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# Toward a wholistic, objective, timely, and quantitative approach to microplastic analysis.

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Microplastics (MPs) represent an ever-evolving field of study with an immense body of literature to address this growing global concern. Reviewing the current research dedicated to MP isolation, detection, identification, or quantitation consistently reveals limitations, including:

1. Rigorous method optimization is often dedicated to only one portion of the overall process (e.g., particle isolation and/or detection approaches that are ineffective when applied to environmental samples);
2. Automated methods developed on idealized samples that fail when applied to real-world samples (e.g., Raman-based analyses can fail due to fluorescence of weathered particles);
3. Particle detection and quantitation approaches that are inherently subjective, preventing inter- and intra-lab comparisons (e.g., recognition and classification schemes that are dependent upon analyst experience/knowledge);
4. Methods that quantify solely on physical characteristics or chemically identify only a fraction of the quantified MPs; and
5. Laborious methods that do not allow for the throughput necessary to process research-based sample sets on a realistic timeline.

These limitations, among others, motivated the pursuit of an approach to microplastic isolation and analysis that is (a) wholistic, (b) objective, (c) reproducible, (d) quantitative, and (e) time-conscious. The approach presented here attempts to adapt and borrow from the strengths of existing literature, while minimizing their limitations, and was honed using real-life water and sediment samples.

The approach we have arrived at consists of three parts, namely particle isolation and cleanup, automated analysis, and data interpretation. Water and sediment samples are quantitatively processed using 75 µm sieves and iterative density separations (sediment samples only) followed by oxidative clean-up before concentrating MPs onto a gold-coated filter. An automated analytical routine which utilizes a combination of image analysis and particle-based infrared microspectroscopy characterizes MPs on a particle-by-particle basis to identify their polymer type, size, estimated mass, and shape. Ultimately, this data set permits a quantitative comparison of microplastics on a particle-by-particle and sample-to-sample basis.

This approach has been applied to a set of over 40 environmental samples and counting and shows progress toward the above goals. Our presentation will discuss the method, validation efforts, results, benefits, and limitations of this process.