

Smart Notes



Is fast, automated particle analysis of microplastics achievable with FTIR microscopy?

Microplastics are a persistent and ubiquitous environmental pollutant; their presence in aquatic sources, air, and food chains is of growing concern across the globe. Working to address the concern, regulatory agencies monitoring environmental pollution aim to establish the scope and methodology for microplastic characterization. Yet the size and diversity of these micro-contaminants present challenges to such method development. How can this work be established and done efficiently?

Fourier-transform infrared spectroscopy (FTIR) is a widely accepted analytical tool for identifying polymers, and it's well-suited for detecting large numbers of microplastic particles in a simple, straightforward manner. The Thermo Scientific™ Nicolet™ RaptIR™ FTIR Microscope provides automation to quickly extract the information about microparticles. Let's walk through the short workflow for analyzing microplastics.

Methodology

Microplastics on appropriate filters such as silicon, gold-coated polycarbonate, or aluminum oxide (Al_2O_3) on stainless steel can be easily evaluated using the Particle Analysis feature in Thermo Scientific™ OMNIC™ Paradigm Desktop Software.

Image analysis of the filter surface first locates the particles based on their visual contrast. Next, the software uses the stored locations to move the sampling stage and collect a spectrum of each particle which is then analyzed against appropriate spectral libraries. This workflow is particularly efficient because the Nicolet RaptIR FTIR Microscope can collect hundreds or thousands of particle spectra without user supervision. Also, the collection time is minimized because only the spectra of particles, not the filter, are collected.

Finally, a report is created presenting results for each particle, including identification and size.



Nicolet RaptIR FTIR Microscope with the Thermo Scientific™ Nicolet™ iS50 FTIR Spectrometer

Particle analysis in a few clicks

The Nicolet RaptIR FTIR Microscope is driven by its OMNIC Paradigm Software. The Particle Analysis tool allows microplastics analysis to be done with three simple steps.

1. Choose the target analysis region and define the size range for particles. See Figure 1.
2. Collect spectra from the selected set of particles with one click (typically, 16 scans at 8 cm⁻¹).
3. Request particle analysis report. Each particle's match to library spectra of known polymer materials and size characteristics are calculated and presented in the report.

Complete results in report format

An example particle analysis report is shown in Figure 3. The sample analysis picture is complete with a listing of each particle's image, size, and identification. The report can also be customized to show specific particle measurements and histograms of size distributions for each particle material.

Answer to the question

Fast, automated particle analysis with FTIR microscopy is not only achievable, but simple to perform. Hundreds of microplastics can be analyzed in minutes with the Nicolet RaptIR FTIR Microscope, depending on the resolution, scan number, and the number of particles being analyzed. The IR microscope has tremendous tools and flexibility designed for fast, accurate analysis of microplastics.

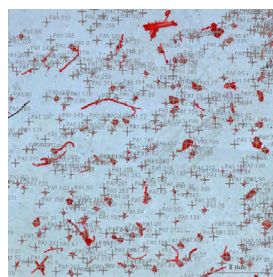


Figure 1: Silicon filter with atmospheric deposition of microplastics. Particles were selected in the size range of 25 μm – 1.5 mm.

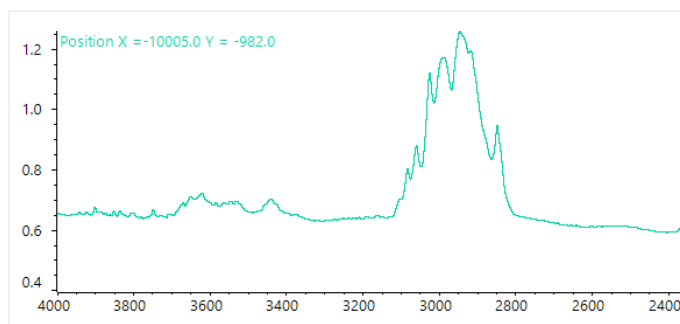


Figure 2: A single scan of a representative particle.

Rank	Component Name	Area %	Count	Library	Color
1	soil-silicate	6.79	11	test micropl	
2	MINIUM	0.29	5	HR Minerals	
3	Poly (tetrafluoroethylene)	2.77	4	Hummel Polymer and Additives	
4	PE with Additives	1.88	4	test micropl	
5	Poly(N-methyl acrylamide)	1.02	4	Hummel Polymer and Additives	
6	Polyethylene, LD	0.64	4	Hummel Polymer and Additives	
7	Polymerized, oxidized organic	3.72	3	Hummel Polymer and Additives	

#	Component Name	Match %	Area (μm ²)	Library	Particle thumbnail
PA1.99	Poly(N-methyl acrylamide)	76.97	10238	Hummel Polymer and Additives	
PA1.100	Ethylene glycol stearate	73.70	10188	Hummel Polymer and Additives	

Figure 3: Typical particle analysis report.

Learn more about the FTIR microscope that allows users to analyze large samples efficiently at thermofisher.com/raptir