Developing a Method of Microplastic Extraction from Acid Digested Environmental Samples

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Rampant use and manufacturing of plastic-based products in the last century has left pervasive microplastic (<5 mm) and nanoplastic (<1 µm) contaminants in its wake. Microplastics behave as adsorbent transporters of other environmental pollutants, such as heavy metals. In order to generate accurate and comparable quantitative data, a more standardized method of digestion and separation of plastics from environmental samples must be established. The purpose of this study was to establish a microwave-assisted method of tissue digestion that sufficiently oxidizes organic material while preserving microplastic contaminants for subsequent analysis for heavy metals with inductively-coupled plasma mass spectrometry. Freeze-dried mussel tissue samples (NIST SRM 2976) were spiked with powdered polyamide (PA), polyvinyl chloride (PVC), high-density polyethylene (HDPE), and nurdles. They were then reacted with concentrated nitric acid and heated in a Mars 5 microwave system. Samples were then filtered under vacuum and microplastic recovery was measured by the change in filter mass. An aliquot was analyzed with ICP-MS to measure concentrations of Pb, Cd, Cr, and As. Mussel tissue being digested in the presence of microplastics did not significantly alter the recovery of heavy metals (>90%). Digestion conditions appeared to partially melt the PA and HDPE microplastic powders during digestion. More acid resistant plastics, like PVC, withstood digestion and displayed no obvious visual changes upon recovery. These findings act as a step towards developing a microwave-assisted digestion method that strikes a balance between plastic preservation and metal leaching for ICP-MS analysis. Supported by NIH R25ES020721.