics in Contaminated Urban Informal Landfill Soil With Removal Methods "IJERT

[4] R Karthik et al (2018) "Microplastics along the beaches of southeast coast of India" Science of the Total Environment 1388-1399

[5] K Zhang et al (2021) "Understanding plastic degradation and microplastic formation in the environment: A review" Environmental Pollution

[6] F Stock et al (2019) "Sampling techniques and preparation methods for microplastic analyses in the aquatic environment A review" Trends in Analytical Chemistry