

Quantification and characterization of Microplastics Contamination in Periakulam Lake, Coimbatore.

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Abstract- Microplastics (plastics that are less than 5 mm in size) has entered the water, soil and air that we breathe. By successive degradation of larger plastic debris in a wide timeline, we get microplastics. Microplastic is one of the emerging contaminations in the recent times. This study aims at investigating the presence of microplastics in Periakulam, one of biggest lake in Coimbatore district, TamilNadu. The methodology of the study involves collecting samples at planned locations followed by moisture removal, density separation, digestion, filtration and finally subjected to FTIR spectroscopy to characterise the identified micro-plastics. As ascertained, the presence of microplastics has been confirmed. Among the identified contaminants, LDPE (low density polyethylene) and HDPE (High density Polyethylene) was dominant type of polymer component. The aquatic life which in turns out to be food for local population, thus microplastic enters the food web of humans. We hope this study contributes something to the researcher's community who are working on microplastics contamination in different aspects and component of environment.

Keywords – Microplastics, Periakulam, Coimbatore, FTIR spectroscopy

I. INTRODUCTION

Microplastics are one of the emerging pollutants in the recent times. The plastics that are the less than 5 mm in size are categorized as microplastics. They can be broadly categorized into primary and secondary. The primary refers to plastics that are micro in its nature itself for example micro beads in the cosmetics and secondary MPs refer to large plastics that are degraded and disintegrated over years. There has been large interest among researchers in recent time in finding its impact in natural systems such as Water, Air and Soil. Microplastics have found its way into our water bodies, air and soil due to its intense use among people. Polymers has ruled our market because of its numerous advantages over its successors (Iron, Aluminum) such as cost and its ductility characteristics. But now a time has come where government has started placing limitations on its usage since its impact on nature is irrevocable.

This formed the foundation for this study. In Coimbatore where early cholas (Rulers) has laid a wonderful irrigation system. A River named Noyyal which is one of the tributaries of the Cauvery forms the life line of the city. Early cholas has digged around 21 lakes along the path of Noyyal, so that all the farm land get their water adequate during summer. But now due to unprecedented growth of industries and economy, importance to

ecological well-being of the lakes and river were not even in priority list. Now as our economy is far better than late 80s, now local government has started looking into nature's well-being too.

Periakulam, situated at Ukkadam is one biggest lake in the city. Commercial activities around it has made into a trash bin. Hence this study aims at the quantification of the microplastic contamination in the lakes and characterize it.



Fig. 1- Periakulam Lake -Overview

II. METHODOLOGY

2.1 -Study Area

Periakulam ($10^{\circ} 58' 54''$ N $76^{\circ} 57' 17''$ E) having water spread zone of 320 sections of land has limit of 1980800 cubic meters. The top bund level is 7.88m and profundity of the lake is 5.8 m. The lake is being taken care of by Coimbatore anicut channel from Noyyal River and lake additionally gets surplus water from selvachinthamani lake situated in the upstream (North - west). The outlet of the lake is taken care of into Valankulam lake which is situated at the east side of the lake. Number of the bays is 7 i.e., one from Noyyal stream, one from Selvachinthamani and five sewage deltas. Length of the surplus getaway is 15.40 m. The samples were collected from 4 sites; two near inlets and two near the outlet area during the pre-monsoon period (March – April 2019). The sampling points are shown in the figure 1.



Fig. -2- Periakulam – Sampling Points

2.2 – Sample Treatment

Two samples (a sediment sample, a surface water sample) from each of four locations were collected using van veen grab (25 cm²) and plankton net respectively. The samples are subjected to following processes: Moisture Removal, Density separation, digestion followed by filtration. The treatment process varied for the sediment samples and water samples. It is illustrated in the figures. the samples were sieved with 5 mm mesh sieves to retain particles in less than 5mm size. The sediment samples (covered with aluminum foil) were oven dried for 30 hours, temperature was maintained below 105-degree celcius. Then to digest the biological matter in the samples, 30 percent hydrogen peroxide is added. Characterization of identified microplastics are done with Fourier Transform Infrared (FTIR) spectroscopy.

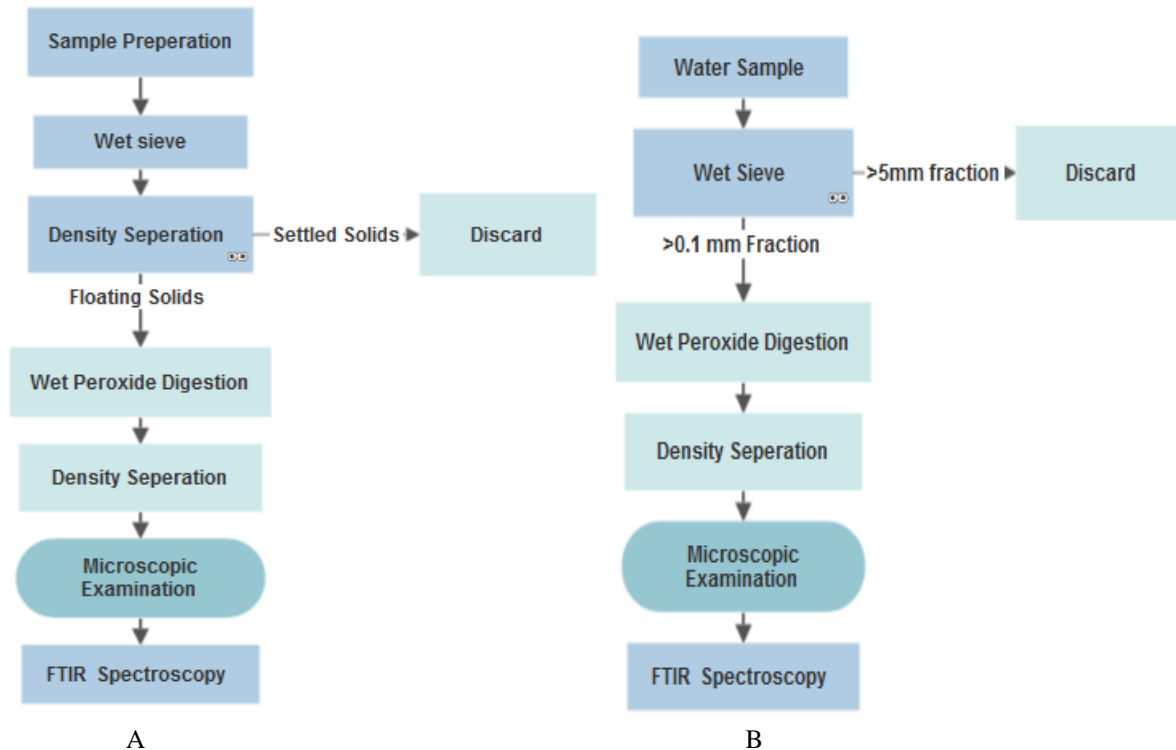


Fig. 3- Methodology of study conducted (A- Sediment Sample & B- Surface water)

III. RESULTS

From the test (FTIR) conducted, Microplastic contamination has been confirmed in Periakulam lake. Its mean abundance was 300 ± 5 (150-200 items) m⁻² which clearly dicatates its wide dispersion in the lake.

Microplastics extricated from dregs tests were physically arranged into classes dependent on morphology through visual observation under a compound magnifying lens. They are categorized into various groups such as Flims, Fibres, Foams and Fragments.

Identification of polymer components of microplastics was done using Fourier Transform – Infrared Spectroscopy (FTIR). Presence of Four components of Microplastics were confirmed in Periakulam lake. They are Low-density Polyethylene, High-density polyethylene, Polypropylene and Polystyrene. FTIR spectra of all the site samples clearly dictates there are ample amount of PE, LDPE, HDPE, PS found in the lake samples. The spectra of all the samples (both surface and sediment) are shown in the Fig 4-7.

Table 1- Quantified and Characterized Microplastics

Sample	Latitude	Longitude		Microplastic-Particles	Polymer - Characterized	Form Category
1	10'98'09.94'	10'98'09.94'	Surface	150+1	PE, LDPE	Fragment, Flim
			Sediments	290+5	PE, others	Fragment, Sheet
2	10'97'94.06'	76'94'52.64'	Surface	120+7	PE, LDPE, others	Foam, Fragment
			Sediments	290+3	PE, LDPE, others	Sheet, Fragment, Flim
3.	10'98'00.99'	10'98'00.99'	Surface	132+4	LDPE, Others	Fragment, Flim
			Sediments	290+5	LDPE, HDPE, others	Fragment, Flim
4	10'98'44.69'	76'94'43.26'	Surface	112+4	LDPE, PS, others	Fragment, Flim
			Sediments	290+2	LDPE, PS, PE, others	Fragment, Flim

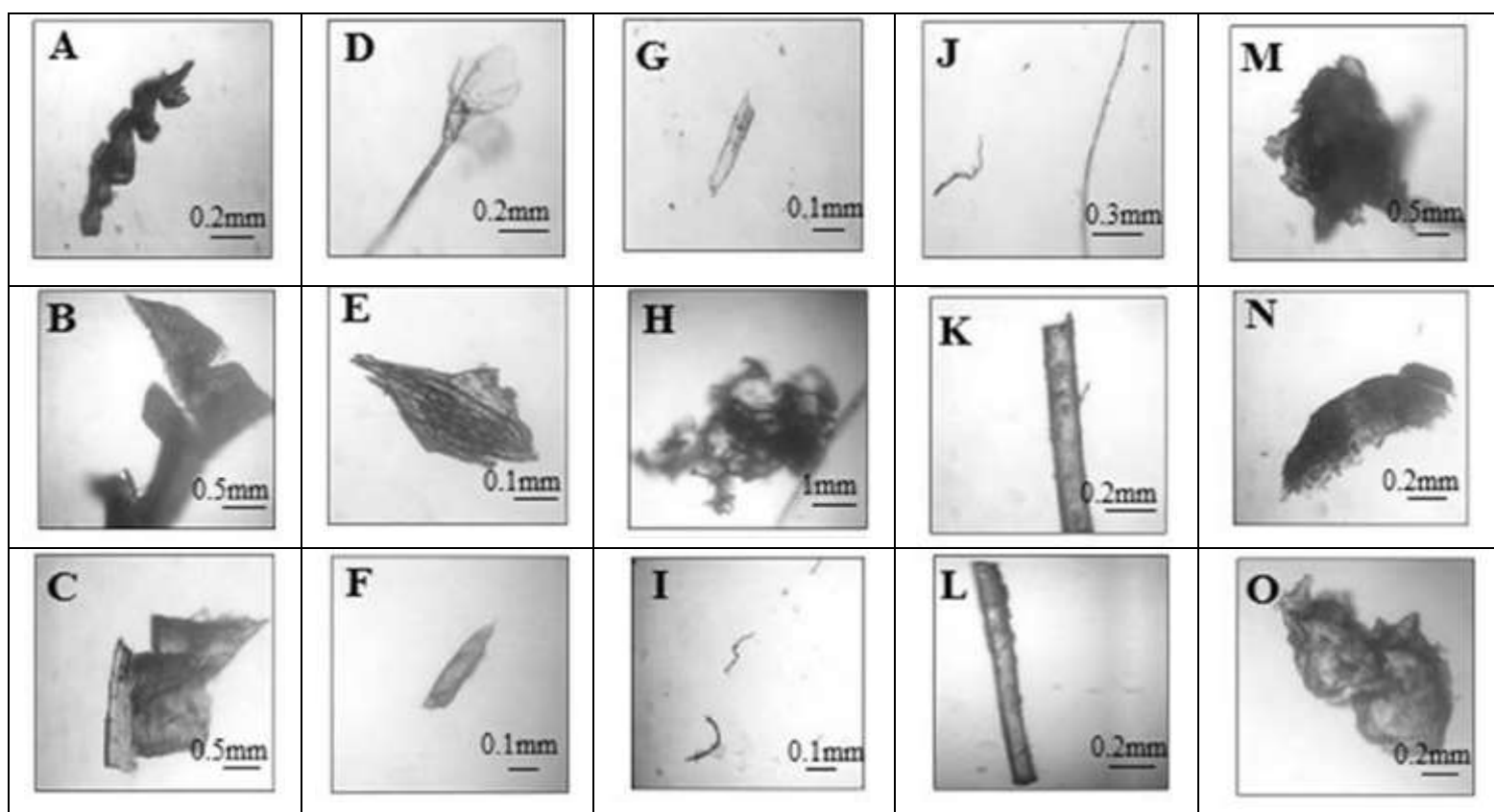


Fig. 3 - Microplastics Representing each particle type category: fragment (A-C) Flim (D-C), Fiber (I-I and pellet (M-O)

FTIR Spectra of samples

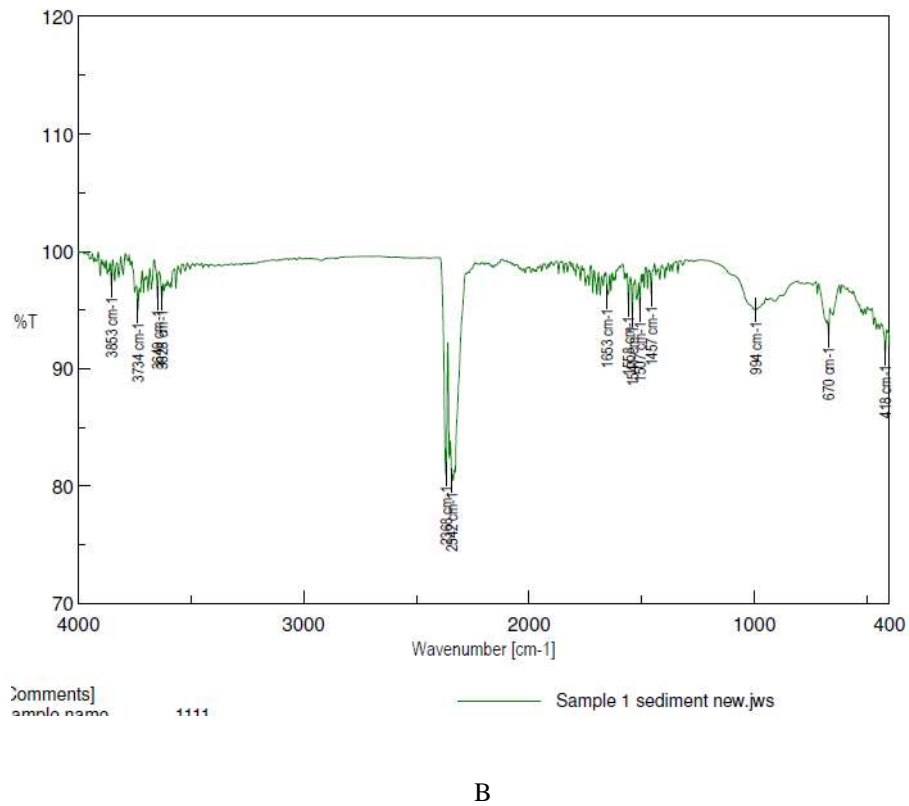
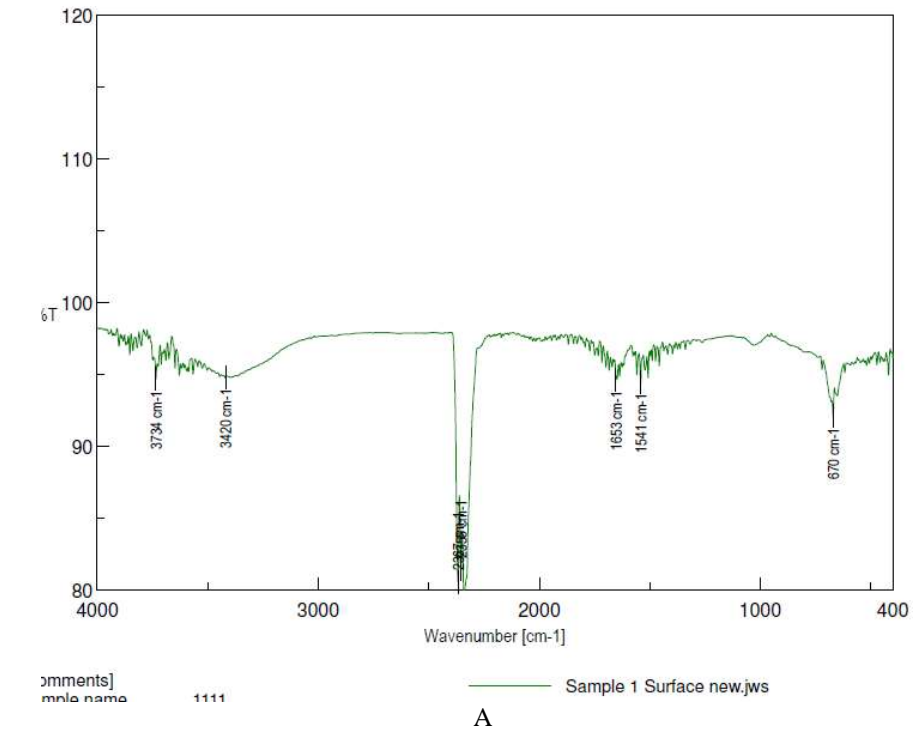
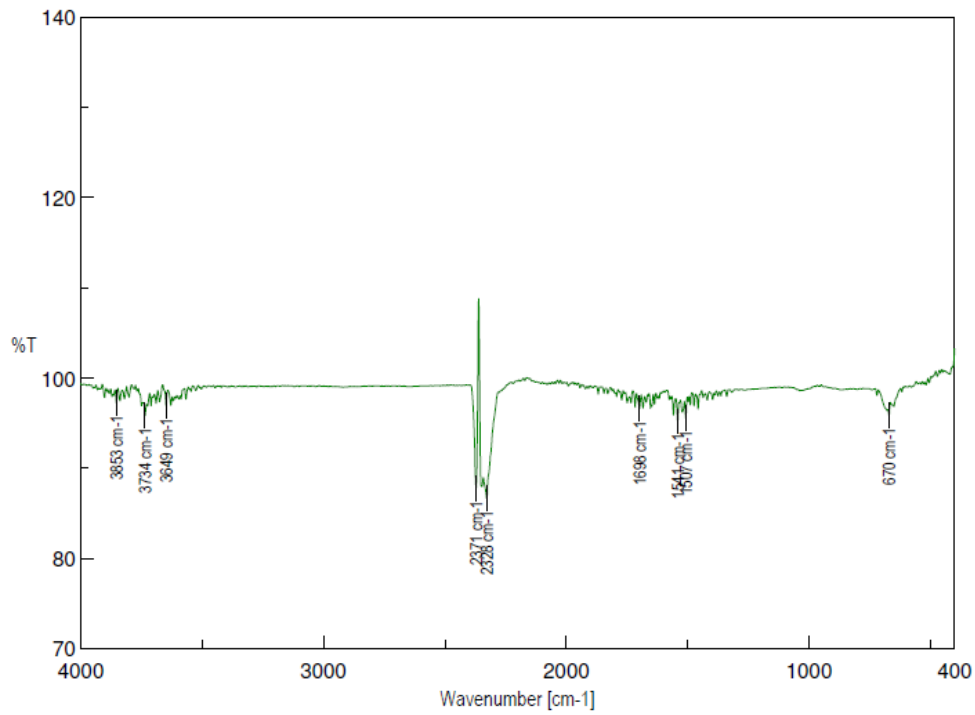
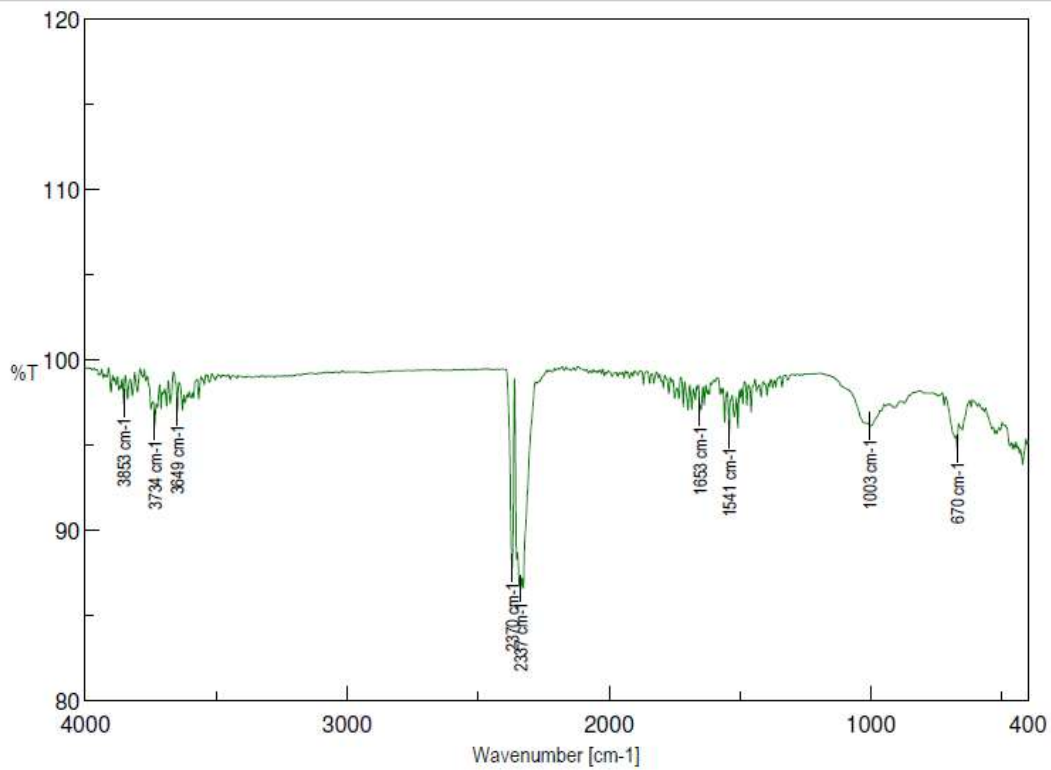


Fig. 4 - FTIR Spectra of Site 1 in Periakulam Lake (A- Surface and B- Sediment)



A



B

[Comments]
Sample name

1111

— Sample 2 sediment new.jws

Fig. 5 - FTIR Spectra of Site 2 in Periakulam Lake (A- Surface and B- Sediment)

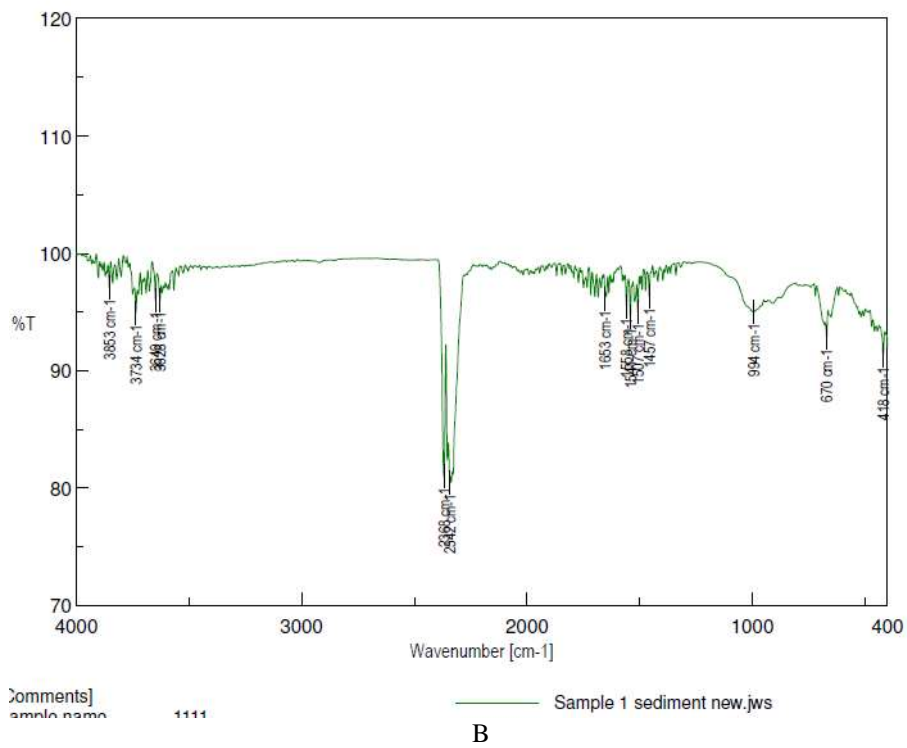
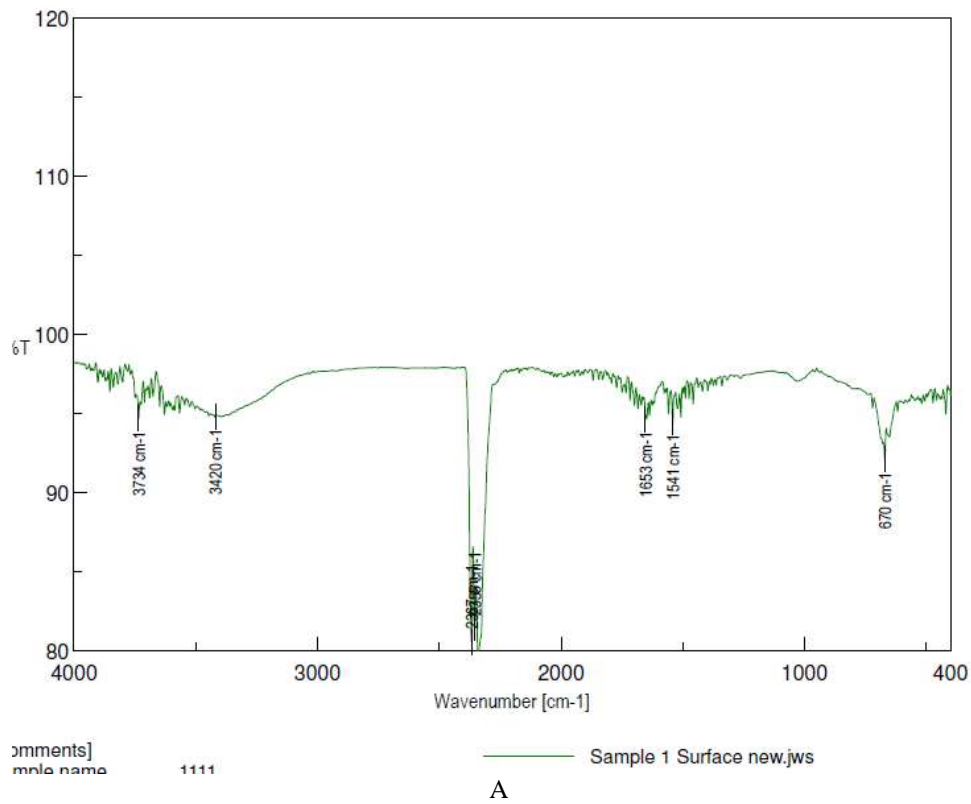
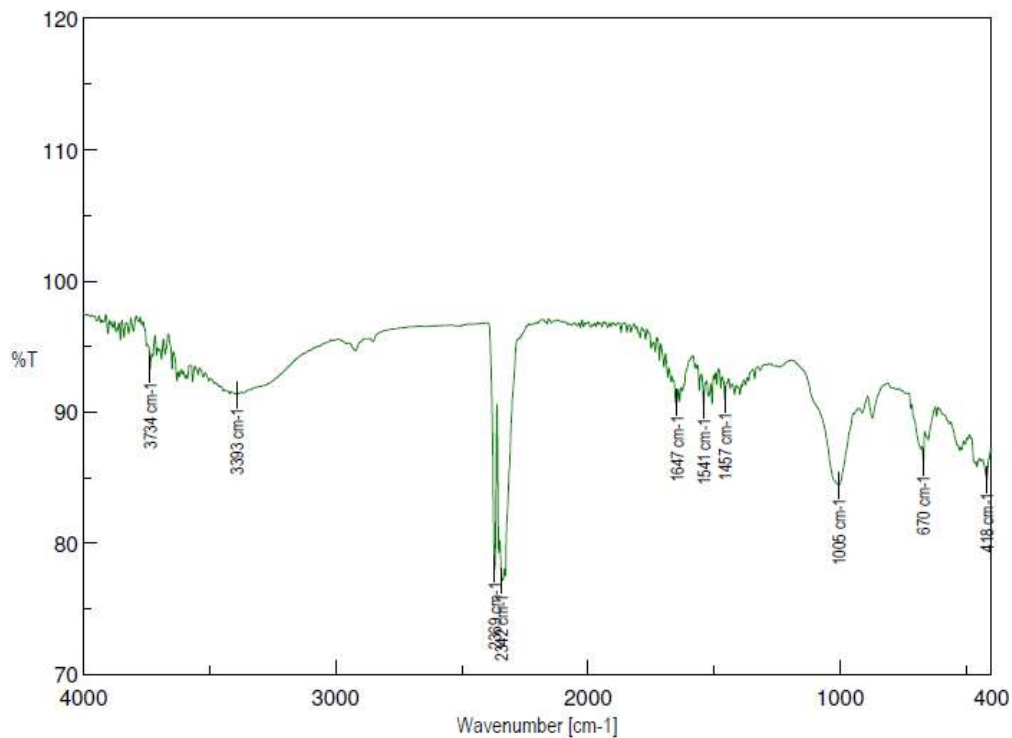
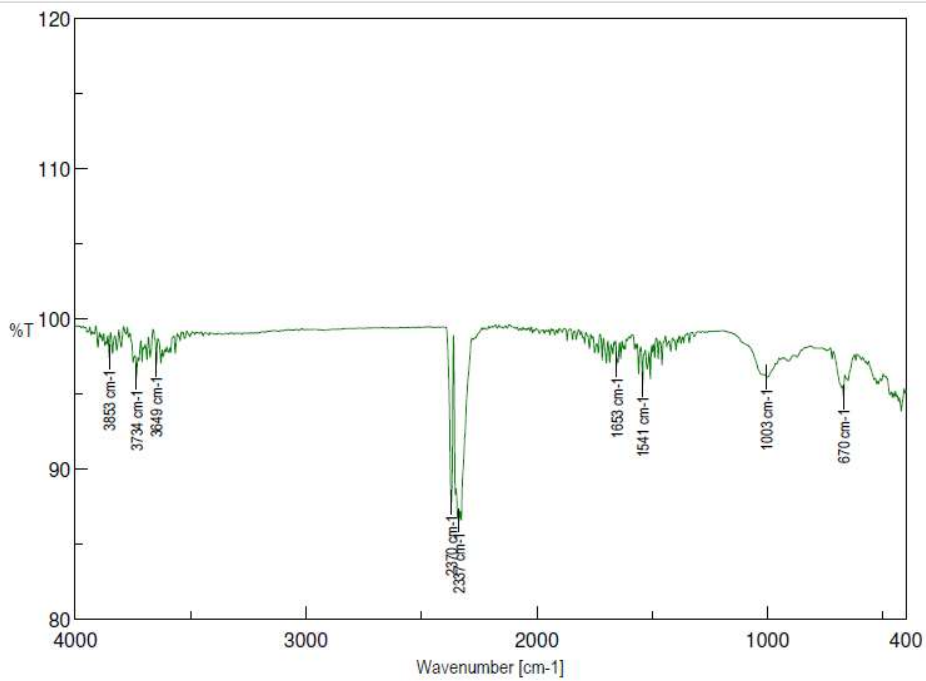


Fig. 6 - FTIR Spectra of Site 3 in Periakulam Lake (A- Surface and B- Sediment)



[Comments] Sample name 1111 Sample 4 surface new.jws
A



[Comments] Sample name 1111 Sample 2 sediment new.jws
B

Fig. 7 - FTIR Spectra of Site 4 in Periakulam Lake (A- Surface and B- Sediment)

IV.CONCLUSION

Information on freshwater microplastics are deficient in India, while explore on this rising poison is drawing more consideration all inclusive. Current investigation reports just because, the omnipresent nearness of microplastic particles (MPs) in the dregs of Periakulam Lake Coimbatore in India. This lake fills in as the focal point of vocation for a huge number of individuals, henceforth the event of MPs right now their presumable effects on amphibian creatures of the whole nourishment web are basic issues to be tended to. The morphology of the MPs saw right now that their root from discontinuity of bigger plastic flotsam and jetsam demonstrating the utilization and removal of plastics as their definitive inception. In this manner, controlling MPs/plastics at the source is the choice to be investigated truly, in light of the fact that, when MPs are discharged into the earth there is a lot of little should be possible to constrain their circulation and effects. Purposeful endeavours in improving and observing waste administration programs, underscoring on the three 'R' rule (lessen, reuse, and reuse) for the plastic administration, may diminish the convergence of plastics/MPs in the lake.

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