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Analysis and Sampling of Micro plastic Pollutants & their Impact in Nala's of Jabalpur City (M.P.)

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ABSTRACT - Micro plastics (MP) pose a significant environmental challenge, categorized into primary (e.g., cosmetic particles) and secondary (resulting from plastic waste degradation).They pervade river beds, Arctic ice, soil, and even drinking water, entering the human food chain. Industries and improper disposal contribute to primary and secondary MP. While aquatic life risks are known, the full extent is unclear. Plasticizers in MPPs affect marine life and potentially enter thehuman body. Various filters, like aluminum oxide, aid MP analysis.Genetic damage to marine organisms from micro plastics, absorbing harmful substances, is documented. Environmental pollution stems from resource exploitation, urbanization, and population growth. Management interventions are crucial. Human interventions, altering rivers and urbanization, impact water qualityand MP distribution. In conclusion, addressing micro plastic pollution is imperative for environmental and human well-being.

Keywords: Nalas; Micro plastics; contamination control method; Pollution.

1. INTRODUCTION

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 wornat 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.

According to the definition, polymer particles with a diameter of less than 5 mm are referred to as micro plastic (MP) particles. They are further classified as primary and secondary particles depending on their origin. They are found in river, Arctic ice, natural fertilizers, soil, and even drinking water showing significant amounts of MPPs. Over the past years, micro plastics have found

Their way into the human food chain through various means whether it may be through aquatic animal consumption or direct consumption of water through Nala's ***(Aragawl T. A. 2020).*** In short, the expansion micro plastics makes it a huge challenge for our environment.

In 2021, **L. Simone, W. Kryss, C. G. Sandhani , S. A. Sannasiraj, V. Sundar, S. Jan and S. Holger** did investigation on three different rivers in Chennai megacity, they choose 2 urban river(Kosasthalaiyar River and the Adyar River) and 1 rural river(Muthirappuzhayar River). They want to find if there is any difference in micro plastic concentration based on type of population along river and its possible influence. They noticed there was a huge domestic and industrial waste,i.e., unprocessed waste water were present in Urban Rivers. Which means a good possibility of Micro plastic detection in urban rivers is expected.

The rough methodology they followed:

- The samples were taken from bridges at 5 different location throughout city.
- At a location, 3 samples were taken in 6 days to manage fluctuation.
- A special bag for sampling is used (Neuston Net) having a filter net size of 335 micro-meter, and dimension around 15cm high and 30cm wide.
- Discharge of each sampling is measured through a mechanical flow meter.
- Samples were taken by dropping trawls from bridge.
- Microscopic evaluation of each sample is done.
- Partial Evaluation with Fourier transform infrared spectroscopy.Analysis from their samples:
- Total no. of micro plastics Detected: 447
- Percentage of fibers: 64.1%
- Percentage of films: 21.7%
- Percentage of fragments: 12%
- Percentage of pellets: 2.2%
- Colors classification is also done, mostly black particles present.
- Micro plastic size ranges from 335 micro-meter to 5 milli-meter.
- 3 types of polymers were identified: PE, PP and PS.
- Concentration of micro plastic is found highest in a sample from Adyar River (Urban) i.e.,
1.82 particles per liter.
- Concentration of micro plastic is found lowest in a sample from Adyar River (Urban) andthe Multhirappuzhayar River (Rural) i.e., 0.00 particles per liter.
- Average concentration of micro plastic is also determined in which urban rivers had slightlygreater concentration (0.67 and 0.33 particles per liter) than rural river (0.22 particles per liter).
- A general decrease in micro plastic concentration has been observed when go downstream.
- They concluded with their study that increase in high population, increases biological andindustrial waste, and very low waste water treatment capability these waste water along with non-visible micro plastic makes their way into river.
- A good waste water treatment infrastructure is recommended.

Rapid urbanization, industrialization and population growth in India undoubtedly lead to a significant increase in waste. According to the Central Pollution Control Board (CPCB), 3.3 million metric tons of total plastic waste was generated in India from the year 2018–2019 (Centre for Science and Environment,2020). Inefficient waste management, such as disposing of plastic waste in an open-air landfill, is a common method in India (Joshi and Ahmed, 2016; Sharma and Jain, 2019).

In 2020, **S. Nisha, M. Arijit, B. Amarjeet, T. Ekta, K. Nitin, A. M. Fazel, G. K. Darbha** did micro plastic study in ganga river delta and analyzed its water and sediments, They chose this location because at this point whole water load of upper Indian peninsula passes through this point and should have population influence of half billion people.
The methodology they followed:

- Analyzed Micro plastic range from 0.7 mm to 7.5mm
- Analyzed for shape, size, colour and type of polymer.
- Analyzed by stereomicroscope and Fourier-transform infrared spectrometer.
- Chose 5 locations: Patna, Billie, Baraka, Bhagalpur, and Diamond Harbour
- Water samples were taken at three spots from a location.
- Water samples were taken from 300 micro-meter plankton net.
- Sediments were taken by scrapping 5cm top sediments of surface are of 300x300mm andplaced in aluminum foils.
- Analyzed Micro plastic range from 0.7 mm to 7.5mm.
- Patna showed very large number of micro plastic.
- Mostly white colored micro plastic has been found and may be this due to discoloration bysunlight.
- Micro plastic is divided into 4 sizes, i.e., less than 1mm, 1-2.5mm, 2.5-5mm and more than 5mm
- 2.5mm to 5 mm is majorly present.
- Micro plastic is divided into 4 shapes: fragments, films, foams and filaments.
- Films are majorly present.
- Polyethylene pollution is majorly present as micro plastic.

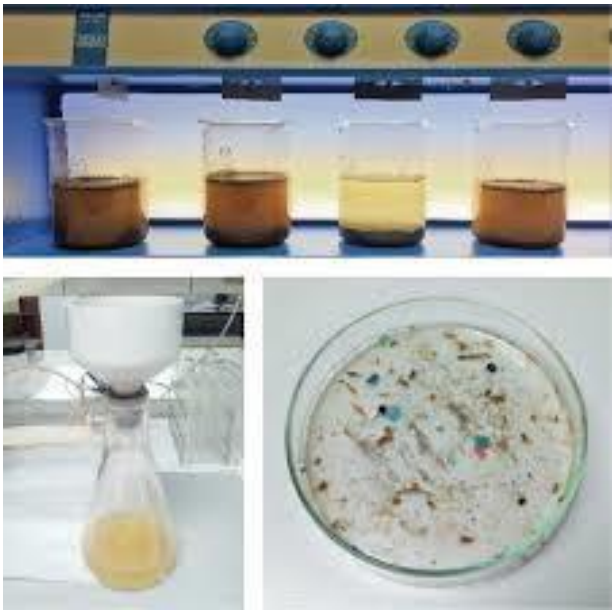
In 2019, **Joana Correia Prata, Joao da Costa, Armando Duarte, Teresa Rocha-Santos** did study on how to detect micro plastic in water bodies, collect micro plastic in bulk, separate it from water and mitigate it.

- Recommended sampling of water in form of long water column, because it may be presentin any depth inside water body depending upon its density and physical characteristics.
- Also it can be accumulated in bulk in certain part of water bodies based on environmentalfactors like wind, gravity, water wave or currents.
- Recommended same sampling method for both sea and fresh water.

In 2021, **T. Tenzin, S. Mika, S. Markus, V. Mirka, R. Satu-Pia** found out microplastic in shore

Sediments of Himalayan Rivers Indus and Brahmaputra

- Pre-treatment was done using $Na_2WO_4 \cdot 2H_2O$ for density separation
- H_2O_2 is used for oxidation of organic matter.
- FTIR microscope is used for analysis
- They concluded, Brahmaputra and Indus, both are highly rich in microplasticcontamination.



2. 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 wornat 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, 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 litre of deposition from nala samples was separated as a final sample. Overall, five of these samples were collected at five different locales, and the collected samples were taken to the laboratory and dried with maintained temperature of 45 °C during 72 hours before pretreatment.

3. PRE-TREATMENT

For pre-treatment, 50ml of samples from each of the samples were taken and subordinated to densimetric separation using $ZnCl_2$ result. $ZnCl_2$ 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 (0.85-0.94g/ 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% H_2O_2 result in a borosilicate glass teacup for 24hours.

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 micro plastics in nalas. For illustration, micro plastics attached to biofilms may have been discarded during viscosity separation, or micro plastics may have been introduced into samples during the slice crusade, sample pretreatment, and analysis, despite strict impurity control procedures along the way.

4. 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 waterseveral 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.

The semi-automated μ-FTIR system was performed for microplastic analysis using a FTIR microscope equipped with a robotic stage control unit and liquid nitrogen cooled medium band mercury cadmium telluride (MCT) sensor. Spectra were measured with the following settings surge number from 4000 cm −1 to 700 cm −1, spectral resolution of 4 cm −1. All patches larger than 20 μm were anatomized from the entirearea effective sludge. All patches between 20 μm and 5000 μm were anatomized. The cornucopia of micro plastics is presented in a unit of MP/ kg reasoning the anatomized for the entire effective area of the sludge and 50 ml of weight of samples in litres.

Table 1 Composition of different nala with different parameters

Sl. No.	Different Nala's	Sampling Depth (cm)	Microplastics extraction	Microplastics size	Microplastics Abundance
1	Near gaur river (L1),	0–2 or 0–3	$Na_2WO_4.2H_20$; 30% H2O2	20–150 µm	531–3485 MP/kg dw
2	Omti nala (L2)	0–2 or 0–3	$Na_2WO_4.2H_20$; 30% $H2O_2$	150–5000 µm	525–1752 MP/kg dw
3	Moti nala (L3)	0–10 or 0–15	$ZnCl_2$; 30% H2O2	63–5000 µm	108–410 MP/kg
4	Khandari nala (L4)	0–5	$ZnCl_2$; 30% H_2O_2 Solution	with 300–5000 µm 50 -200 µm	9–253 MP/kg 525 -1751 MP/kg dw
5	Uldana nala(L5)	0 – 2	Na2Wo4.H2o;30 %		

1. RESULT AND DISCUSSION

Microplastics were classified into five main color groups dark (including brown, wine red, blue, plum, lilac and black), transparent, multicolored, white (cream, grey, white) and red (including light red, pink, yellow, orange). In this study, more than 7,000 particles of nala sediment were analyzed and of these 139 particles were detected as polymers, the main types of polymers being PP, PE, PA, Polyester, PVC and others.

The sample is collected in different Nalas such as near gaur river (L1), Omti nala (L2), Moti nala (L3), Khandari nala (L4) And Uldana nala (L5).

Table 2 Composition of micro plastics in percentage without pretreatment of different Polymer Types in L1

SI. No.	Polymer Type	Size of microplastic < 1mm (in%)	Size of Microplastic >1mm (in %)
1	PP	38	12
2	PE	34	9
3	PA	6	4
4	POLYSTER	5	3
5	PVC	2	1

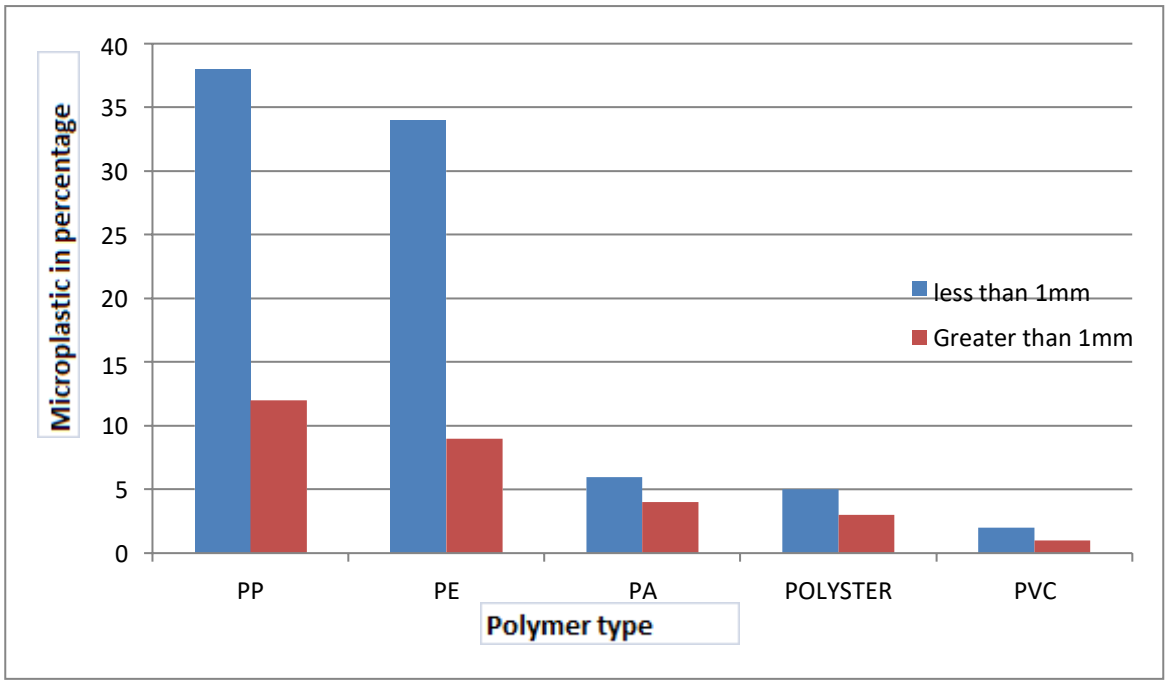


Figure 1 Composition of micro plastics in percentage without pretreatment of different Polymer Type in L1

Table 3 Composition of micro plastics in percentage without pretreatment of different Polymer Types in L2

SI. No.	**Polymer Type**	**Size of microplastic < 1mm (in %)**	**Size of microplastic >1mm (in %)**
1	PP	39	13
2	PE	41	16
3	PA	2	1
4	POLYSTER	4	2
5	PVC	7	4

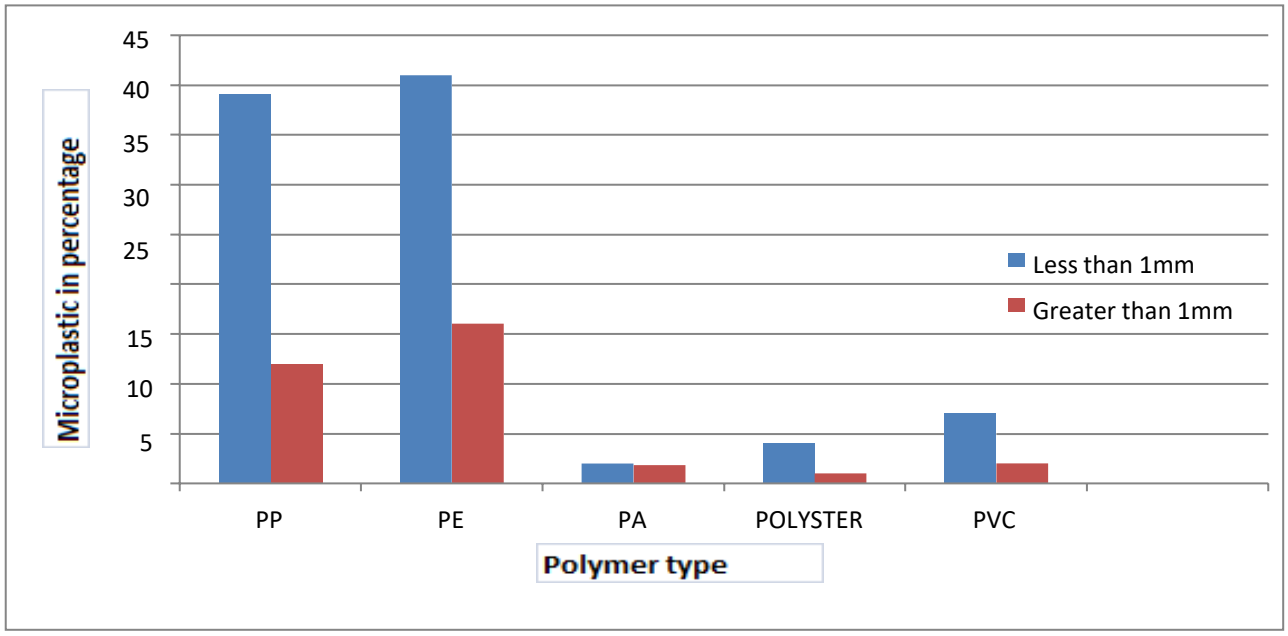


Figure 2 Composition of micro plastics in percentage without pretreatment of different Polymer type In L2

Table 4 Composition of micro plastics in percentage without pretreatment of different Polymer types in L3

SI. No.	Polymer Type	Size of microplastic < 1mm (in %)	Size of Microplastic >1mm (in %)
1	PP	38	12
2	PE	34	9
3	PA	6	4
4	POLYSTER	5	3
5	PVC	2	1

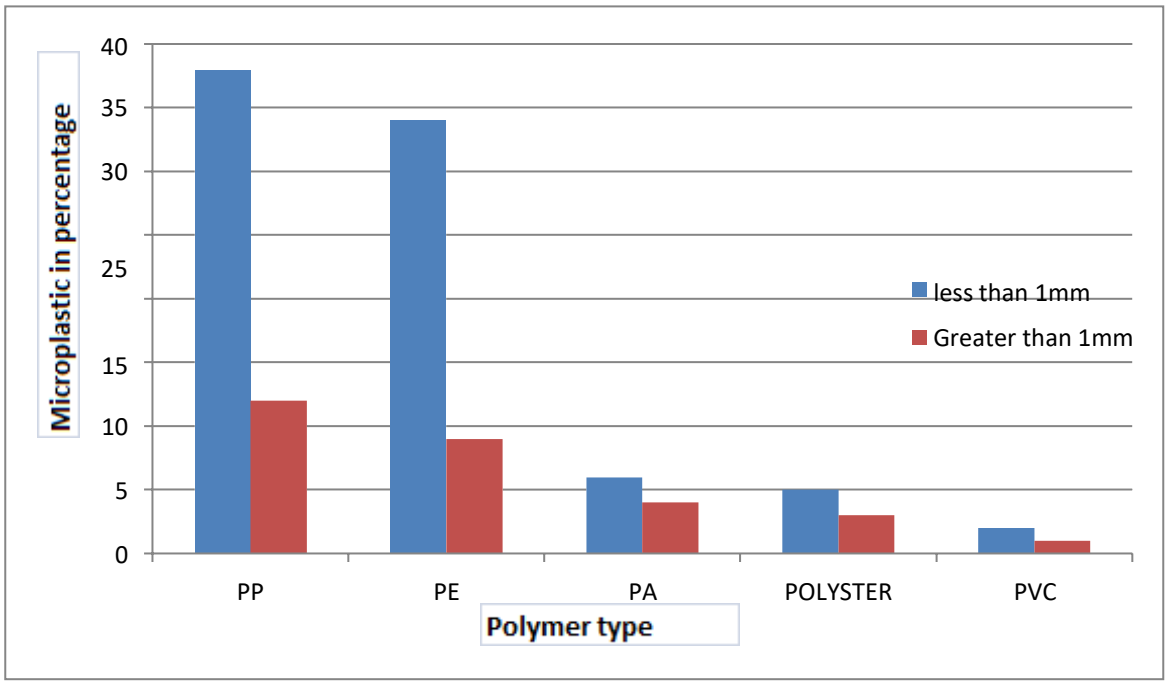


Figure 3 Composition of micro plastics in percentage without pretreatment of different Polymer Type in L3

Table 5 Composition of micro plastics in percentage without pretreatment of different Polymer types in L4

SI.No.	**Polymer Type**	**Size of microplastic < 1mm (in %)**	**Size of microplastic >1mm (in %)**
1	PP	37	13
2	PE	40	15
3	PA	2	1
4	POLYSTER	4	2
5	PVC	7	4

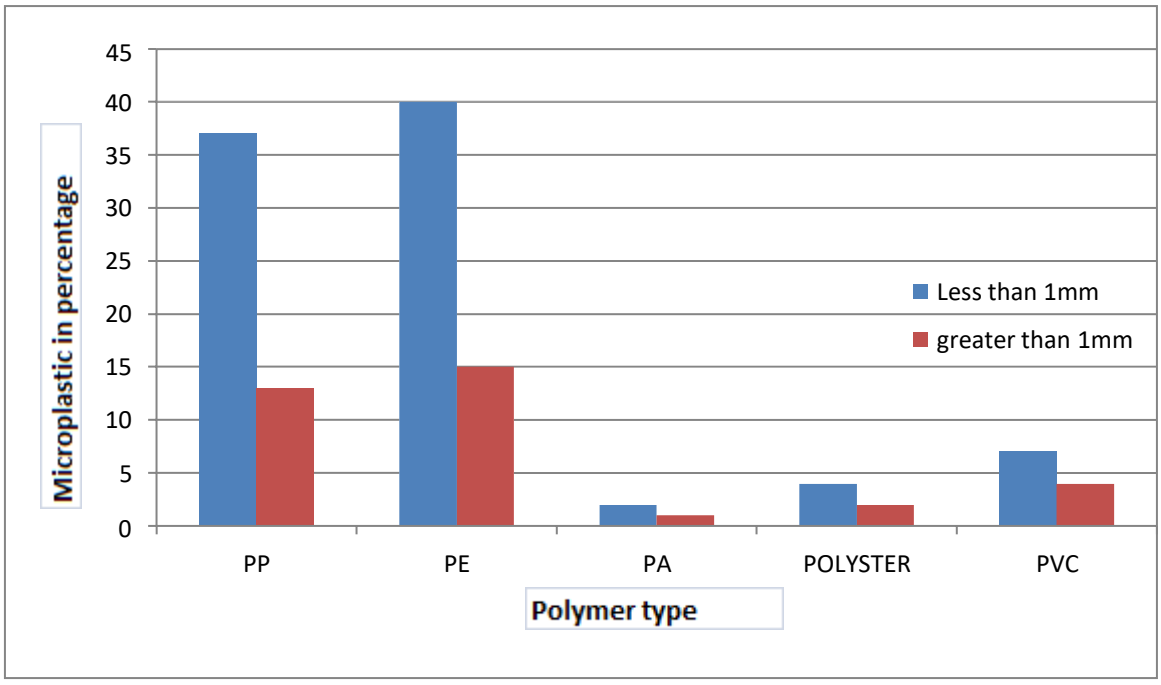


Figure 4 Composition of micro plastics in percentage without pretreatment of different Polymer types in L4

Table 6 Composition of micro plastics in percentage without pretreatment of different Polymer typein L5

S.No.	**Polymer Type**	**Size of microplastic < 1mm (in %)**	**Size of microplastic > 1mm (in %)**
1	PP	35	14
2	PE	38	17
3	PA	7	5
4	POLYSTER	4	2
5	PVC	3	2

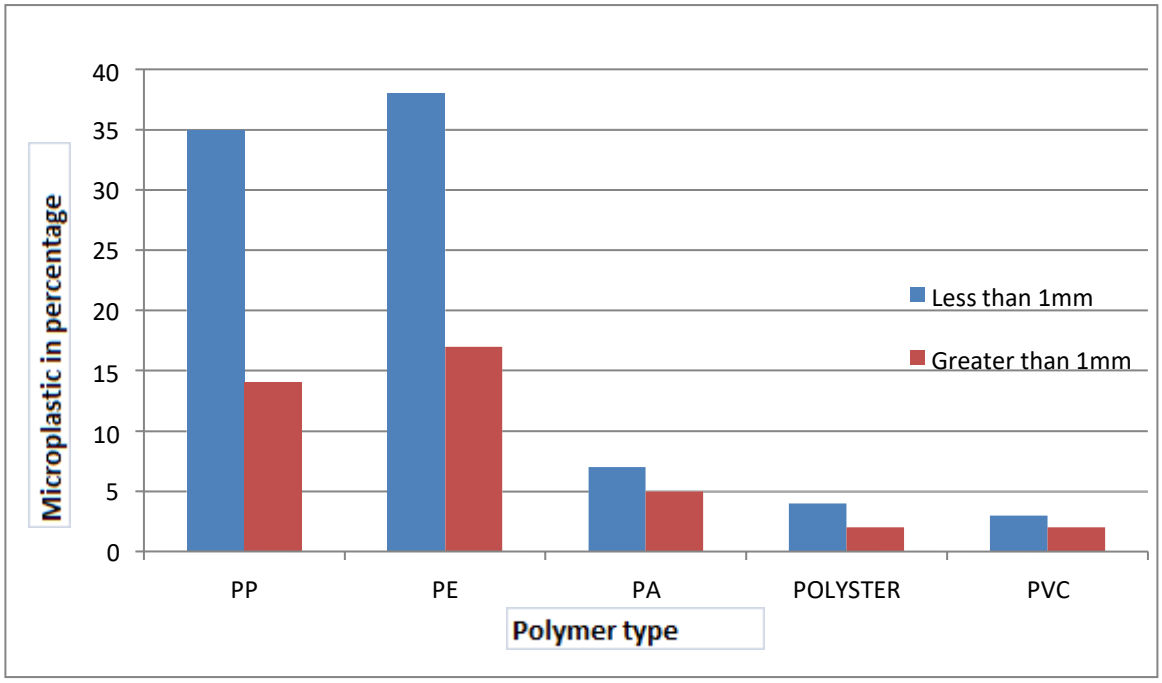


Figure 5 Composition of micro plastics in percentage without pretreatment of different polymer Type in L5

Table 7 Composition of micro plastics in percentage with pretreatment of different Polymer type in L1

S.No.	Polymer type	Size of microplastic < 1mm (in%)
1	PP	28
2	PE	25
3	PA	4
4	Polyester	3
5	PVC	1

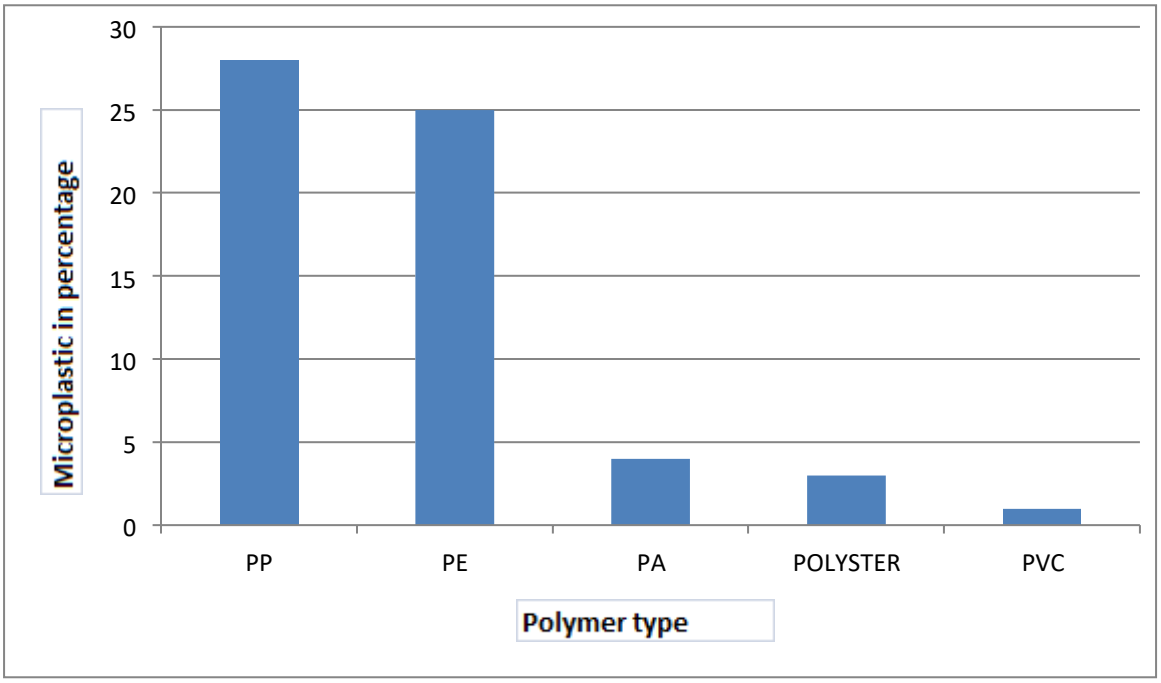


Figure 6 Composition of micro plastics in percentage without pretreatment of different Polymer Type in L1

Table 8 Composition of micro plastics in percentage with pretreatment of different Polymer type In L2

Sl. No.	Polymer type	Size of microplastic < 1mm (in %)
1	PP	33
2	PE	35
3	PA	1
4	Polyester	2
5	PVC	3

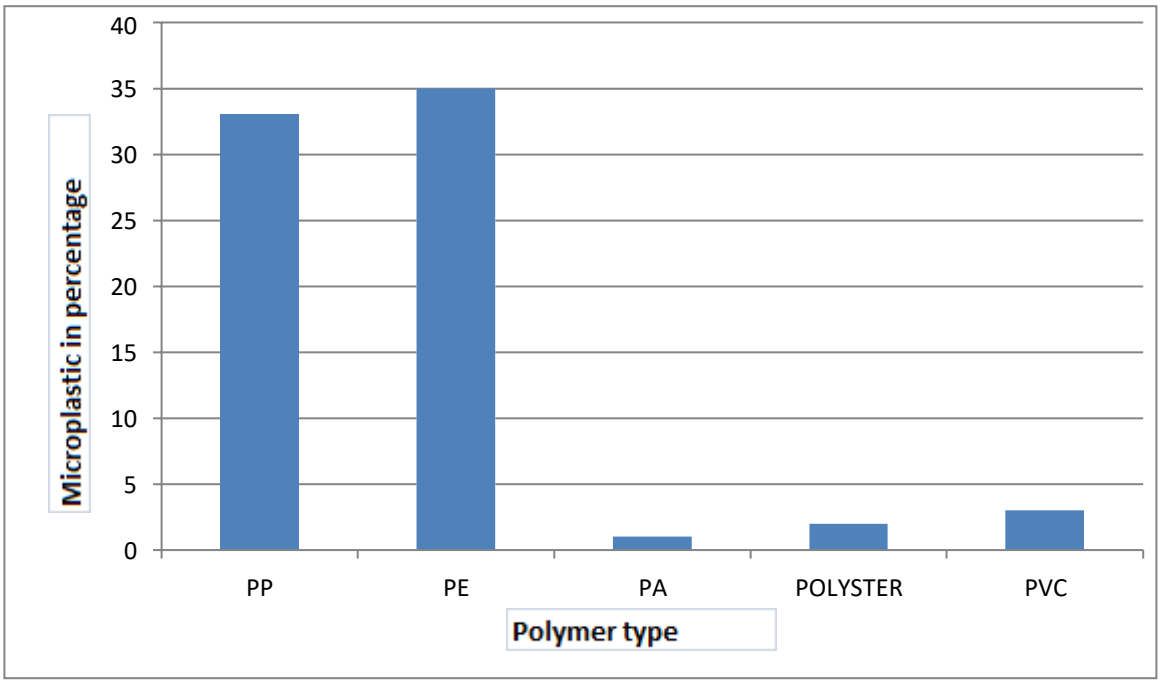


Figure 7 Composition of micro plastics in percentage with pretreatment of different Polymertype in L2

Table 9 Composition of micro plastics in percentage with pretreatment of different Polymer types inL3

Sl. No.	Polymer type	Size of microplastic < 1mm (in %)
1	PP	27
2	PE	20
3	PA	2
4	Polyester	3
5	PVC	2

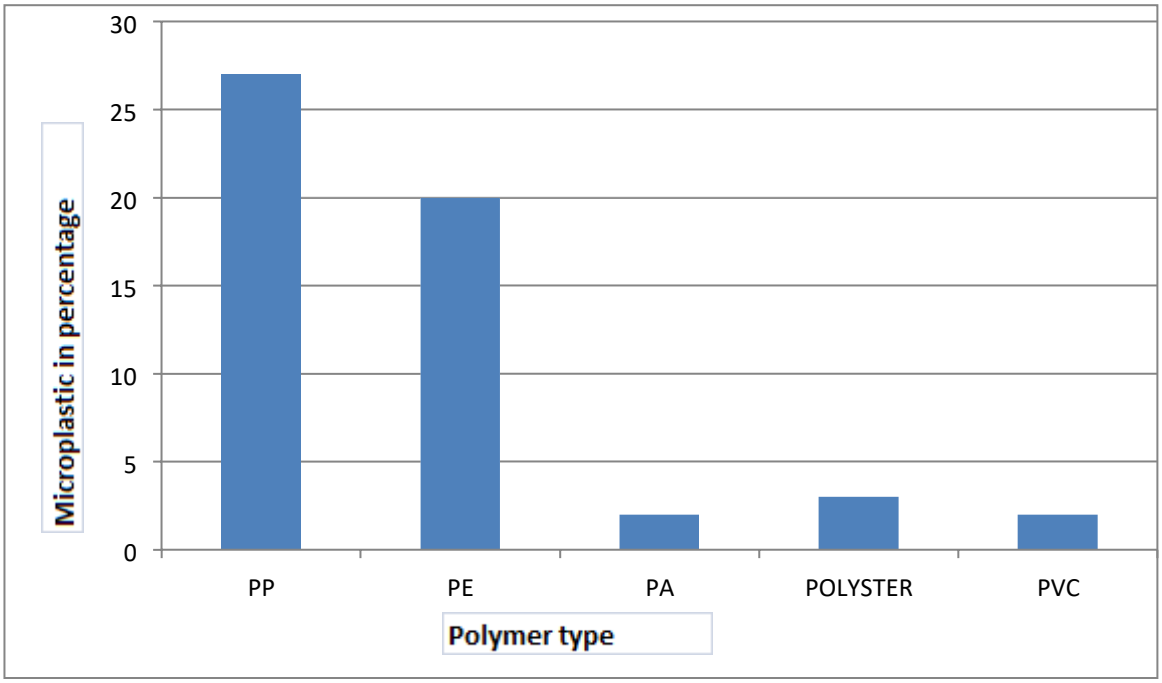


Figure 8 Composition of micro plastics in percentage with pretreatment of different Polymer Types in L3

Table 10 Composition of micro plastics in percentage with pretreatment of different Polymer types inL4

Sl. No.	Polymer type	Size of microplastic < 1mm (in%)
1	PP	23
2	PE	26
3	PA	1
4	Polyester	2
5	PVC	4

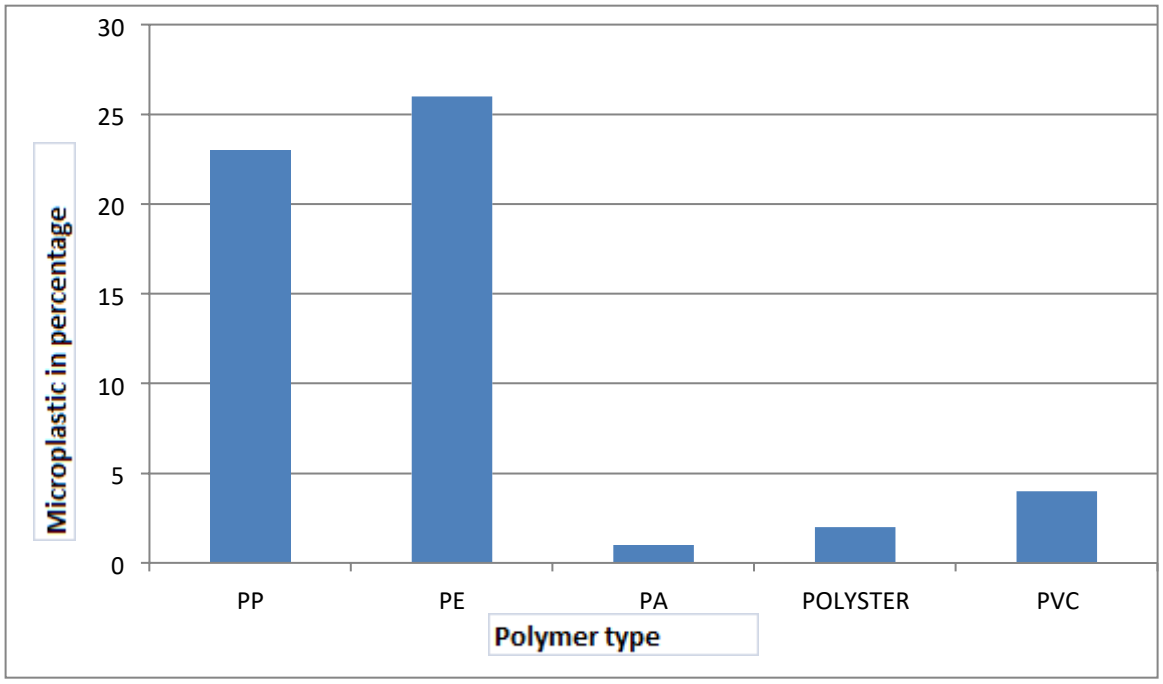


Figure 9 Composition of micro plastics in percentage with pretreatment of different Polymer types in L4

Table 11 Composition of micro plastics in percentage with pretreatment of different Polymer typesin L5

Sl. No.	Polymer type	Size of microplastic < 1mm (in%)
1	PP	24
2	PE	28
3	PA	3
4	Polyester	2
5	PVC	1

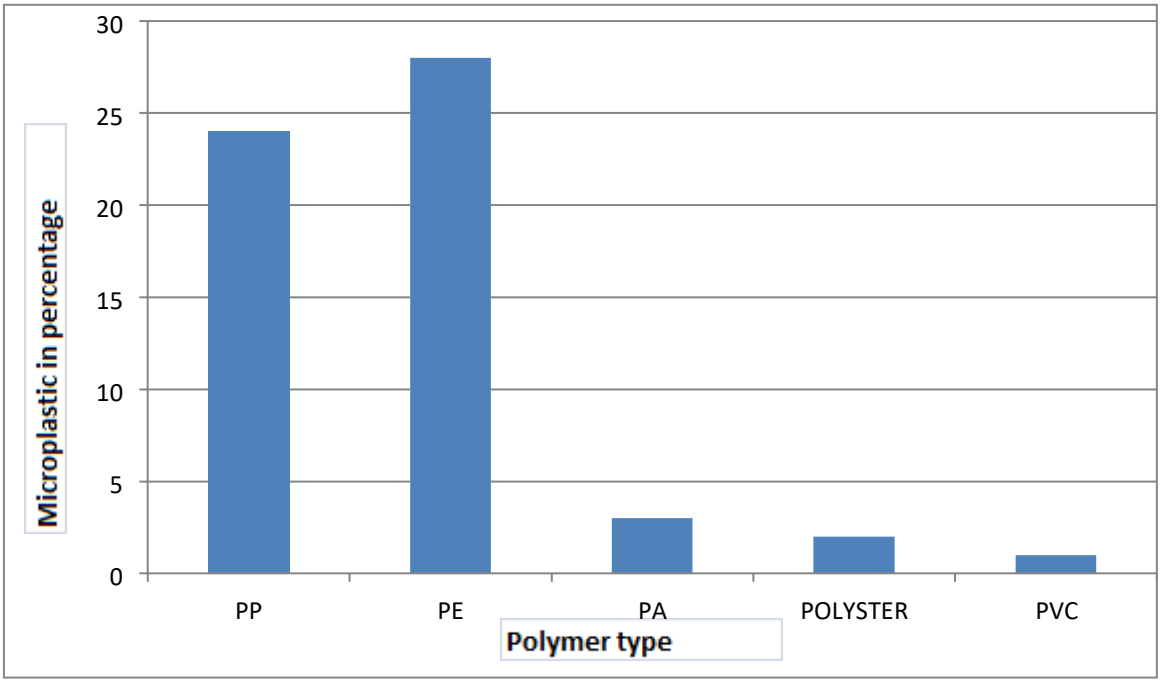


Figure 10 Composition of micro plastics in percentage with pretreatment of different Polymer types In L5

CONCLUSION

This study concludes that plastic contaminants along the props of nala 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 micro plastics decreases, the cornucopia increases. This study concludes that the sediments along the different nalas act as cesspools for the deposit of micro plastics. Secondary micro plastics were abundant among all samples, attesting that outmost micro plastics 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 micro plastics dropped, the cornucopia increased.

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