Using FTIR to Analyze Microplastics in the Environment

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GOALS AND OBJECTIVES
The goal of this work is to describe the application of infrared spectroscopy to the identification and characterization of microplastics encountered in the environment. This spectral analysis can provide valuable information about the origin of the plastics particles, advertised chemicals and possible toxicity.

EXPERIMENTAL
FTIR microscopy is an excellent tool for detecting and identifying polymeric materials. The Thermo Scientific™ Nicolet™ iS20 FTIR spectrometer coupled with the Thermo Scientific™ Nicolet™ iN5 FTIR Microscope shown in Figure 1 was designed for exactly such an application, with automatic beam switching, extreme simplicity in functional design and powerful analysis software. The Nicolet iN5 microscope large field of view makes it easy to locate and target your sample with minimal microscopy experience. The most common microplastics are around 25-100 microns in size, for which the microscope and its Ge-tip ATR are perfectly suited. Coupled with OMNIC and OMNIC Specta software, a typical analysis can require no more than a minute. This combination delivers answers with automatic beam switching, visual positioning using manual operations, simple contact-and-analyze ATR function is a powerful tool for detecting additives or trace components adsorbed on a plastic. In Figure 5 the small blue sphere is identified as polyethylene but appears to contain a second component, indicated by peaks between 1000 and 1200 cm⁻¹. OMNIC Specta software identifies all components simultaneously as polyethylene and a barium sulfate compound. The comparison of the measured sample and the calculated composite spectrum confirm barium sulfate as the second component.

PLASTICS IDENTIFICATION
The Nicolet iS20 infrared microscope is capable of measuring spectra in transmission and switching to reflectance mode without moving the sample. Figure 3 shows the iS20 spectra from two microbeads placed on an infrared transparent window.

RESULTS
Figure 2 shows a sparsely populated region where a single, isolated particle could be swiveled. The image is taken through the 100 micron aperture of the Nicolet iN5 microscope. The Ge-tip ATR was inserted and contact made as indicated by a simple red-green-light on the Nicolet iN5 system. The resulting spectrum (6 second acquisition) is also shown in Figure 2, clearly indicating that the Ge-tip ATR is properly contacting the particle. The high level match to polystyrene (> 92) further confirms the excellent performance of this combination.

FIBER IDENTIFICATION
A major source of microplastics found in the environment is from clothing and fabrics. In the example in Figure 4, a small piece of fiber on a filter is directly measured by ATR. For placement only

MULTI-COMPONENT SEARCH
The combination of Nicolet iS20 spectrometer and the Nicolet iN5 FTIR microscope is ideally suited for the identification of microbeads and plastics while keeping the spectrometer sample compartment open for other accessories providing flexibility for busy laboratories. The simplicity of operation targets this combination at laboratories with minimal microscopy experience. The most common microplastics are around 25-100 microns in size, for which the microscope and its Ge-tip ATR are perfectly suited. Coupled with OMNIC and OMNIC Specta software, a typical analysis can require no more than a minute. This combination delivers answers with automatic beam switching, visual positioning using manual operations, simple contact-and-analyze ATR and the most trusted software in spectroscopy.

EXPERIMENTAL

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