

## Microplastics Reflecting Water Quality Degradation in a Sediment-Laden Urban River of India

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### INTRODUCTION & AIM

Microplastics (MPs) have emerged as critical indicators of anthropogenic pollution in riverine ecosystem, reflecting the cumulative impact of urbanization, industrial discharge, wastewater effluents and diffuse surface runoff [1]. Although global assessment estimates that approximately 1,000 rivers contribute nearly 80% of plastic inputs to the oceans, however, MPs are still not routinely monitored in most of the water quality monitoring programs [2]. As a result, MPs interaction with other pollutants are often overlooked.

Urban rivers such as the Yamuna (Delhi stretch), one of the most polluted and highly sediment-laden river represent highly stressed system where complex interactions between physico-chemical parameters such as ionic strength, dissolved oxygen, pH variability and suspended particulate matter govern MPs distribution. Recent studies indicate that microplastic abundance is strongly associated with physico-chemical parameters, particularly higher electrical conductivity (EC) and total dissolved solids (TDS), coupled with lower dissolved oxygen (DO) levels and decreasing pH.

This study aims to integrate microplastic occurrence within the broader physico-chemical context of river water quality assessment. By examining statistical relationships between MPs and major physico-chemical parameters, this work mainly focuses to evaluate MPs as an indicator of water quality degradation in urban river systems.

### METHOD

Surface water samples were collected from the Delhi stretch of Yamuna River under strict quality control conditions. Along with microplastic analysis, key physico-chemical parameters including pH, DO, EC, TDS, temperature and turbidity were measured. For microplastic extraction, samples underwent filtration, chemical digestion to remove organic matter and density separation. Further, MP were initially identified through visual and stereomicroscopic analysis, followed by polymer confirmation using FTIR spectroscopy. MPs were characterized based on size, shape, colour, polymer composition and abundance (items per unit volume).

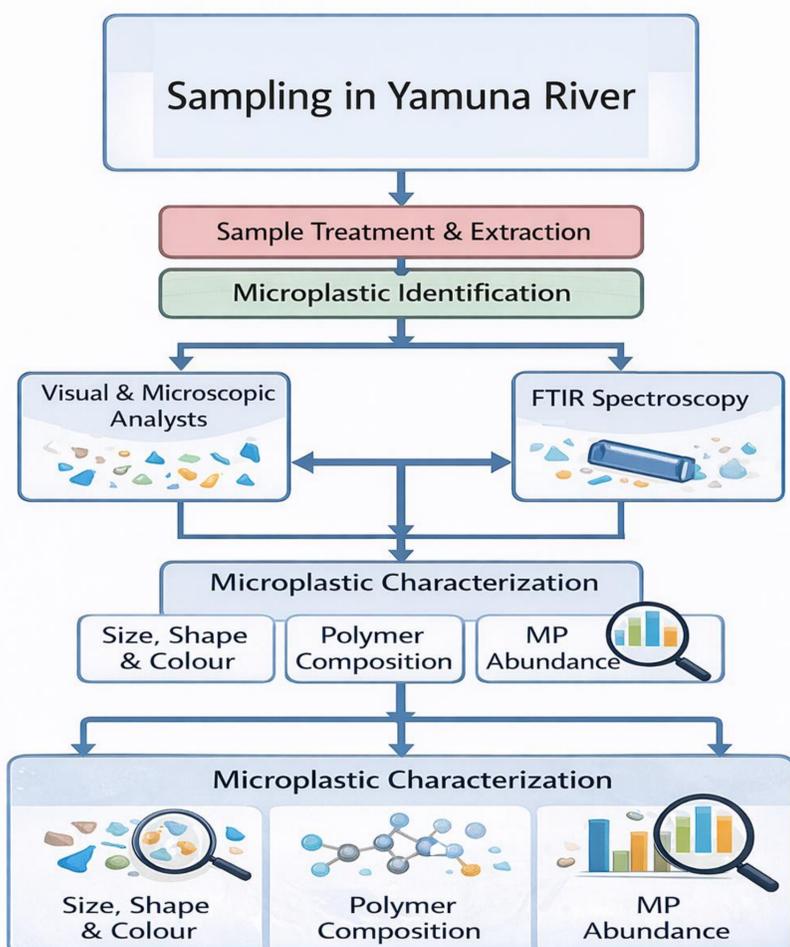


Fig. 1: Microplastic sampling and characterization workflow

### RESULTS & DISCUSSION

#### Physico-chemical Trends

- Polluted river stretches exhibited low dissolved oxygen (DO) levels.
- Elevated EC and TDS indicate increased ionic load.
- Strong spatial variability was observed across sampling locations (W1–W5), reflecting localized anthropogenic inputs.
- Overall physico-chemical conditions suggest chronic pollution stress in urban stretches of the Yamuna River

#### Correlation between Microplastic & physico-chemical parameters

- Microplastic abundance increased with increase in TDS.
- Peak MP levels corresponded to locations with elevated ionic strength (W2–W4).
- The positive association between TDS and MP abundance suggests co-transport of particulate and dissolved contaminants.

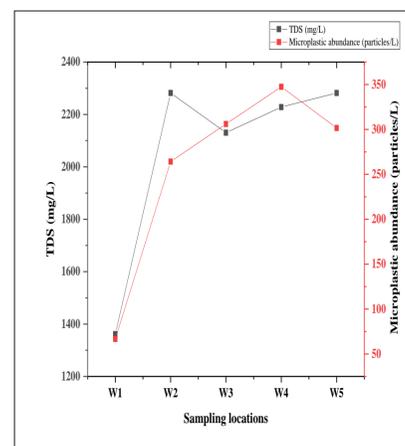


Fig. 2: TDS vs. Microplastic Abundance

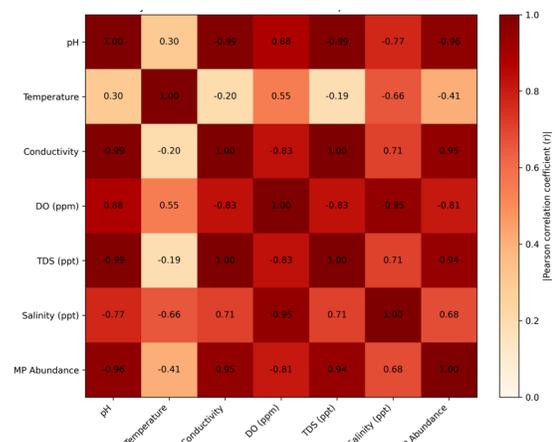


Fig.3: Heatmap showing hydrochemical–microplastic correlations

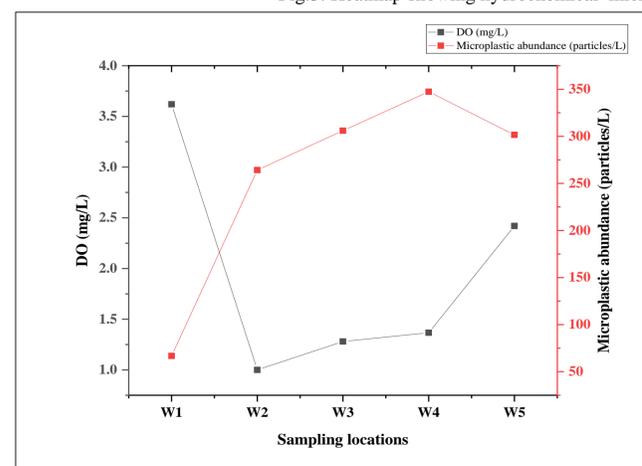


Fig. 4: DO vs. Microplastic Abundance

### CONCLUSION

- Microplastic abundance is strongly governed by physico-chemical conditions
- High MPs directly correlated with high TDS, high conductivity and low DO
- MPs serve as effective indicators of ecosystem degradation
- Integrated monitoring is essential for sustainable river management

### FUTURE WORK / REFERENCES

1. Wagner, M., Scherer, C., Alvarez-Muñoz, D., Brennholt, N., Bourrain, X., Buchinger, S., Fries, E., Grosbois, C., Klasmeyer, J., Marti, T., Rodriguez-Mozaz, S., Urbatzka, R., Vethaak, A. D., Winther-Nielsen, M., & Reifferscheid, G. (2014). Microplastics in freshwater ecosystems: What we know and what we need to know. *Environmental Sciences Europe*, 26, 12.
2. Meijer, L. J. J., van Emmerik, T., van der Ent, R., Schmidt, C., & Lebreton, L. (2021). More than 1000 rivers account for 80% of global riverine plastic emissions into the ocean. *Science Advances*, 7(18).