Characterization and Optical Properties of Nanoplastics Synthesized From Common Household Products

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Plastics are not biodegradable and are used at an alarming rate. They carry an enormous amount of environmental pollution. Nanoplastics that result from these plastics endanger marine life and indirectly cause problems to human health through water pollution. Characterizing nanoplastics is vital to finding ways of monitoring the water pollution that plastics cause. Such studies are scarce and this investigation is aimed at addressing the question of characterizing nanoplastics so that one can design novel sensing methods and removal strategies for nanoplastics. In this study, research was carried out on two different kinds of plastics: low density polyethylene (clear plastic bags) and polyterephthalate (PTE, water bottles). It was quite difficult to simulate the environmental conditions that cause plastic degradation in the laboratory. Several strategies were used by previous researchers that include: grinding, dissolution, etc. In this experiment, it has been attempted to simulate harsh environmental conditions that can occur in deep sea and marshy wetlands in the form of hydrothermal conditions in acidic and basic media. Also, hydrothermal under oxidation and reduction conditions are also studied. LDPE is quite insoluble in water. However, when it is digested under acidic conditions, it was found to become quite soluble. Infrared (IR) measurements have shown that it possesses mostly unsaturated carboxylic acid groups. Size was determined using dynamic light scattering measurements and it has shown a size of 90 nm. Additionally, intensity wavelength dependent photoluminescence was observed, suggesting that the plastic is forming carbon based nanomaterials. This is the first study that has shown the presence of luminescent nanoplastics from clear plastic bags.

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