Detection of Diverse Microplastic Polymers in Human Breast Milk

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Introduction

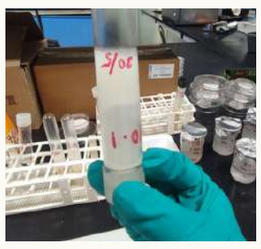
The detection of microplastics (MPs) in human breast milk (HBM) [1] has raised urgent concerns about infant exposure to environmental contaminants at a critical stage of development. Breastfeeding, long regarded as the gold standard for infant nutrition, may inadvertently serve as a pathway for MPs to reach newborns.

Methodology

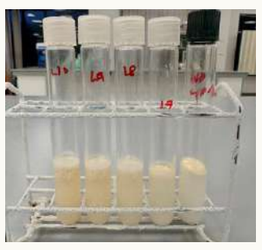
1) Sample collection



2) Lipid separation



3) Chemicals and enzymatic digestion of lipids



4) Organic matters digestion



5) Filtration



6) Microplastic identification via ATR-FTIR

Breast milk samples collected from the Halimatussaadia Mother's Milk Centre (HMMC) were processed according to the sequential steps to isolate MPs, which were subsequently characterised using Attenuated Total Reflectance Fourier Transform Infrared (ATR-FTIR) spectroscopy. The negative control used in this study was ultra-pure (Milli-Q) water, while the positive control was milk spiked with MPs (PET, PP, Nylon 66).

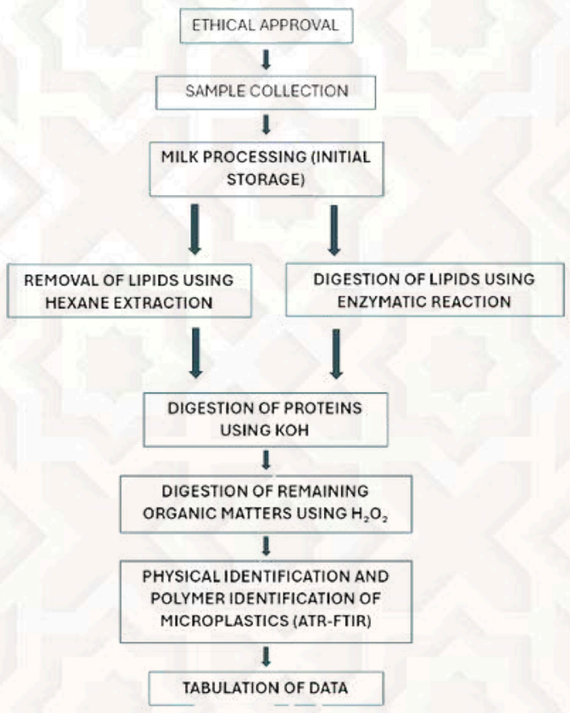


Fig 1. Methodology workflow

Discussion

This study confirms the presence of diverse microplastic (MP) polymers—polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET), and polyvinylidene fluoride (PVDF)—in human breast milk (HBM), emphasizing that MPs are pervasive even in vital biological fluids. The findings align with global reports detecting similar polymers in human tissues and fluids, underscoring the widespread environmental infiltration of synthetic materials. The detection of PVDF, typically linked to industrial use [2], suggests additional contamination routes beyond food packaging. Variations in polymer types may reflect differences in maternal lifestyle, dietary habits, and environmental exposure. These results highlight the potential for early-life exposure to MPs during breastfeeding, raising concerns about long-term health implications [3]. Although this study provides preliminary evidence, the small sample size and methodological limitations warrant further investigation. Future work should employ standardized protocols and advanced analytical tools to quantify MP concentrations and evaluate possible toxicological impacts on infants.

Acknowledgement

The authors would like to express their sincere gratitude to the Sultan Ahmad Shah Medical Centre (SASMEC) @IIUM for the generous support through the SASMEC Research Grant (ID:SRG25-167-0167). We also extend our appreciation to the Department of Biomedical Science, Kulliyyah of Allied Health Sciences and the INOCEM, Kulliyyah of Science, IIUM for providing research materials, technical support, and access to laboratory and research facilities

Results

A range of polymer types was identified in HBM. The most frequently detected MPs included polyethylene (PE), polypropylene (PP), and polyethylene terephthalate (PET)—materials widely used in packaging, food containers, and textiles. In addition, polyvinylidene fluoride (PVDF), typically associated with industrial and household applications, was also present. The diversity of polymers suggests multiple contamination pathways, including consumer products, packaging, and broader environmental exposure.

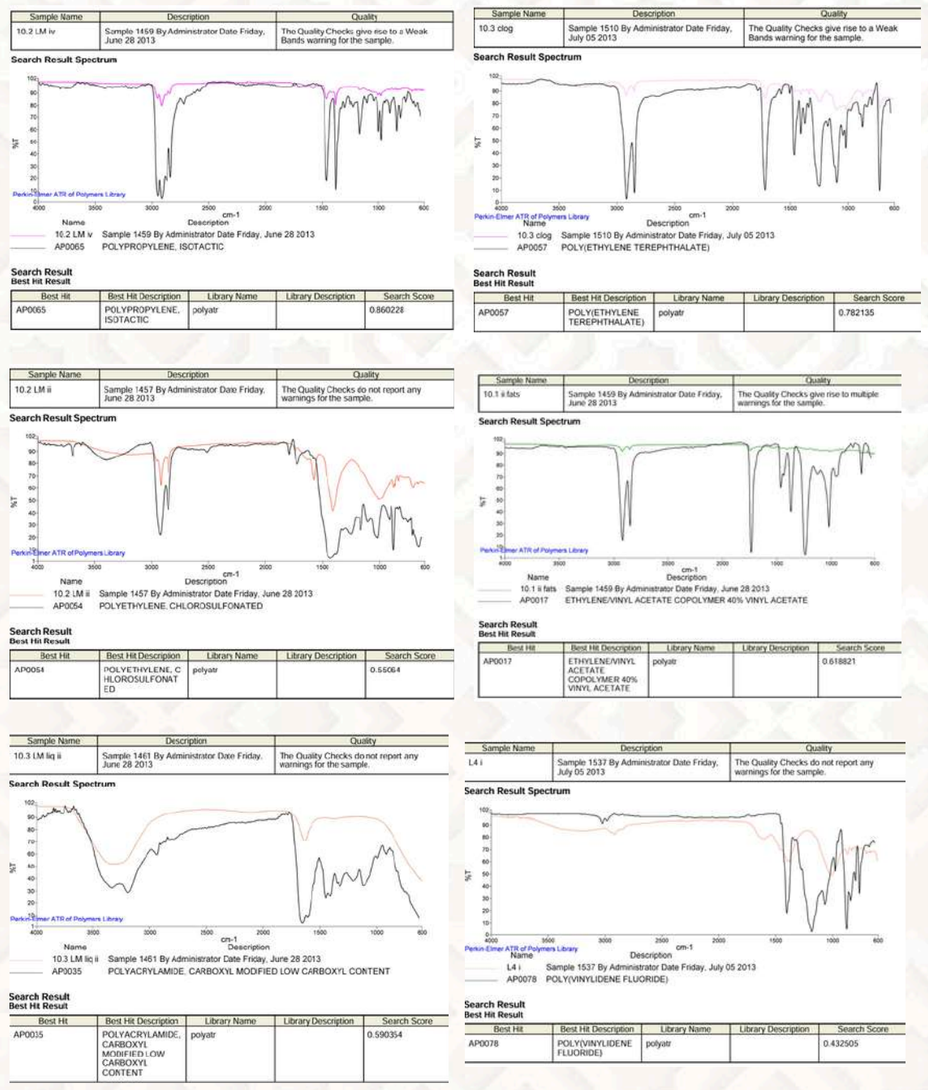
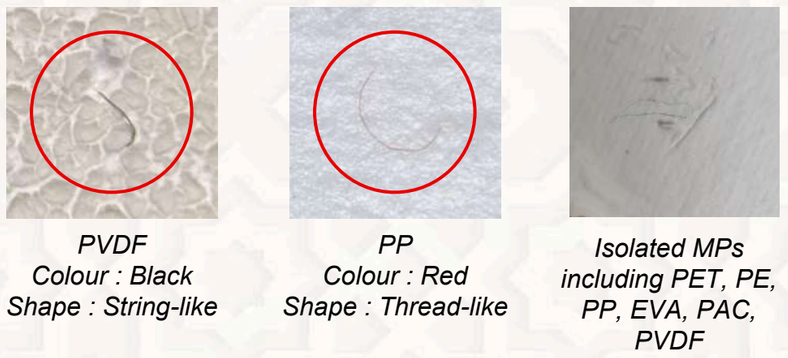


Fig 2. ATR-FTIR results



PVDF
Colour : Black
Shape : String-like

PP
Colour : Red
Shape : Thread-like

Isolated MPs including PET, PE, PP, EVA, PAC, PVDF

Fig 3. MPs under stereomicroscope

Conclusion

This study highlights the presence of multiple microplastic polymers in human breast milk, indicating potential early-life exposure in infants. The detection of common plastics such as PE, PP, PET, and PVDF highlights the pervasive nature of microplastic pollution. These findings underscore the urgent need for standardized detection methods and further studies to assess exposure sources and potential health risks to breastfeeding infants.

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