Formation of commercial and real world nanoplastics in aqueous media

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Abstract

Nanoplastics and small microplastics form and persist in the environment, but details on their transport, interacts and fate are unknown. These particle pollutants pose concerns to humans and other living organisms, yet accurate measures of exposures are difficult to assess. With limited availability of standards, especially those created from real world nanoplastics, studies of micro and nanoplastics are hindered. The recognized mechanism of formation of nanoplastics is mechanical fragmentation of larger pieces of plastic. This can occur through natural weathering (abrasion, sunlight photolysis, wind, etc.) or by way of industrial or laboratory processes. Here, we have developed a procedure for the preparation of small micro and nanoplastics in aqueous media via solubilization that is applicable for a wide variety of plastics. Suspended nanoplastics have been formed from commercial and numerous real world plastic materials and the suspensions have been analyzed and quantified. Raman spectroscopy has been used to verify the small, suspended microplastics and the particle sizes of the suspended particles have been measured using dynamic light scattering. We have recently demonstrated that the particles formed through solubilization exhibit a wide range of sizes from a few micrometers to less than one hundred nanometers, and that they can be reduced in size using ultrasound. Suspensions of small micro and nanoplastics can be made as pure polymer types or as combined different polymers and can be used in complex solutions. The ease of formation suggests that this solubilization of plastics in aqueous media is a common property of these materials.

Keywords: Nanoplastics, solubilization, commercial plastics, aqueous media

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