

VOLUME 8 ISSUE 2 2022

ISSN 2454-3055



**INTERNATIONAL
JOURNAL OF
ZOOLOGICAL
INVESTIGATIONS**

***Forum for Biological and
Environmental Sciences***

Published by Saran Publications, India



International Journal of Zoological Investigations

Contents available at Journals Home Page: www.ijzi.net

Editor-in-Chief: Prof. Ajai Kumar Srivastav

Published by: Saran Publications, Gorakhpur, India



ISSN: 2454-3055

Assessment of Microplastics in the Gastrointestinal Tract of the Indian Major Carps from Periyakulam, Kurichi and Singanallur Lakes of Coimbatore, Tamil Nadu, India

Efgin Ann¹, Surya D.¹, Thirunavukkarasu N. ², Nesakumari Sheeba A.C.^{1*}

¹Department of Zoology, Madras Christian College (Autonomous), Tambaram, Chennai 600 059, India

²Department of Zoology, Dr. Ambedkar Government Arts College (Autonomous), Vyasarpadi, Chennai 600 039, India

*Corresponding Author

Received: 14th August, 2022; **Accepted:** 12th September, 2022; **Published online:** 24th September, 2022

<https://doi.org/10.33745/ijzi.2022.v08i02.048>

Abstract: The investigation of microplastics has been carried out among Indian Major Carps from three lakes of Coimbatore, India. The gastrointestinal tract of fishes were isolated and examined to detect the presence of microplastics. The fishes of Indian major carps viz., *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* were used in this study. Three lakes were selected namely Periyakulam Lake, Kurichi Lake and Singanallur Lake in Coimbatore district, India. The microplastics samples were confirmed with Bruker – Alpha FTIR ATR spectrophotometer in order to confirm plastics functional groups. The presence of microplastics in the fish from the sampling locations may be due to unmonitored dumping of wastes in the water. The presence of microplastics may affect the growth of fish which leads to poor commercial value. The future research should be aimed to evaluate the impact and the risk of microplastics to the fishes, environment as well as to human beings.

Keywords: Microplastics, Indian Major Carps, Periyakulam lake, Kurichi lake, Singanallur lake

Citation: Efgin Ann, Surya D., Thirunavukkarasu N., Nesakumari Sheeba A.C.: Assessment of microplastics in the gastrointestinal tract of the Indian Major Carps from Periyakulam, Kurichi and Singanallur lakes of Coimbatore, Tamil Nadu, India. Intern. J. Zool. Invest. 8(2): 389-396, 2022.

<https://doi.org/10.33745/ijzi.2022.v08i02.048>



This is an Open Access Article licensed under a Creative Commons License: Attribution 4.0 International (CC-BY). It allows unrestricted use of articles in any medium, reproduction and distribution by providing adequate credit to the author (s) and the source of publication.

Introduction

In recent years, microplastics have become a major developing pollutant to both the freshwater and seawater ecosystem. In India people are consuming microplastics about 117 mg/year. There is a dearth of research information on microplastic pollution in the Indian aquatic ecosystems. The aim of this study was to analyze

the microplastics content in the Indian Major Carps such as Catla (*Catla catla*), Rohu (*Labeo rohita*) and Mrigal (*Cirrhinus mrigala*) from three major fishing hubs of Coimbatore namely Periyakulam lake, Kurichi lake and Singanallur lake. No previous study has been carried out along these freshwater ecosystems in Coimbatore,

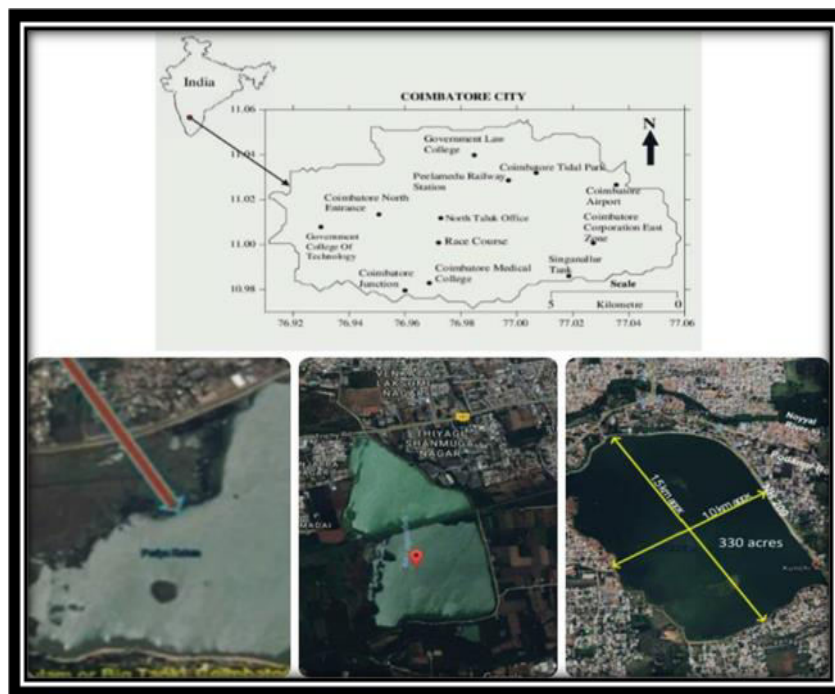


Fig. 1: Showing the study area.

specifically for examination of microplastics hence, this study was undertaken. The most common type of microplastics found in river sediments was polyethylene (PE), polypropylene (PP), and polyethylene terephthalate (PET). These plastic chemical types were reported extensively as dominant plastic debris in the coastal plain river (Kattaoka *et al.*, 2018). The most important morphotypes of plastic particles were found to be fibers (polyesters) and sheet or film (Rodrigues *et al.*, 2019). The fibers in the Ganga sediment might have been coming from garment washing through effluents from municipal sewages (Lahens *et al.*, 2017). One of the main sources of microplastic for freshwater ecosystems appears to be wastewater treatment plants and urbanization has been associated with higher levels of microplastic concentration in rivers (Peters and Bratton, 2016).

Materials and Methods

Study area:

Coimbatore, being a rapidly developing city in the Western part of Tamil Nadu, India is surrounded by several freshwater resources and they are important source of water for drinking and irrigation (Fig. 1). Therefore, in this study three

lakes were selected namely Periyakulam Lake, Kurichi Lake and Singanallur Lake in Coimbatore district fed by Noyyal River and analyzed the accumulation of microplastics in the gut region of Indian Major Carps. These freshwater resources have been facing rapid degradation due to liquid or solid waste disposal, filling and reclamation, real-estate ventures and industrial development have open drainage and sewage systems that join these lakes without any prior treatment. Hence, these three lakes are presently deteriorated and cannot be used as a source of drinking.

Fish were collected and identified with the help of standard FAO identification keys. The gastrointestinal (GI) tracts of fish were isolated and kept in separate sterilized zip lock covers and stored at -20°C. The GI tracts of the fishes were thawed and brought to room temperature. The tracts were cut open and examined under a dissection microscope. Particles that do not resemble natural prey were collected and kept for further analysis. The tracts and other organs were homogenized with the help of an autoclaved mortar and pestle. For digesting the rest of the organic material alkaline digestion method were

Table 1: Source of various microplastics content

Microplastics	Sources
Nylon	Rope, net
Polyamide (PA)	Textiles
Polyethylenene (PE)	Plastic bags, bottle caps
Polystyrene (PS)	Cups, tools, packaging
Polyvinyl chloride (PVC)	Bags, tyres

followed (Lusher *et al.*, 2015; Karthik *et al.*, 2018; Kumar *et al.*, 2018). The digested material was filtered through two sets of filters of mesh size 1 mm and 125 µm, respectively using filtered tap water. The remnants of the digested material were checked for the presence of micro-plastics. Suspected particles were isolated and kept for further analysis. Once passing the primary confirmation test, the particles were isolated, photographed and its diameter were measured. Then the particles were classified based on their size and colour. Then the IR spectrum was recorded with the help of Bruker – Alpha FTIR ATR spectrophotometer in order to confirm polymer functional groups (Mirabella Jr, 1993).

Results and Discussion

Coimbatore is the second largest city in Tamil Nadu, South India. There are more than 25,000 small, medium, large and tiny industries and textile mills. The unplanned and uncontrolled expansion of Coimbatore has caused serious pressure on its natural resources. Furthermore, the results highlight the significance to identify direct sources of microplastics to mitigate the environmental pollution with plastic particles. Each fish of the three lakes were found to contain at least one synthetic particle in the gut region which was less than 5 mm in size. More amount of microplastics were found in the catla (*Catla catla*) because of its habit of feeding from the surface, the other two varieties of major carps namely rohu (*Labeo rohita*) and mrigal (*Cirrhinus mrigala*) are column feeders or subsurface feeders and bottom feeders, respectively. The majority of the particles

were fibers while the remaining were fragments. Particles were mainly yellow and blue color followed by clear, black, white and green (Table 1; Fig. 2). Some of the microplastics obtained were differentiated based on the hot needle test, in which the polyethylene exhibit shrinking nature and polyester can be identified easily because they are highly inflammable. Other obtained particles were successfully tested using the Fourier Transform Infrared (FTIR) spectroscopy and the result concluded the presence of nylon and other polyamide fiber particles. Nylon fiber was the most prevalent and the remaining included other polyamide synthetic fibers.

The result of this study revealed that three freshwater systems were severely polluted with microplastic particles. Synthetic polymers were determined in all of the tested fishes from the Periyakulam Lake, Singanallur Lake and Kurichi Lake in Coimbatore, Tamil Nadu, India. The large abundance of buoyant, high production plastic materials and the presence of many spherical microplastics showed the importance of regulation on plastic products (Fig. 3). The major impact on the surface water environment is exhibited by the rapid industrialization and urbanization in Coimbatore. Due to developmental activities both surface and subsurface water resources are getting polluted. Numerous textiles, automobiles, home appliances and small scale industries are located in Coimbatore. The effluents from these industries greatly impacted the quality of surface water. The three studied lakes showed the occurrence of microplastics such as nylon,

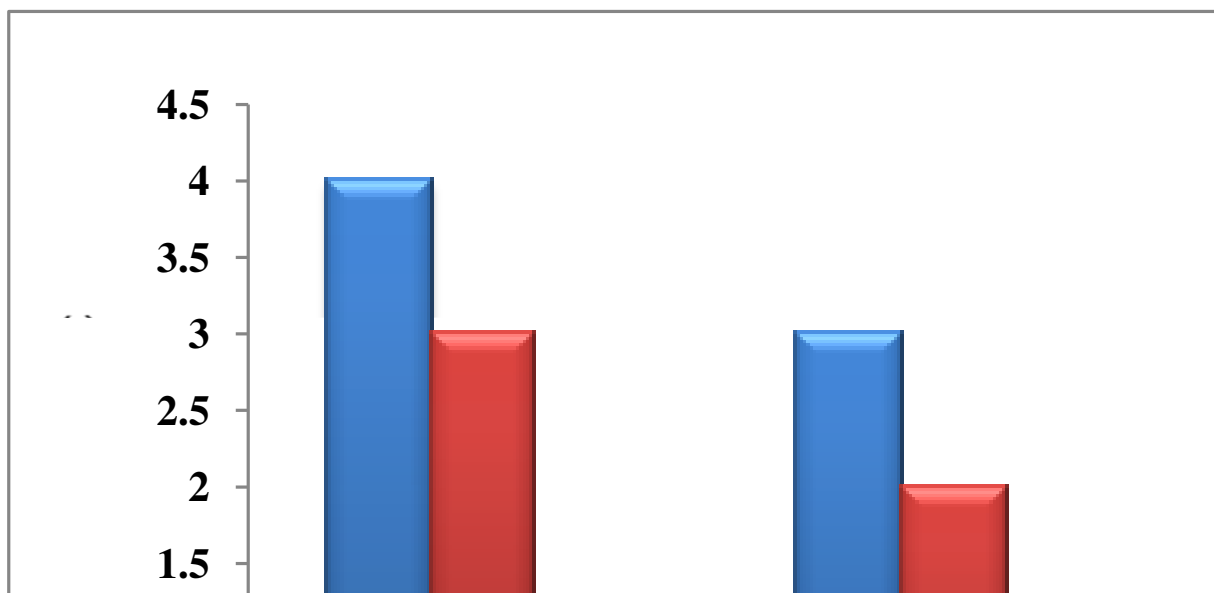


Fig. 2: Microplastics found in the fishes of the Periyakulam, Kurichi and Singanallur lakes.

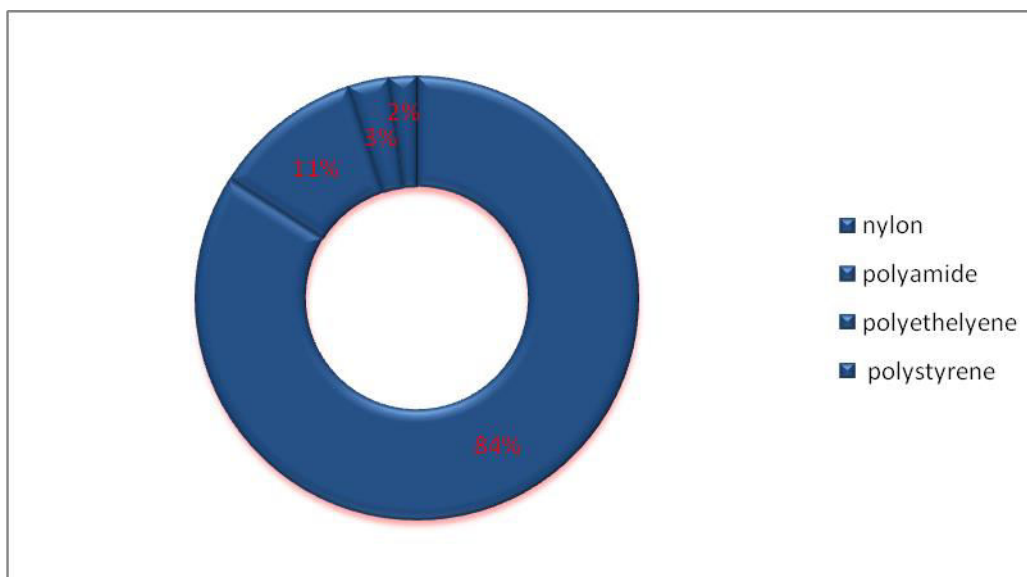


Fig. 3: Total percentage of different microplastic content.

polyester and other polyamide particles, fibers uptaken by the investigated fish may have come from ropes, nets and other materials associated with fishery directly input, and also from continental sources such as washing and textile industries. Various industries such as steel, automobiles, textiles and plastic industries play a vital role in polluting the quality of water in the Singanallur Lake. It may also be attributed to the fact of dumping lot of suspended solid wastes containing effluents received from textile and dyeing industries. The ATR-FTIR results obtained

for the plastic materials are illustrated in Figures 4-12.

Awareness should be created about the presence of plastics in fishes to the fishermen and fish vendors. Fishes must be cleaned properly prior to selling otherwise, plastics may also enter the human body. This study was primarily aimed at detecting microplastics and raising attention to the issue of the rising plastic pollution in three lakes of Coimbatore. The future research should be aimed to evaluate the impact and the risk of

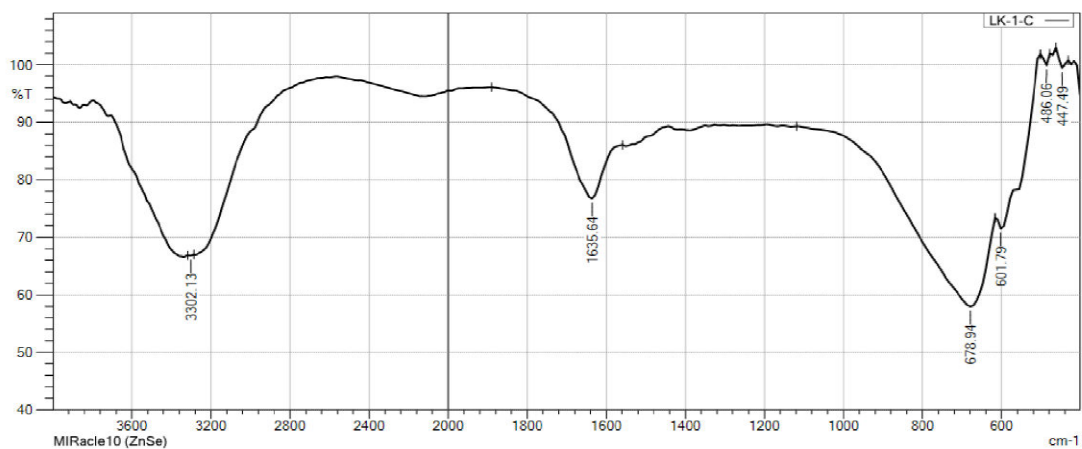


Fig. 4: ATR-FTIR result of *Catla* from Periyakulam Lake.

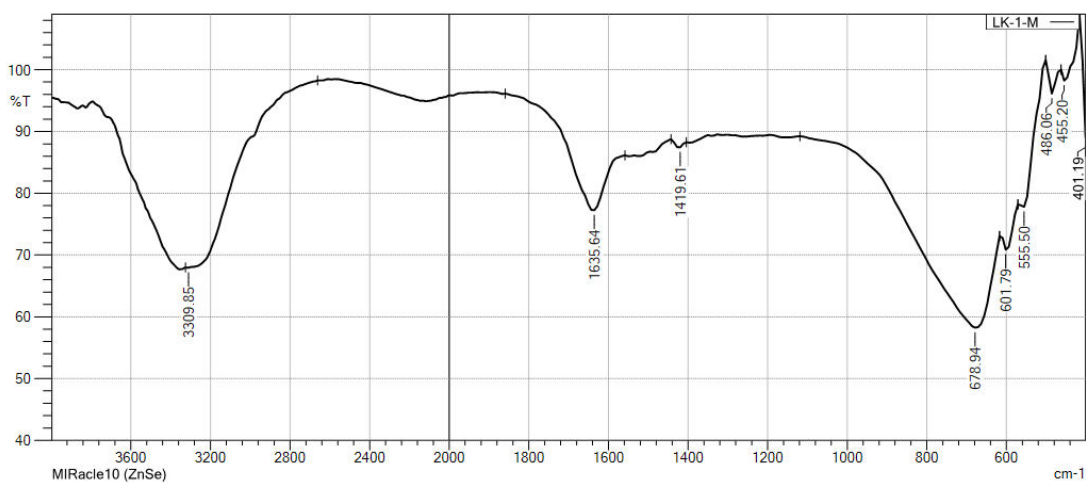


Fig. 5: ATR-FTIR result of *Rohu* from Periyakulam Lake.

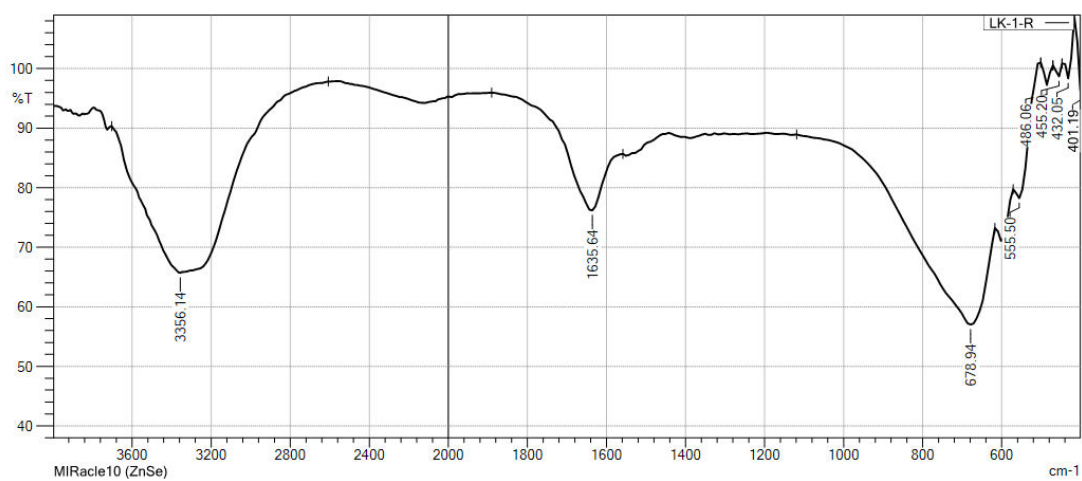


Fig. 6: ATR-FTIR result of *Mrigal* of Periyakulam Lake.

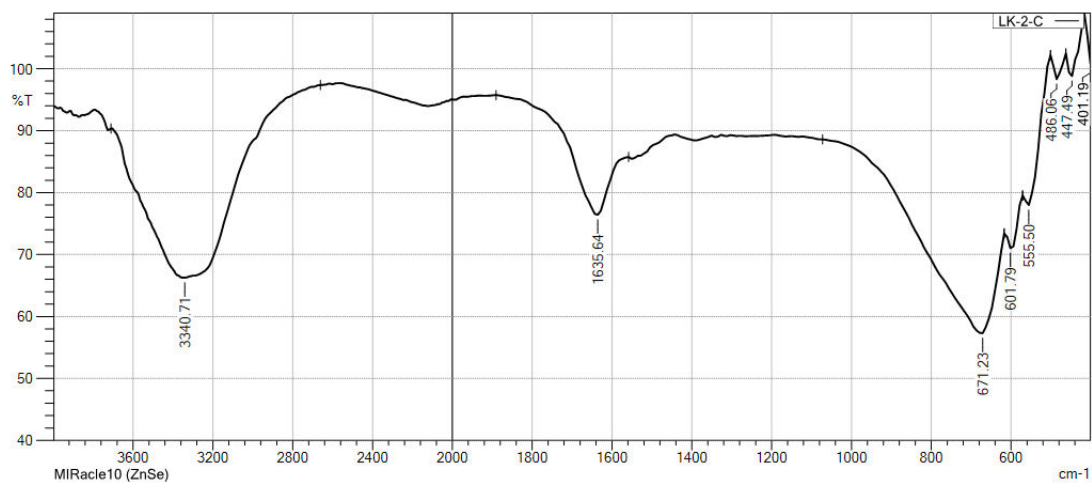


Fig. 7: ATR-FTIR result of *Catla* of Kurichi Lake.

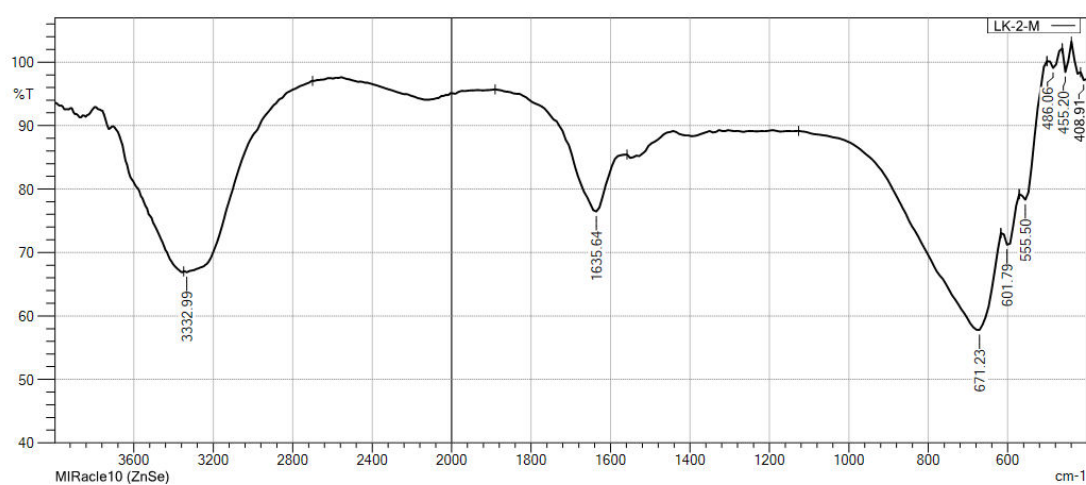


Fig. 8: ATR-FTIR result of *Rohu* of Kurichi Lake.

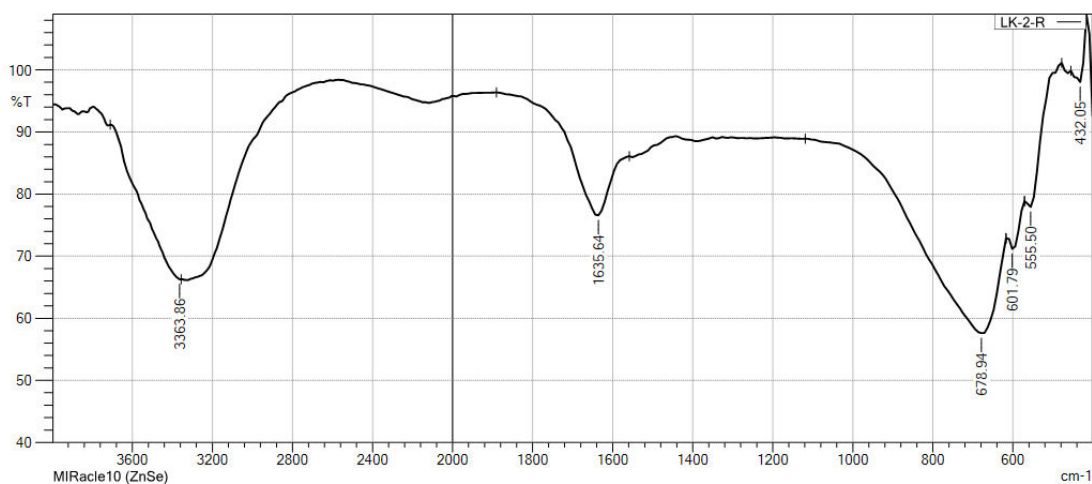


Fig. 9: ATR-FTIR result of *Mrigal* of Kurichi Lake.

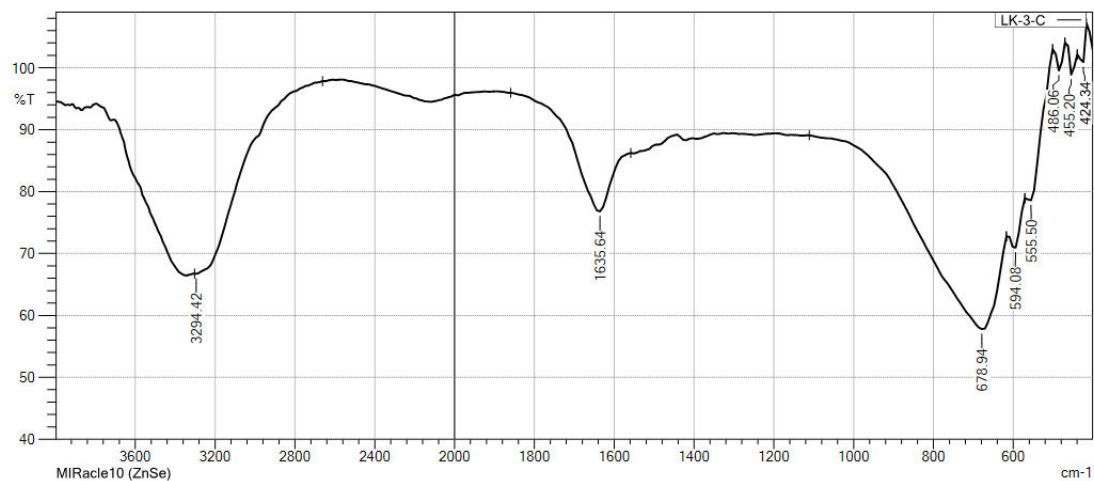


Fig. 10: ATR-FTIR result of *Catla* of Singanallur Lake.

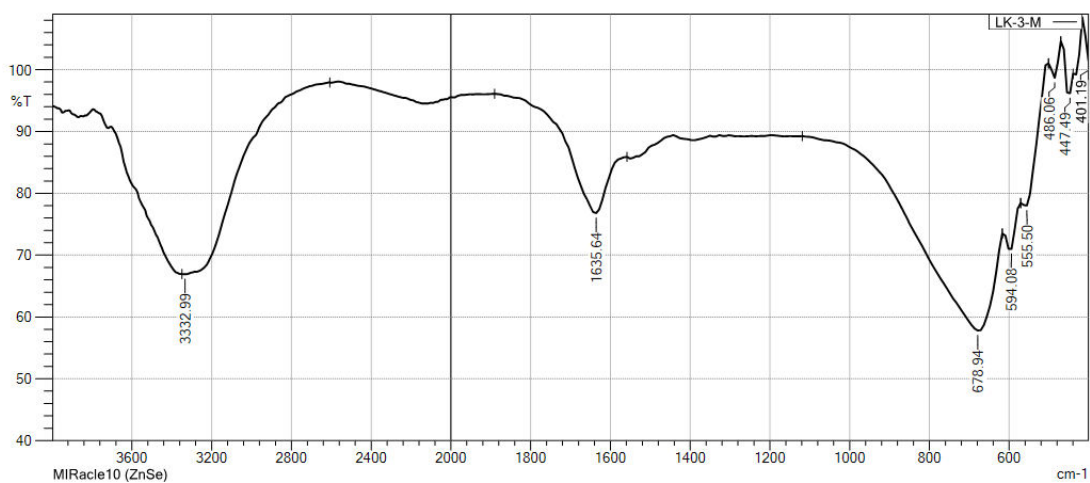


Fig. 11: ATR-FTIR result of *Rohu* of Singanallur Lake.

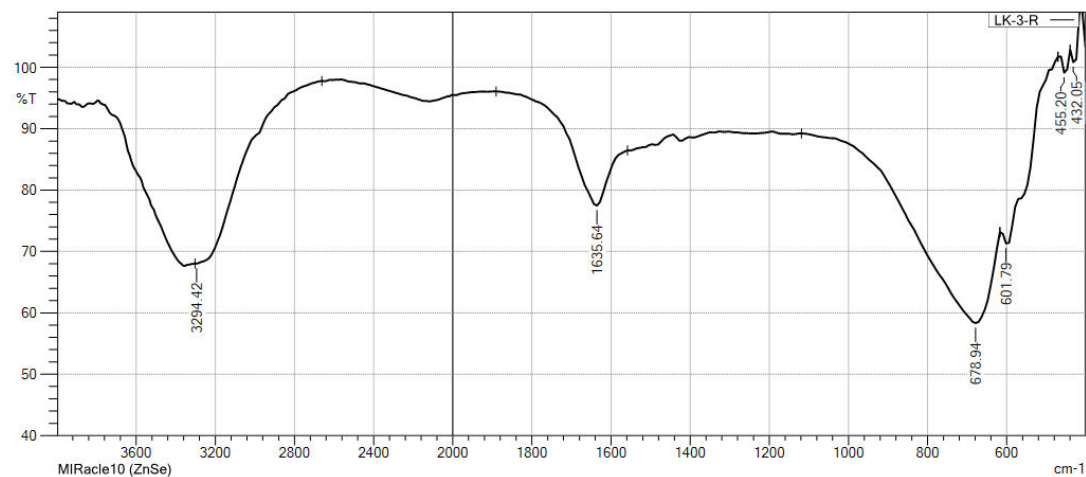


Fig. 12: ATR-FTIR result of *Mrigal* of Singanallur Lake.

microplastics to the fishes, environment as well as human beings and to create awareness among the people, as well as to the fishermen community.

Acknowledgements

The authors are thankful to authorities of Madras Christian College (Autonomous), Tambaram, Chennai for providing the necessary facilities.

References

- Karthik R, Robin RS, Purvaja R, Ganguly D, Anandavelu I and Raghuraman R. (2018) Microplastics along the beaches of southeast coast of India. *Sci Total Environ.* 645:1388-1399.
- Kataoka T, Nihei Y, Kudon K and Hinata H. (2018) Assessment of the sources and inflow processes of microplastics in the river environments of Japan. *Environ Poll.* 244: 958-965.
- Kumar VE, Ravikumar G and Jeyasanta KI (2018) Occurrence of microplastics in fishes from two landing sites in Tuticorin, South east coast of India. *Mar Poll Bull.*135: 889-894.
- Lusher AL, Hernandez-Milian G, O'Brien J, Berrow S, O'Connor I and Officer R. (2015) Microplastic and macroplastic ingestion by a deep diving, oceanic cetacean: The True's beaked whale *Mesoplodon mirus*. *Environ Poll.* 199: 185-191.
- Lusher AL, Welden, NA Sobral, P and Cole M. (2017) Sampling, isolating and identifying microplastics ingested by fish and invertebrates. *Analytical Methods.* doi: 9.10.1039/C6AY02415G.
- Mirabella, Jr FM. (1993) *Practical Spectroscopy Series; Internal reflection spectroscopy: Theory and applications*, Marcel Dekker, Inc., pp. 17-52.
- Rodrigues D, Antunes J, Otero V, Sobral P and Costa MH. (2019) Distribution of patterns of microplastics in seawater surface at a Portuguese estuary and Marine Park. *Front Environ Sci.* <http://doi.org/10.3389>.