Special Edition on "Frontiers of Biosciences in Sustainable Development (FBSD)"
CIBTech Journal of Zoology ISSN: 2319–3883; http://www.cibtech.org.htm
2023 Vol.12/S1, pp.252-256/Surya et al.
***Research Article** (Open Access)*

ISOLATION AND IDENTIFICATION OF MICRO AND MESOPLASTICS FROM *OREOCHROMIS NILOTICUS* OF PUZHAL LAKE, REDHILLS, TAMIL NADU, INDIA

Surya D, Sherene Victoria, Jeethasri R and Ananthi Rachel Livingstone*
Department of Zoology, Madras Christian College (Autonomous),
Tambaram, Chennai 600059, India
**Author for Correspondence: ananthirachel@mcc.edu.in*

ABSTRACT
Micro plastics are ubiquitous in all types of environments. The current study was carried out in the Puzhal lake which is one of the freshwater systems supplying water to the north of Chennai city. 250 individuals of *Oreochromis niloticus* were selected to identify and characterize the micro and meso plastics in the gastro intestinal (GI) tract of fishes. Bruker-Alpha FTIR ATR Spectrophotometer were used to confirm the microplastic samples with its functional groups. A total of 36 plastics were isolated, out of which 16 were mesoplastics and 20 were microplastics. The FTIR- ATR peaks confirmed polythene (11), polyester (12), polyamide (7). The micro and mesoplastic in the GI tract of fishes may be due to the accumulation of plastic wastes in the water body. These microplastic pollute and reduce the commercial value of the fish. Future research could be focused on the risk and damages of microplastics to fishes, other aquatic organisms as well as humans and creating an awareness among the people.

Keywords: *Microplastics, Mesoplastics, FTIR-ATR, Puzhal lake*

INTRODUCTION
The introduction of toxins into the environment results in pollution, which has a negative impact on all living things. Any type of pollution is possible, including solid, liquid, gas, radiation, sound, and light. Freshwater ecosystems, biodiversity, and aquatic species are all threatened by pollution, which lowers the quality and productivity of the water. The primary pollutants of freshwater bodies are effluents from adjacent industries, sewage from neighboring homes, and rubbish dumped on the water's edge [Sharma, 2022]. Runoff is the term used when industries discharge chemicals into the environment, which makes it difficult for aquatic species to live and reproduce [Chowdhary *et al.,* 2020].
In addition, modern plastics and microplastics play a significant role as contaminants and pose a number of threats to the ecosystem [Alfaro-Núñez *et al.,* 2021]. Polymers used to make plastics are moulded at precise temperatures and pressures and each one has unique qualities depending on the final result [Wang & Mao, 2013]. Polymers may be easily recognized as a whole and removed from the environment, however owing to inappropriate disposal, fragmentation of plastic components has increased the amount of meso and microplastics contaminating the environment.

Fig. 1: Plastic accumulation in Puzhal lake.

Hence the present study conducted in 2022 was aimed to isolate and identify the micro and mesoplastic from the gastro intestinal tract of *Oreochromis niloticus*. The goal of this research is to locate and describe the micro- and mesoplastics in the fish of Puzhal Lake.

MATERIALS AND METHODS

Chennai is known as the capital of Tamil Nadu. Puzhal lake also known as the Redhill's lake is located in Redhills, Chennai, India. It lies in Thiruvallur district of Tamil Nadu state. It is one of the prominent lakes in Chennai with 18 sq. kilometer area. It was established in the year 1876. This lake has lot of organisms such as phytoplankton, zooplankton, fishes, and molluscs. This freshwater lake was selected for fish sampling.

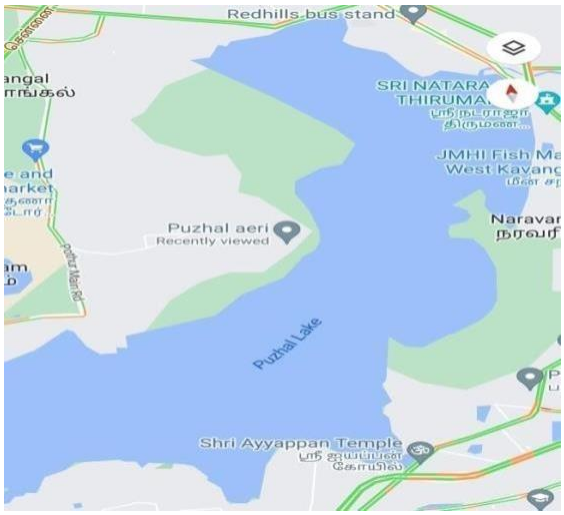

Figure 2: Sampling area Puzhal Lake.

A total of 250 fish of the species *Oreochromis niloticus* were collected. FAO identification keys were used to identify the fishes. The GI tracts of the fish that had been collected were cut, placed in zip-lock bags, and kept at -20°C. The GI tracts of fish were sliced open after thawing and examined under a microscope. For further investigation, the particles that were dissimilar to its feed or prey were gathered and saved. A conical flask was filled with the homogenized GI tracts and other organs for alkaline digesting. Aqueous Potassium hydroxide was utilized as the standard for alkaline mode of digestion [Karthik, *et al.*, 2018, Kumar, *et al.*, 2018, Lusher, *et al.*, 2017]. After digestion, the digested material was filtered with two sets of filters which were of the mesh size 1mm and 125 µm respectively. The left overs of the digested material were thoroughly checked for the occurrence of micro and mesoplastics. The particles suspected to be plastics were taken and confirmed with primary confirmation test (hot needle test) and photographs were taken under scanning electron microscope and its diameter were measured. Then the particles were classified based on its size and colour. Using Bruker- Alpha FTIR ATR spectrophotometer, the IR spectrum of the plastic particles were recorded in order to confirm its polymer functional groups [Mirabella Jr., 1993].

RESULTS AND DISCUSSION

Plastics become a very important material in our day to day life. We are very keen in using plastics but least concerned in disposing the plastics. Plastic accumulation in freshwater bodies are increasing day by day. There are reports regarding the occurrence, sources, physical effects, biological interactions, bioaccumulation and bio magnification [Lusher, *et al.*, 2017]. There are findings regarding the occurrence of microplastic in aquatic organisms in standard procedures [Collard, *et al.*, 2017, Karthik, *et al.*, 2018, Kumar, *et al.*, 2018, Lusher, *et al.*, 2015]. A total of 30 plastic particles were isolated out of which 16 particles were mesoplastics and 20 were microplastics (Fig.3). Using Bruker- Alpha FTIR ATR Spectrophotometer the IR spectrums of

the isolated plastics were recorded. The functional groups of the isolated plastics were identified based on the peaks formed. 11 plastics which showed predominant peaks at wave numbers 2912, 2849, 1468 and 719 cm-1 . Based on the standard absorption IR spectrum, there is C-H stretching. Hence the polymer is polythene (Fig.4). 12 plastics showed predominant peaks at wave numbers 2968, 1726, 1453, 1165 and 1372 cm-1 . There is C-H stretching, C=O stretching and C-O stretching. Thus, the polymer is polyester (Fig.5). 7 plastic fibers showed predominant peaks at 2914, 3431, 1456 and 1378 cm-1. Based on the standard absorption IR spectrum, there is C-H and N- H stretching. So, the functional groups were of alkane and amine. Hence the polymer is a polyamide (Fig. 6).

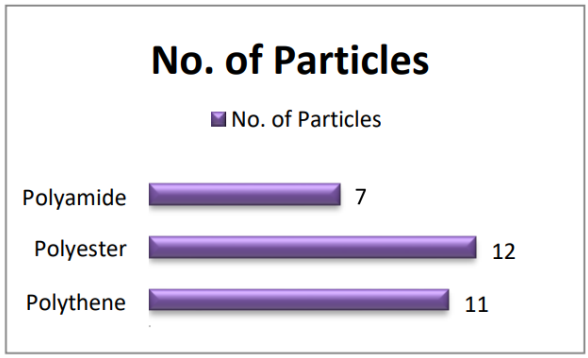

Fig 2: Types of polymers and its number

Polyester, polythene, and polyamide were detected from the FTIR ATR analysis, and their existence in fish GI tracts were validated. The existence of polyester was confirmed by a single dominating peak about 1730 that corresponds to C=O stretching and a peak at 1160 that corresponds to C-O stretching. The existence of polythene was confirmed by wave numbers in the range of 1461 to 1400 cm-1 indicating C-H bending and 2960 to 2926 cm-1 showing C-H stretching. The existence of polyamide was confirmed by wave numbers between 3400 and 3500 cm-1 with large peaks that demonstrate N-H stretching and peaks at various ranges that correspond to C-H bending and C-H stretching

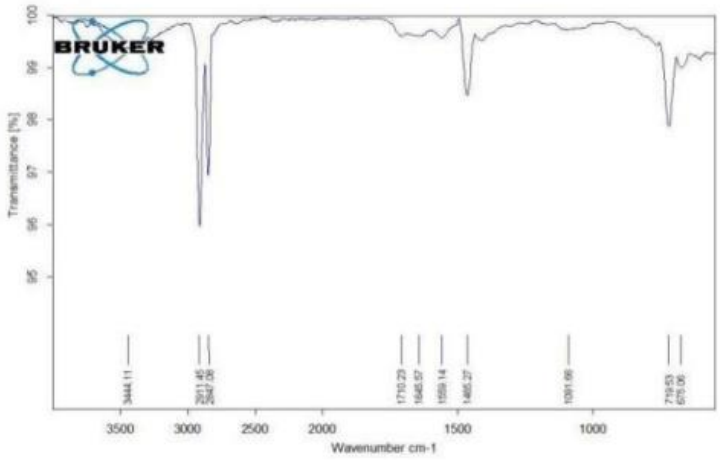

Fig. 4: FTIR – ATR of Polythene

Out of 250 fish samples tested only 30 fish contained micro and mesoplastics. This does not imply that other fish have not eaten the plastic in the water. It could be related to fishes' quick stomach evacuation. Expulsion from the gut happens after a fish dies. Fish must be placed in ice as soon as they are taken from the aquatic body in order to prevent intestinal ejection. In addition to demonstrating environmental contamination, the discovery of microplastic in fish guts raises concern about its potential to migrate to edible fish organs. There were indicators that the fish's GI system had moved the microplastic to other areas [Collard, F *et al.*, 2017]. Microplastic in the GI tract may be avoided by correctly removing the intestines of fish before cooking. In

the case of dry fishes, the entire fish is dried in the sun without the intestines being removed. These dry fishes can then be tested to check for plastic contamination. To prevent these upsetting situations, fisherman, seafood vendors, and the general public should all be made aware of the dangers of plastic in the GI tracts of fish. Fish should always be properly cleaned by people; else, plastic may go inside the body. The purpose of

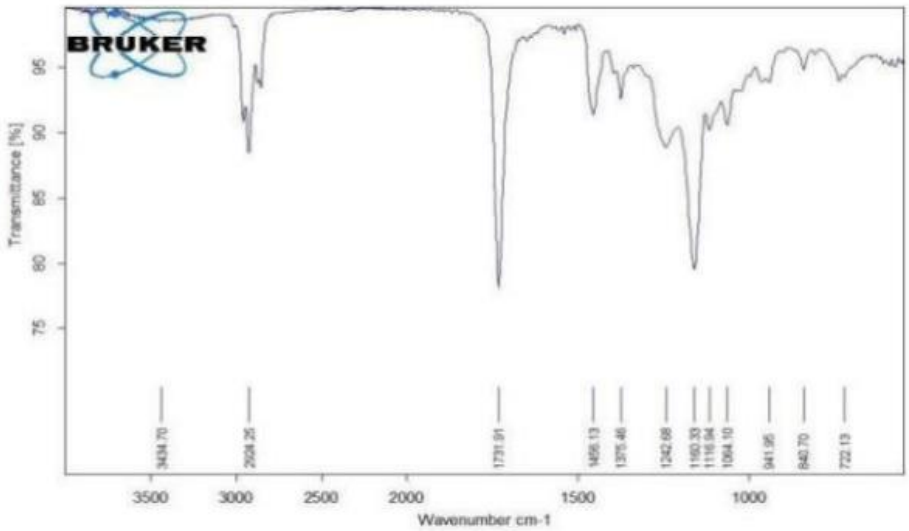

Fig. 5: FTIR – ATR of Polyester

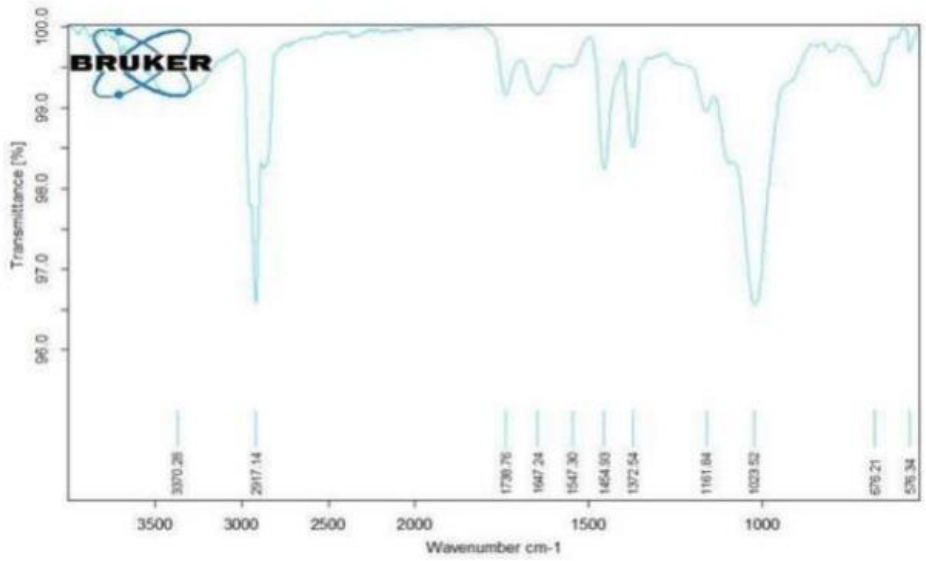

Fig.6: FTIR – ATR of Polyamide

this study was to find microplastic and draw attention to the problem of increasing plastic pollution in Puzhal Lake, a freshwater body. Further studies should be conducted to determine the harm and risk that microplastics provide to humans, other aquatic animals, and fish.

REFERENCES

Alfaro-Núñez, A., Astorga, D., Cáceres-Farías, L., Bastidas, L., Soto Villegas, C., Macay, K., & Christensen, J. H. (2021). Microplastic pollution in seawater and marine organisms across the Tropical Eastern Pacific and Galápagos. Scientific reports, **11**(1), 6424.

Chowdhary, P., Bharagava, R. N., Mishra, S., & Khan, N. (2020). Role of industries in water scarcity and its adverse effects on environment and human health. Environmental Concerns and Sustainable Development: Volume 1: Air, Water and Energy Resources, 235-256.
Collard, F., Gilbert, B., Compère, P., Eppe, G., Das, K., Jauniaux, T., & Parmentier, E. (2017). Microplastics in livers of European anchovies (Engraulis encrasicolus, L.). Environmental pollution, 229, 1000-1005.
Karthik, R., Robin, R. S., Purvaja, R., Ganguly, D., Anandavelu, I., Raghuraman, R., ... & Ramesh, R. (2018). Microplastics along the beaches of southeast coast of India. Science of the Total Environment, 645, 1388-1399.
Kumar, V. E., Ravikumar, G., & Jeyasanta, K. I. (2018). Occurrence of microplastics in fishes from two landing sites in Tuticorin, South east coast of India. Marine pollution bulletin, 135, 889- 894.
Lusher, A. L., Welden, N. A., Sobral, P., & Cole, M. (2017). Sampling, isolating and identifying microplastics ingested by fish and invertebrates. Analytical methods, **9**(9), 1346-1360.
Lusher, A. L., Hernandez-Milian, G., O'Brien, J., Berrow, S., O'Connor, I., & Officer, R. (2015). Microplastic and macroplastic ingestion by a deep diving, oceanic cetacean: the True's beaked whale Mesoplodon mirus. Environmental pollution, 199, 185-191.
Mirabella Jr. FM. (1993) Practical Spectroscopy Series; Internal reflection spectroscopy: Theory and applications,MarcelDekker,Inc.,pp. 17-52.
Sharma, H. (2022). Environmental Pollution: A Great Hazard in The Survival of Man. Central Asian Journal of Medical and Natural Science, **3**(5), 184-193.
Wang, J., & Mao, Q. (2013). A novel process control methodology based on the PVT behavior of polymer for injection molding. Advances in Polymer Technology, **32**(S1), E474-E485.