Optical Photothermal Infrared Spectroscopy – a new reference method for microplastic identification

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Abstract

Material identification is key to assessing the concentration and abundance of microplastic particles in a sample. So far, which method is best suited to probe microplastic particles is still under debate. In 2016 Käppler et al. (*Anal Bioanal Chem* **408,** 8377–8391) raised the question of whether MP analysis is performed best with FTIR or Raman spectroscopy. IR and Raman-based approaches are attractive candidates due to their label-free fingerprint capability. However, limitations include sensitivity, specificity, identification rate, reproducibility, throughput and particle size. Their conclusion that a combined approach would lead to the highest accuracy seemed unfeasible due to the time and cost of dual-analysis, making routine analysis less probable. In response, we present an inter-system comparison of data from nine reference polymers that quantifies the spectral reproducibility between standalone FTIR and Raman instruments with the quantum cascade laser-based optical photothermal infrared (O-PTIR) spectroscopy, which simultaneously enables acquiring IR and Raman spectra from the same location. As a measure for spectral matching, we introduce the two-dimensional hit quality index (2D-HQI) using both Raman and IR spectra for material identification.

Keywords: Optical Photothermal Infrared (OPTIR) Spectroscopy, Fourier Transform Infrared (FTIR) Spectroscopy, Raman Spectroscopy, Microplastics, Twodimensional Identification, 2DHQI, Polymer Identification, Spectral Matching

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