Electronic Supporting Information

"Development of a rapid detection protocol for microplastics using reflectance FTIR imaging"

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Supporting Information Figure SI1: Size distribution of particles as determined by optical microscopy. Median = $44 \mu m$, Mean = $82 \mu m$, Standard Deviation = $135 \mu m$.



Supporting Information Figure SI2: Synchrotron radiation (SR) ATR-FTIR observation of PE and PP microplastic particles <5 um. (A) Images showing univariate tri-colour overlay of integrated area under the curve of $v_s(CH_2)$ absorbance band (spectroscopic marker for PE), $v_{as}(CH_3)$ absorbance band (spectroscopic marker of PP), and v(C=O) as a spectrosopic marker for latex. (B) representative spectra of each of the 3 particles.

Method of Data Collection – SR-ATR-FTIR spectral maps were collected a Bruker Vertex 80v spectrometer coupled with a Hyperion 2000 FTIR microscope and a liquid nitrogen-cooled narrow-band mercury cadmium telluride (MCT) detector (Bruker Optik GmbH, Ettlingen, Germany), at the infrared microscopy beamline of the ANSTO Australian Synchrotron. The beamline is fitted with a hemispherical Ge ATR crystal ($n_{Ge} = 4$) that consists of a 250 µm diameter sensing facet, and a 20× IR objective (NA = 0.60; Bruker Optik GmbH, Ettlingen, Germany). Spectra were recorded over the spectral range of 3800–700 cm⁻¹, using 8 cm⁻¹ spectral resolution and 4 co-added scans, using OPUS 7.2 software suite (Bruker Optik GmbH, Ettlingen, Germany). Background spectra were collected from the blank crystal in air using 256 co-added scans. The sample was mapped with a physical step size of 1 µm which equated to 250 nm step of the focussed IR beam at the sample surface.



Supporting Information Figure SI3: Representative examples of micro-reflectance-FTIR, micro-ATR-FTIR, and micro-transmission-FTIR spectra, collected from a PE microplastic particle. Total absorption of infrared light by the v(C-H) bands, resulting in "flat-topped" peaks can be seen in the micro-transmission-FTIR spectrum. Data collection for ATR and reflectance data is as described in the manuscript. The transmission spectra was collected using the same data collection parameters as the reflectance spectra, but in transmission geometry (and Al_2O_3 substrate).



Supporting Information Figure SI4: Reflectance micro-FTIR spectra at spectral resolutions of (A) 4 cm⁻¹, (B) 8 cm⁻¹, and (C) 16 cm⁻¹ with 2, 16 and 128 coadded scans from a representative PE particle in a marine salt sample.



Supporting information Figure SI5: Reflectance micro-FTIR spectra at spectral resolutions of (A) 4 cm⁻¹, (B) 8 cm⁻¹, and (C) 16 cm⁻¹ with 2, 16 and 128 coadded scans from a representative PP particle in a marine salt sample.



Supporting information Figure SI6: The individual unprocessed spectra from main manuscript Figure 4. (i) Micro-reflectance-FTIR spectra and (ii) SEM images of PE particles with different morphologies: (A) sphere, (B) granule, (C) film, and (D) weathered particle (from environmental marine salt sample).