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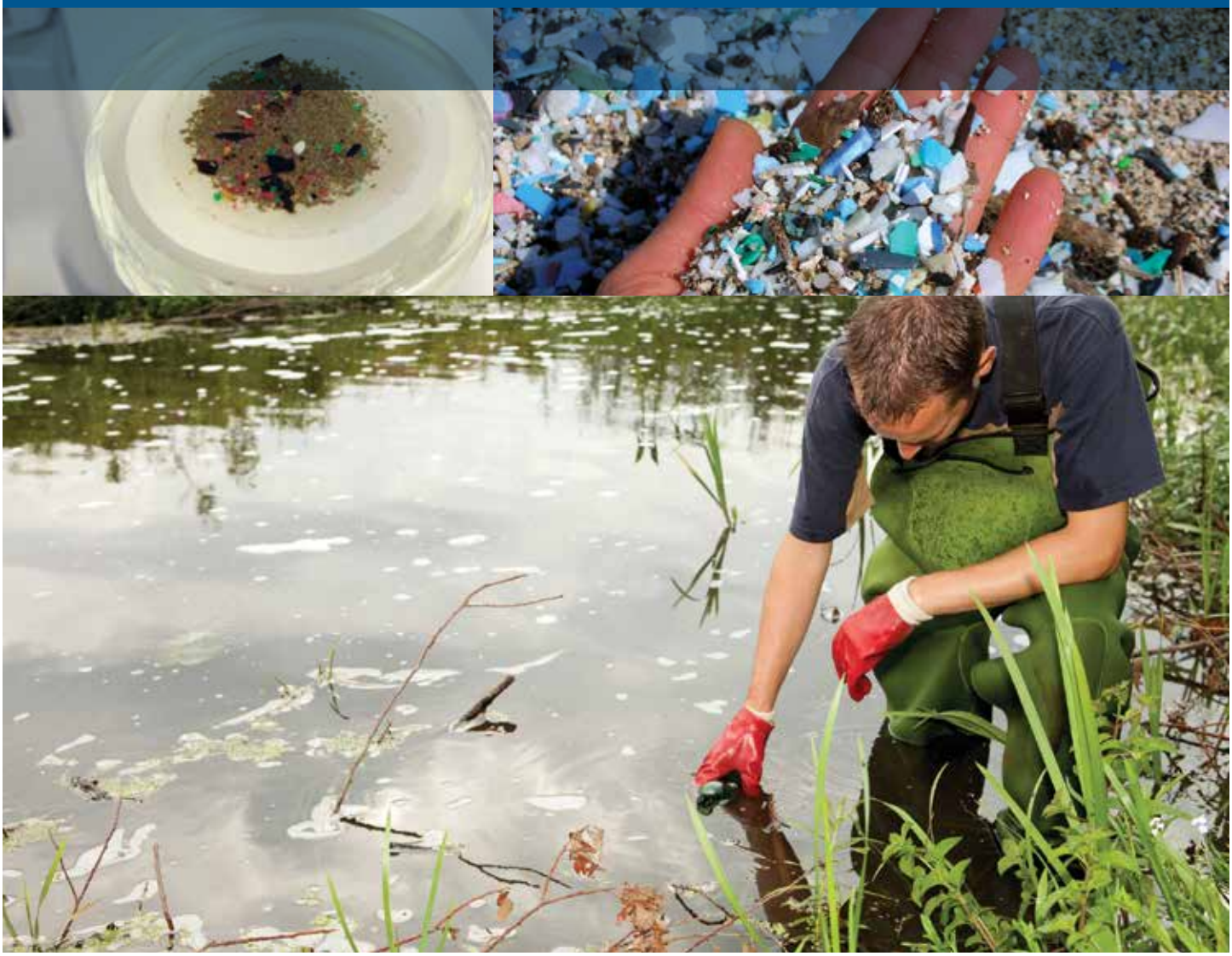
Trusted Answers

Analyzing Microplastics

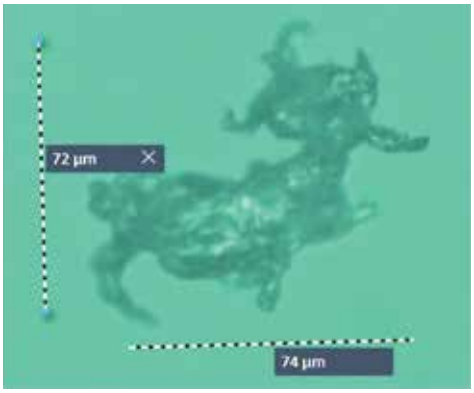
Using the Agilent 8700 Laser Direct Infrared Imaging system for fast and automated analysis of microplastics in environmental samples



Microplastics

Contamination in our waterways, soil, air, and drinking water from microplastics is gaining significant public interest due largely to its emergence as an environmental threat. Researchers are now working towards standardized analytical solutions to best characterize these small particles in terms of chemical identity, size, shape, and total mass.

Organizations such as the National Oceanic and Atmospheric Administration define a microplastic as any particle of a plastic polymer that is less than 5 mm in size. However, it is smaller microplastic particles, less than 100 µm in size, that are often of the most interest. They are not visible to the naked eye and can make their way into the food chain.



Analyzing microplastics

Smaller microplastic particles are most biologically and toxicologically relevant—the smaller the particle, the higher the risk.

Chemically identifying these very small microplastics has typically been done using vibrational spectroscopy. However, this approach is often slow. For example, FTIR point-mapping microscopes require very small apertures for this work. The small aperture degrades the signal-to-noise ratio and each microplastic particle requires more than one minute to analyze. FTIR array microscopes and Raman microscopes are also very slow for this type of analysis.

Identifying and semi-quantifying microplastics down to 10 µm in minutes

The Agilent 8700 Laser Direct Infrared (LDIR) chemical imaging system is a laser-based imaging and spectroscopy technique. It overcomes most of the drawbacks of the techniques used to analyze microplastics. 8700 LDIR uses a Quantum Cascade Laser (QCL), developed by Agilent. When combined with a point detector and rapidly scanning optics, the instrument can obtain the IR spectrum of a microparticle and identify it in seconds.

The 8700 LDIR is a fast automated solution for smaller microplastic identification, size measurement, semi-quantitation and report generation.

LDIR microplastics analysis workflow

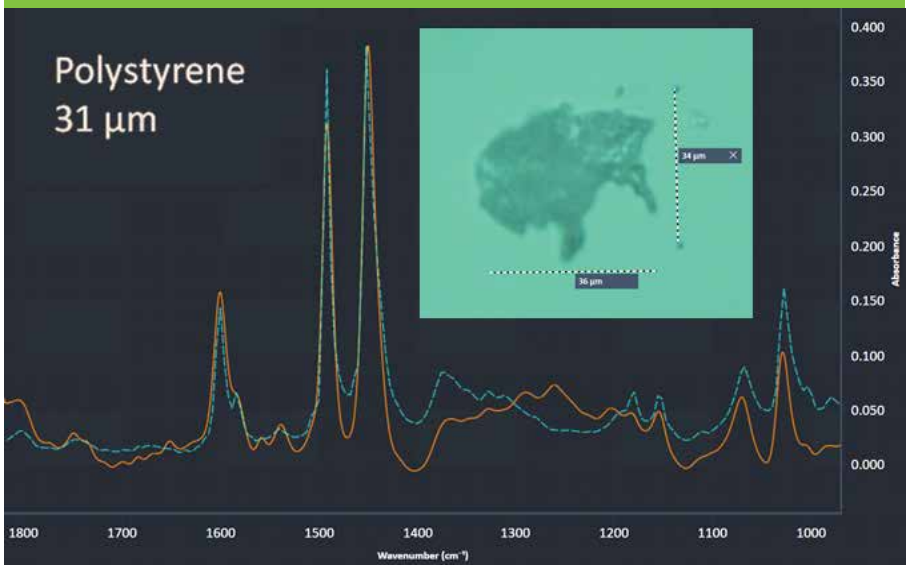
After suitable sample preparation to extract microplastics from a sample, the microplastics are suspended in high purity ethanol. Chemical identification of each microplastic is then done, using the following steps:

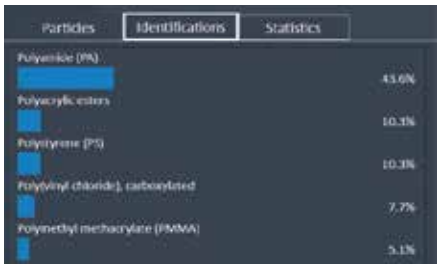
Step 1. Spread the microplastics onto a flat, reflective surface e.g. kevley slide or IR reflective filter.

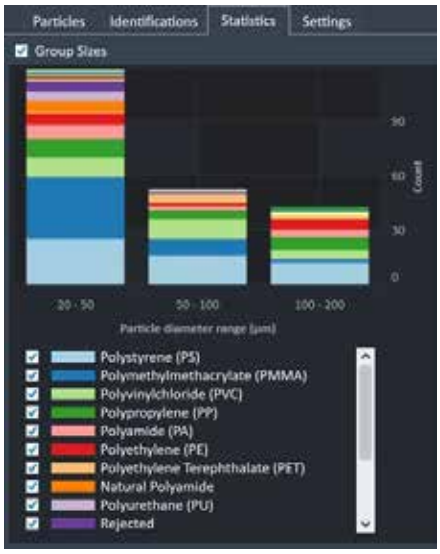
Step 2. Place the slide into the LDIR and close the door. The Agilent Clarity software will automatically start the analysis.

Step 3. The instrument will scan an area using light of a single wavenumber to locate all the particles. It takes only 4 minutes to scan an area 10 x 10 mm at 5 µm pixel size. The instrument then targets the identified particles (appearing as bright spots) and collects an IR spectrum of each one.

Step 4. Each spectrum is then compared against a spectral library to identify the chemical composition of each particle. The LDIR has a high-magnification visible camera to photograph particles. In this case, a polystryene microplastic particle, identified in sewerage.







The 8700 LDIR will report what percentage of the total number of microplastic particles each type of plastic represents (top). It will also report a range of statistics, like the number of particles of each plastic type that fall into different particle size ranges (bottom).

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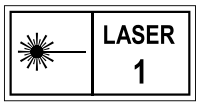

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