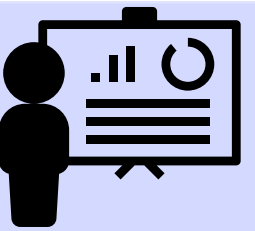


Characterization of Airborne Microplastics (AMPs) in Indoor Environment: A Study conducted in a Plastic Laboratory

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1. INTRODUCTION :

Microplastics (MPs) are the polymeric materials, having undefined shape of its size ranging from 1µm to 5mm which gets exposed through either primary or secondary sources.

An individual can inhale **26 – 130 AMPs per day**

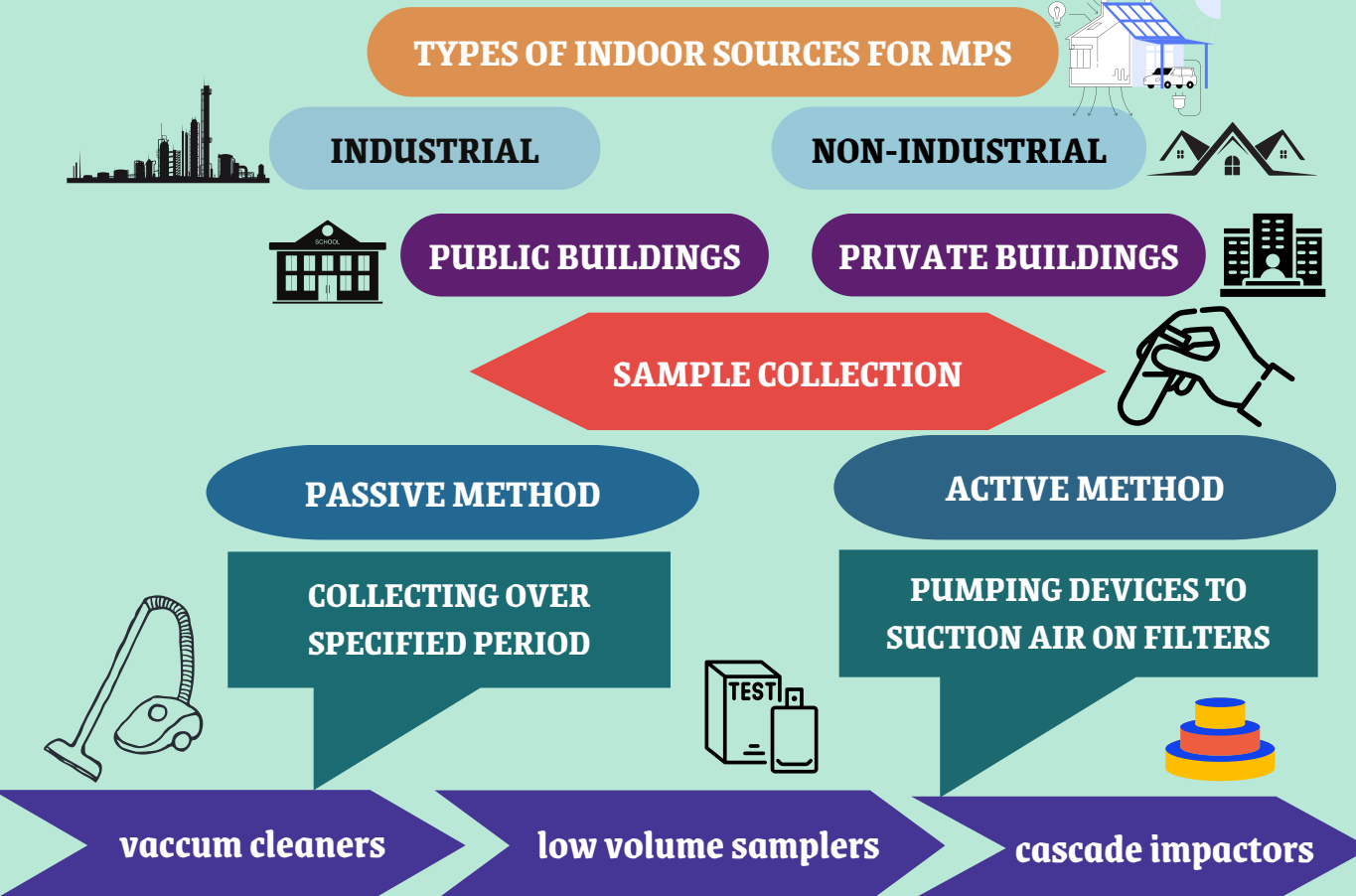


According to the 2023 Plastic Overshoot Day Report by EA, the world produces an estimated **159 million tonnes of plastic annually**. In India, the Central Pollution Control Board (CPCB) reports that around **26,000 tonnes of plastic waste is generated daily**, amounting to approximately 9.5 million tonnes of plastic waste each year.

Improper disposal and degradation of plastic waste lead to the formation of MPs, which infiltrate into air, water, and soil systems.

Most studies have focused MPs in surface water, sediment, sewage, and soil, with **less emphasis on airborne environments**. However, atmospheric transport plays a key role in dispersing MPs across different ecosystems and indoor spaces. This widespread distribution raises concerns about potential health and environmental risks.

2. METHODOLOGY:



3. STUDY AREA :



Fibre Reinforced Plastic Laboratory

MONITORING DETAILS :

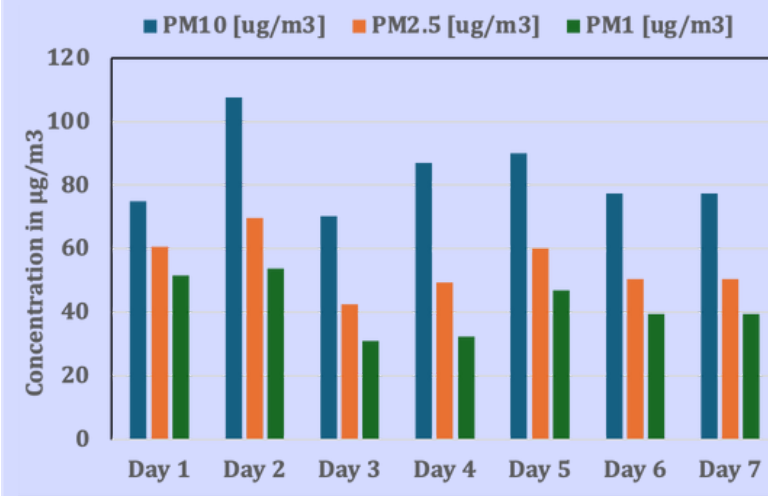
ACTIVE SAMPLING - 7 DAYS
 PASSIVE SAMPLING - 14 DAYS
 IAQ PARAMETERS MEASURED - PM₁₀, PM_{2.5}, CO₂, TEMPERATURE, HUMIDITY, TVOC

4. OBJECTIVE :

The objective of this study is to assess airborne microplastic (MP) concentrations and indoor air quality (IAQ) in a plastic laboratory using passive and active sampling methods.

5. RESULTS AND DISCUSSIONS :

5.1 Measurement of IAQ parameters:



The highest observed concentrations during the 7-day monitoring were 108 µg/m³ for PM₁₀, 70 µg/m³ for PM_{2.5}, and 54 µg/m³ for PM₁.

Temperature, humidity, CO₂, CO, and TVOC levels were assessed and found within standard limits.

Fig 1: Variation in the Concentration of PM₁₀, PM_{2.5}, PM₁

5.2 Active sampling results on airborne MPs :

Active and passive sampling methods were examined for measuring microplastics, highlighting variations in size, color, and shape. The results shown in Figure 2 represent active sampling but closely resemble those from passive sampling as well.

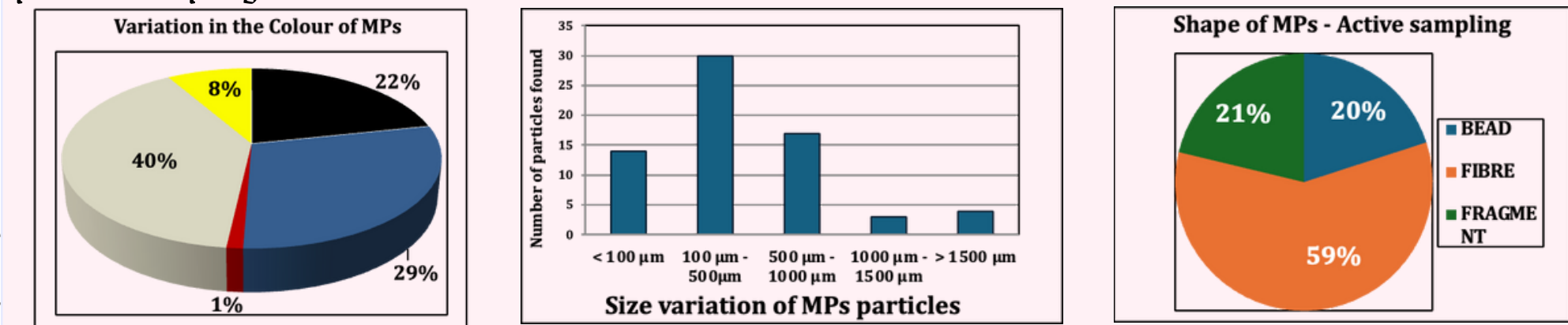
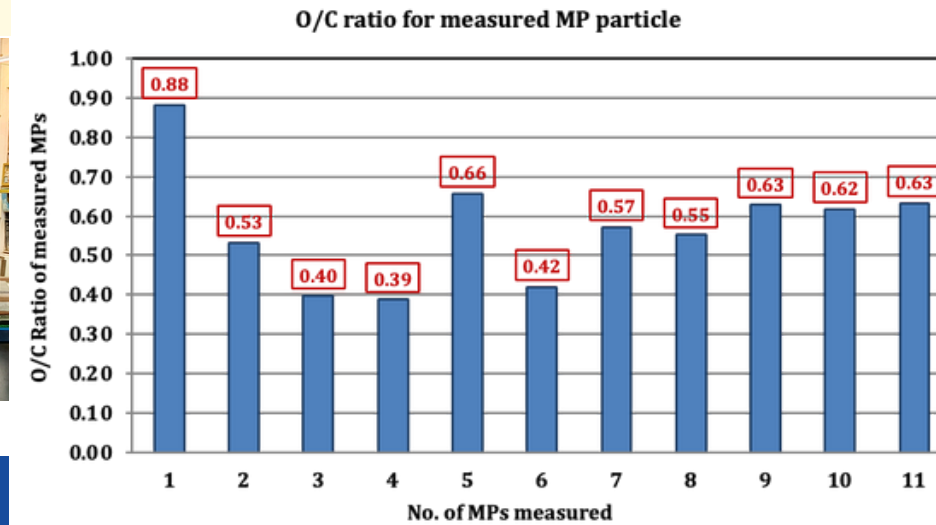


Fig 2: Variation in the colour, size and shape of MPs in active samples

5.3 EDS - SEM Analysis for Assessing the Degradation Rate of Microplastics (MPs) :



The degradation rate of MPs was higher at the particle edges (O/C ratio: 0.66-0.88) compared to the center.

The minimum size of the observed MP was 11.36 µm.

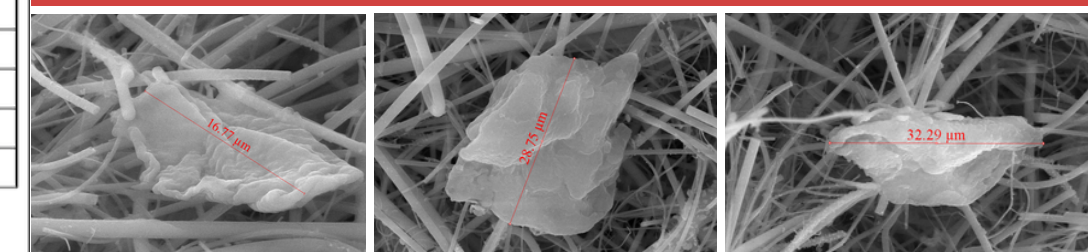


Fig 3: SEM images and O/C ratio of MPs observed through EDS Spectra

5.4 Composition of MPs Analysed using Pyrolysis GC/MS :

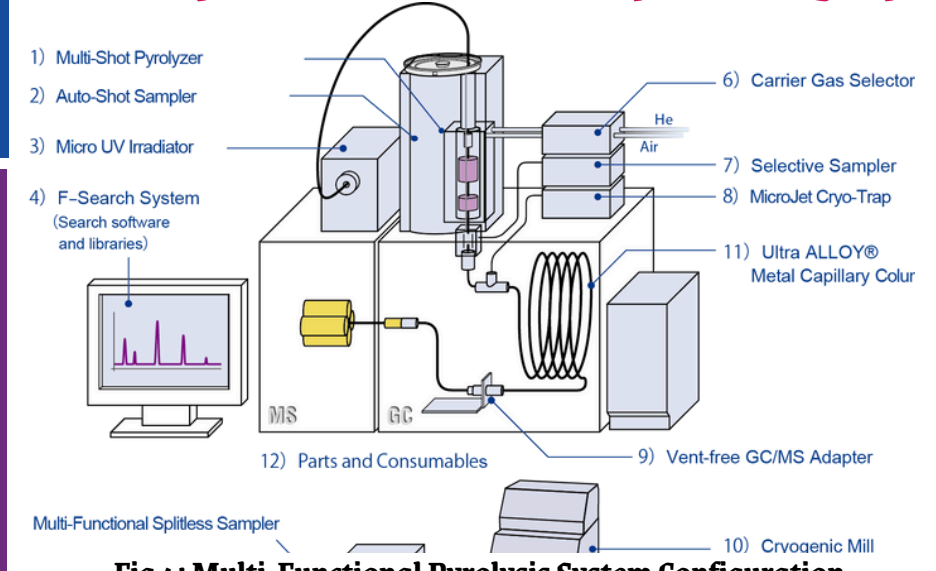


Fig 4: Multi-Functional Pyrolysis System Configuration (Source: <https://www.frontier-lab.com/>)

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6. CONCLUSION :

The study showed PM₁₀ and PM_{2.5} levels exceeded WHO guidelines, while other indoor air quality parameters were within limits. The predominant size range of microplastics (MPs) was 100–500 µm, and EDS-SEM analysis revealed higher degradation rates at particle edges. MPs were composed of PVC, PA, PET, PP, PE, and other polymers, raising concerns about the health impacts on workers inside laboratory.

