Appendix A. Supplementary data

for

Identification and characterization of microplastics released during actual use of disposable cups using laser direct infrared imaging

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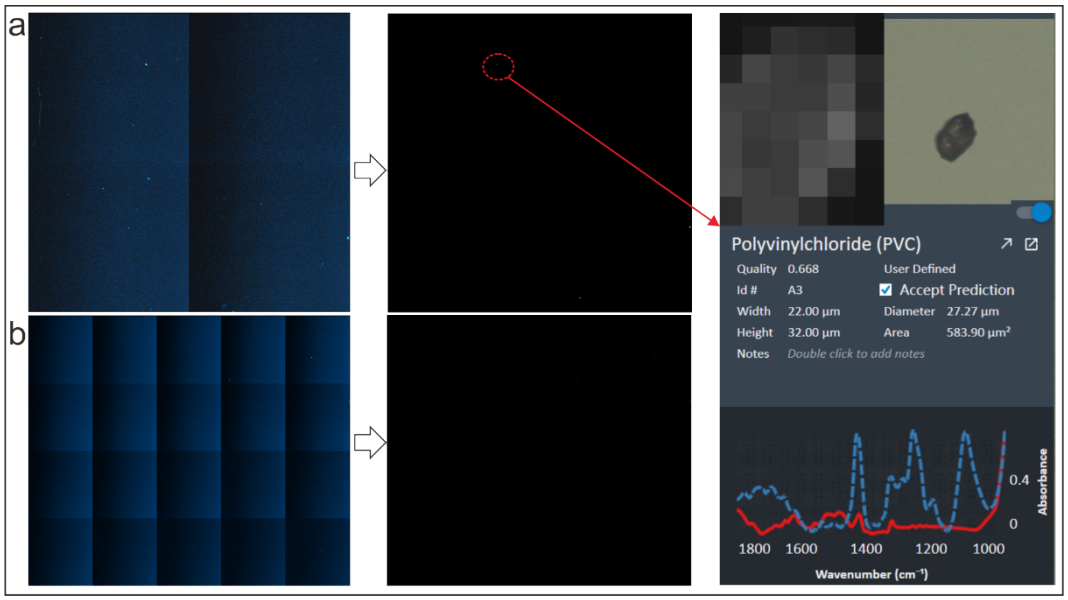


Fig. S1 Optical and LDIR images of ethanol, Mirr-IR low-E glass slides after cleaning.

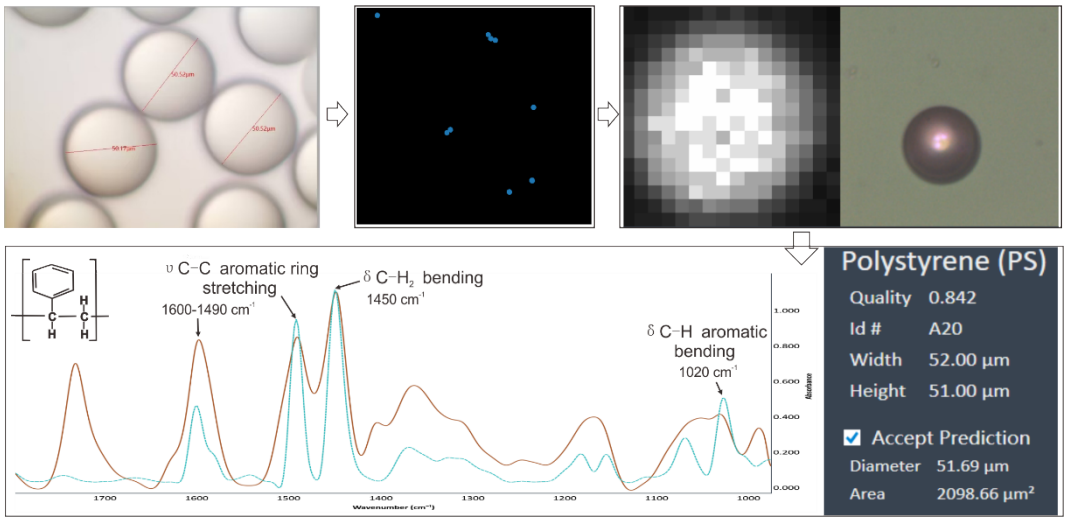


Fig. S2 TEM, IR imaging images, IR spectrum matching and optical images of PS standard particles (50 µm).

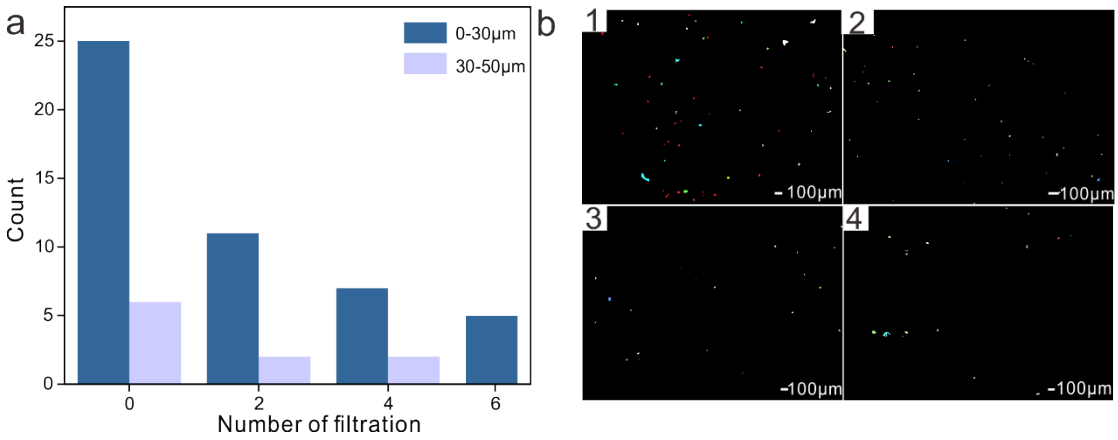


Fig. S3 Size distribution and IR imaging images of MPs with different filtration times.

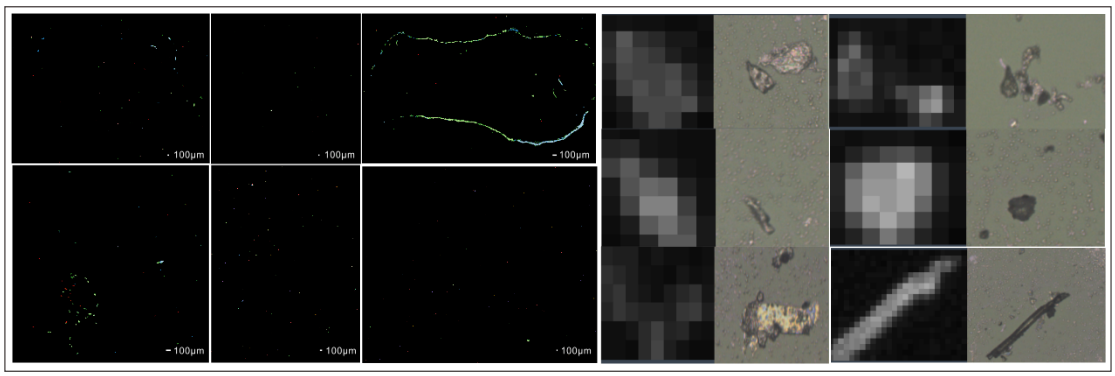


Fig. S4 Different plastic cups in the color-highlighted images of particles after LDIR identification (left) and the IR and optical images of particles (right).

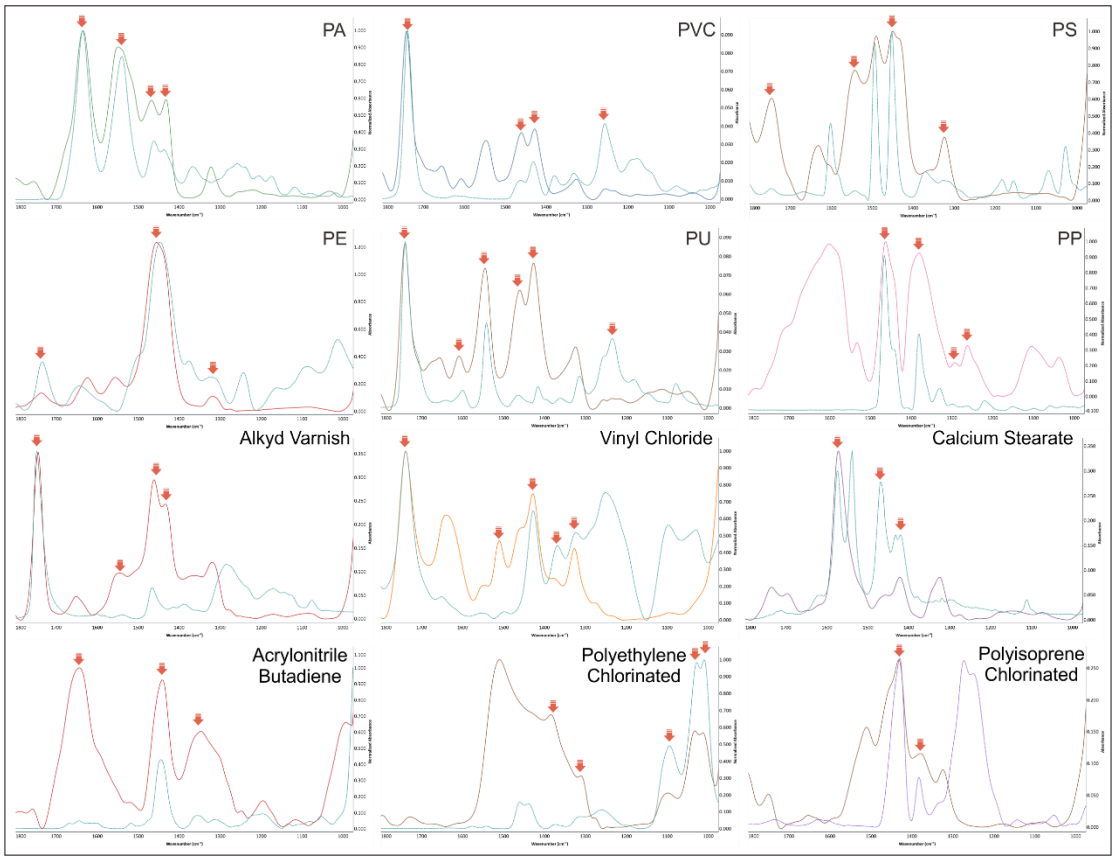
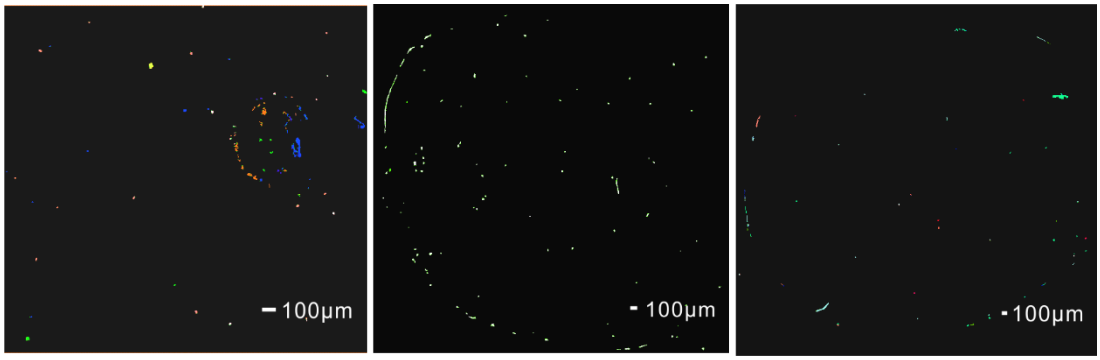


Fig.S5 The matching identification of the IR spectrum of particles filtered from water in disposable cups with the spectra in the spectral library.



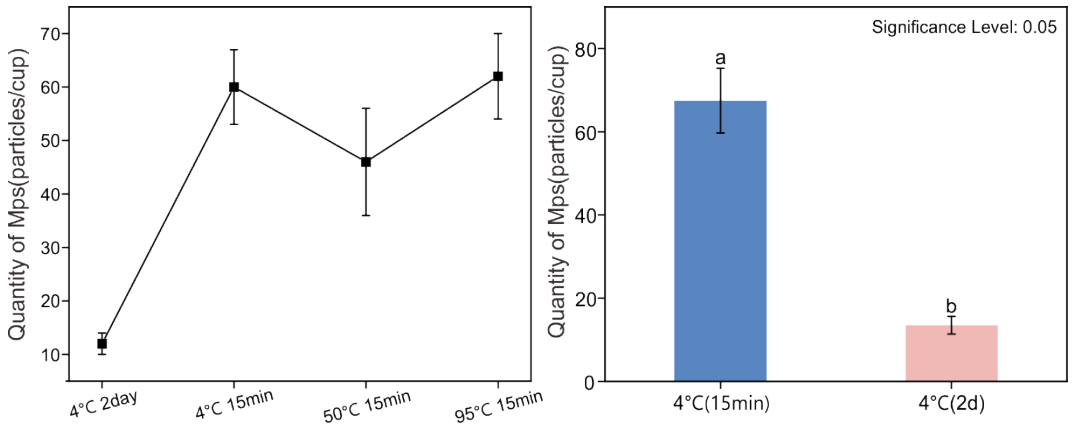


Fig. S6 The influence of temperature on the release of MP in PP plastic cups.

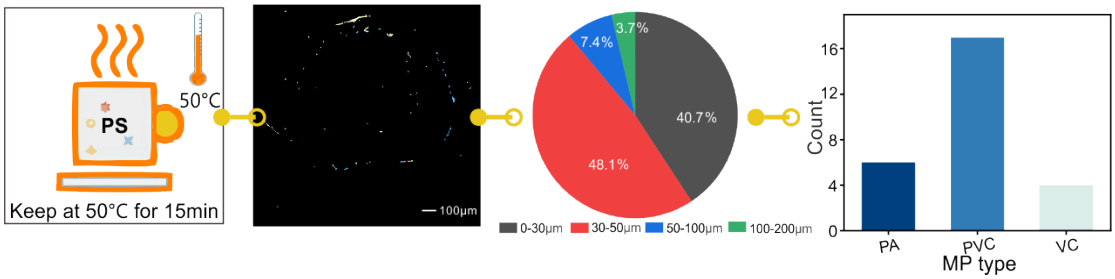


Fig. S7 Size distribution and composition of MPs released by PS plastic cups at 50℃ for 15 min.

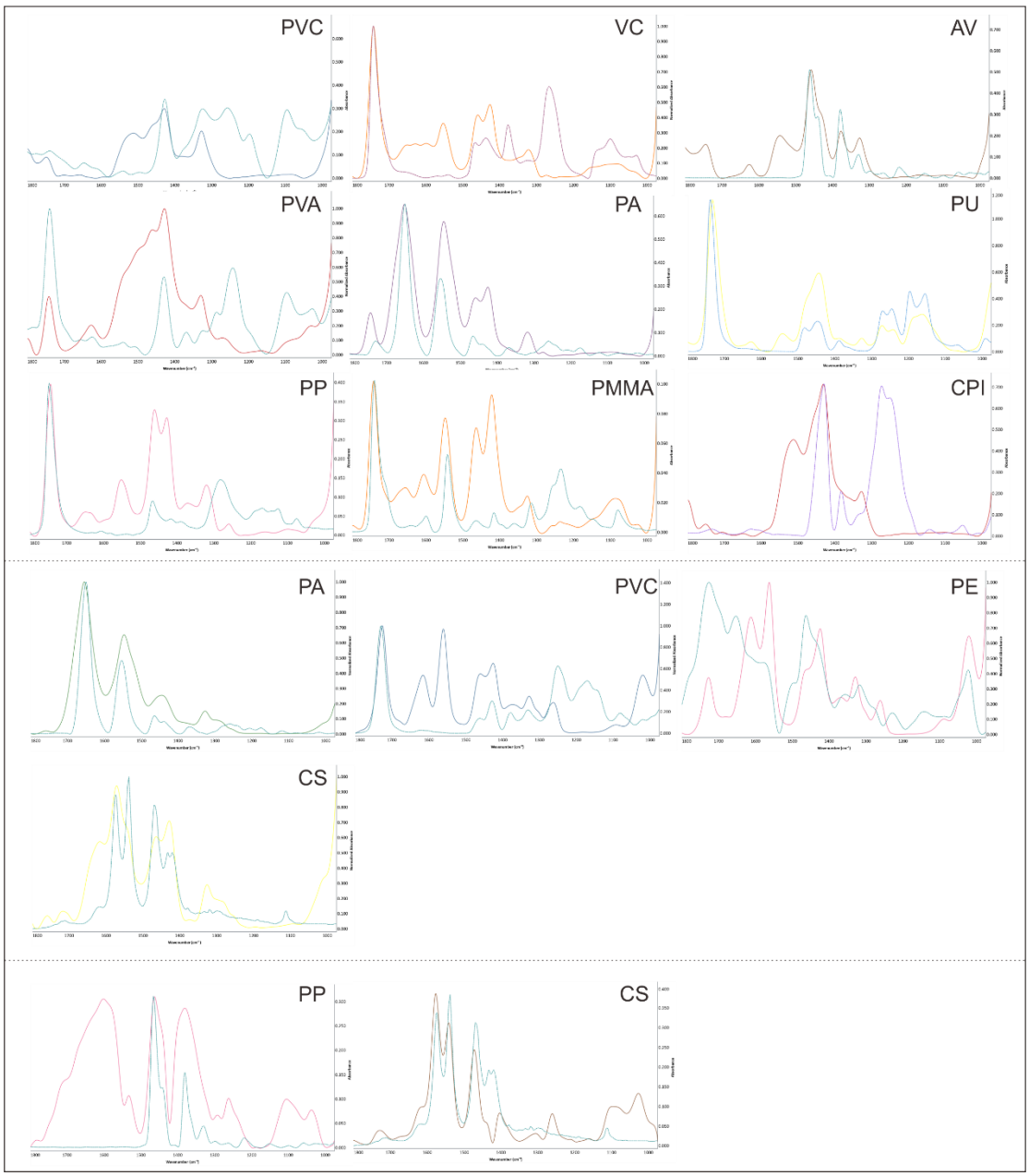


Fig. S8 IR spectra of MPs released at different water temperatures, including (top) maintaining at 4°C for 15 min, (middle) maintaining at 50°C for 15 min, and (bottom) maintaining at 4°C for 48h.

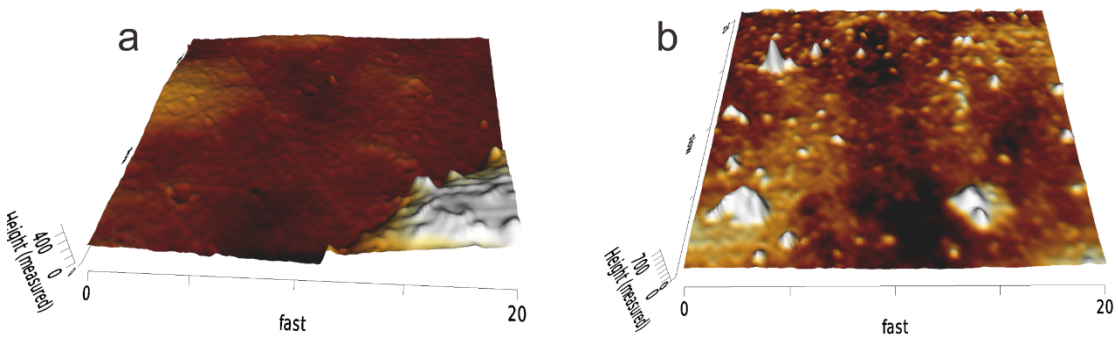


Fig. S9 AFM image of untreated PP plastic cup surface (a) after being kept at 4°C for 15 min (b).

Table S1

Recovery test on PS particles.

	Count
Actual particles	60
Theoretical particles	79
Recovery (%)	86.1

Table S2

Estimation of daily exposure to MPs.

Bulk material	MPs release (particle/L)	Daily exposure
PP	980	294
PS	1340	402

Table S3

Summary and comparison of MPs release from disposable cups, including study results.

Material	Release factor	Conditions	Method	MPs quantity	MPs size	MPs types
PP PET PE[1]	Residence time Shaking Temperatures	95℃ 5min/30min 120r 5min/30min 5℃/60℃	Identification: FTIR Quantification: SEM	723-1489/L	< 50 μm	_
PE PP PS[2]	Temperatures Contained liquid	10℃/40℃/70℃/95℃ Soda/water/Carbonated beverage	Identification: Raman Quantification: SEM	2718, 2720, 2629 /L	< 20 μm	_
PE[3]	Temperatures	100℃ 15min	Identification: FTIR Quantification: Fluorescence	102+21.1 × 10^6 /mL	25000μm	_
This work PP PS	Cup materials Temperatures Contained liquid	95℃ 15min 4℃/50℃/95℃ Tea/pure water	LDIR	980-1340/L	< 30 μm	PA, PVC, VC, PP, PS.....

Reference

1 G. Zhou, Q. Wu, P. Tang, C. Chen, X. Cheng, X. F. Wei, J. Ma, B. Liu, *J. Hazard. Mater*, 2023, **441,** 129982.

2 H. Chen, L. Xu, K. Yu, F. Wei, M. Zhang, *Sci. Total Environ*, 2023, **854**, 158606.

3 V. P. Ranjan, A. Joseph, S. Goel, *J. Hazard. Mater* 2021, **404**, 124118.