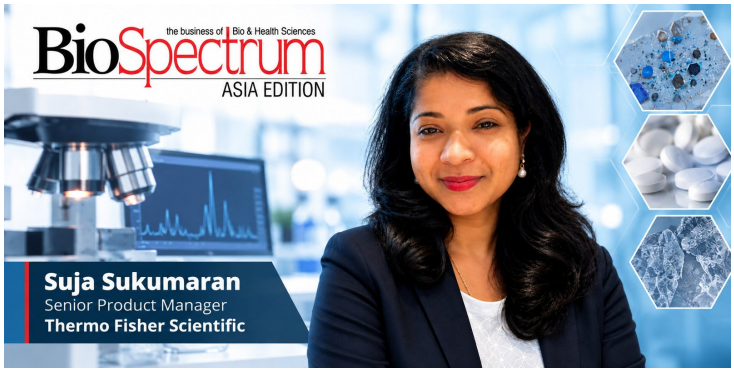
BioSpectrum ASIA EDITION

The Future of FTIR Microscopy Lies in Smarter, Faster and More Precise Chemical Analysis

October 15, 2026 | Opinion | By Ankit Kankar | ankit.kankar@mmactiv.com

Thermo Fisher Scientificâ??s Suja Sukumaran Explores How High-Resolution Imaging, Automation and Intelligent Spectroscopy Are Reshaping Microplastics Research, Pharmaceutical Development and Laboratory Quality Control Across Asia-Pacific



As laboratories across Asia-Pacific face growing demands for faster, more precise and reproducible analytical testing, Fourier-transform infrared (FTIR) microscopy is evolving beyond conventional molecular identification towards automated, high-resolution chemical imaging. From microplastics research and pharmaceutical formulation to contamination detection and quality control, advances in spectroscopy are helping scientists extract deeper insights from increasingly complex samples.

In an exclusive interaction with BioSpectrum Asia, Dr Suja Sukumaran, Senior Product Manager, Thermo Fisher Scientific, discusses how the Nicolet RaptIR X FTIR Microscope addresses longstanding analytical challenges through enhanced spatial resolution, rapid spectral acquisition and streamlined software workflows. She also shares her perspective on the growing adoption of FTIR microscopy across Asia-Pacific and how automation, artificial intelligence and multimodal analysis could shape the next generation of laboratory capabilities.

What specific limitations in conventional FTIR microscopy was Thermo Fisher looking to address with the development of the RaptIR X, and where do you see the biggest improvement for laboratories in day-to-day use?

We had three goals. The first was performance, meaning visual clarity and infrared (IR) spatial resolution. The Thermo Scientific™ Nicolet™ RaptIR™ X FTIR Microscope offers 1-micron visible resolution and 5-micron IR resolution, so an analyst can see a feature clearly and then identify its composition.

The second was flexibility. Labs run very different applications, and the configuration should fit the one in front of them. The stage takes samples up to 40 mm thick and 5 kg, and optional capabilities including micro-ATR, polarized analysis, fluorescence visualization and near-infrared microscopy let a lab build the system around its work.

The third was upgradability. An instrument has to meet a lab's needs today and still be ready for what the lab needs tomorrow, because the science keeps changing. The RaptIR X microscope can run standalone or integrate with Thermo

Scientific™ Nicolet™ Apex FTIR Spectrometer or Nicolet iS50 FTIR spectrometer, and a lab can add capabilities as its requirements grow.

The RaptIR X can collect up to 10 spectra per second. What does that speed make possible for laboratories, particularly those collecting large maps or running routine QC checks?

Speed matters in two situations. For labs collecting large maps, a quick survey measurement is critical, because it lets the user pinpoint the region that will provide the most information. For well-characterized samples where a routine QC check needs to be performed, a high-speed mode gets the work done efficiently. Up to 10 spectra per second gives analysts that option across a range of applications, and it supports rapid chemical mapping of large sample areas.

The system also offers 5-micron spatial resolution. Which analyses depend most on that level of detail, and what does it let users see?

5-micron resolution is critical for analysts mapping out laminate cross sections, where it shows the individual layers. It matters for users who want to understand how components are distributed across a surface, and for users characterizing particles. The RaptIR X microscope pairs it with 1-micron visible resolution, so users can see a microscopic feature clearly and then identify its molecular composition.

Microplastics analysis is emerging as an increasingly important application for spectroscopy. How is demand for FTIR microscopy evolving in environmental and microplastics research, particularly across Asia-Pacific?

Demand is growing as laboratories move toward microplastics characterization that is more automated, more reproducible and higher in throughput. In Asia-Pacific in particular, many countries are working toward standard testing procedures and inter-laboratory calibration studies. There is a need for simple, high-performance instruments to support the growing field of microplastics.

The RaptIR X microscope fits that direction through particle analysis, chemical mapping and high spatial resolution. The particle analysis workflow in OMNIC Paradigm 2.9 Software lets researchers analyze thousands of particles quickly and in a logical order. The report that comes out includes particle identification, size and distribution.

Pharmaceutical research and formulation analysis are highlighted as key applications. Where do you see FTIR microscopy creating the greatest value across pharmaceutical R&D, manufacturing, quality control and failure investigation?

The main advantage is that FTIR microscopy pairs molecular identification with spatial information. In formulation work, FTIR imaging can show how the API and excipients are distributed, identify agglomeration, and help investigate crystallinity. In quality control and failure investigations, microscopy is useful for identifying foreign particles and localized contamination. Above all, many of these labs need software that is ready for 21 CFR Part 11 compliance.

The system combines guided workflows and automation through OMNIC Paradigm Software. How important is software simplification in expanding advanced analytical techniques beyond specialist spectroscopists to a broader laboratory workforce?

It is essential, because FTIR microscopy takes spectroscopy, microscopy and sampling expertise all at once. Guided acquisition, point-and-shoot analysis, automated mapping and particle workflows in OMNIC Paradigm Software cut the number of steps that depend on the operator. On the instrument side, automated detector switching and a fixed detector position reduce manual intervention and support consistent measurements across measurement ranges.

That helps routine users run sophisticated measurements more consistently and leaves the experts more time for interpretation.

Looking ahead, how do you expect FTIR microscopy to evolve over the next three to five years, particularly with advances in automation, AI-driven analysis, spectral libraries, and multimodal analytical workflows?

I expect more automation, smarter spectral interpretation and more multimodal workflows. AI should help identify patterns and anomalies in spectral data, and multimodal approaches will connect microscopy with broader chemical information about a sample.

That is one reason upgradability was a design goal for the RaptIR X microscope. The science is moving, and an instrument should be able to grow with a lab's requirements.