A Novel Method to Synthesize PET Nanoparticles and Measure Their Uptake in Edible Plants

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Humans produce 350 million tonnes of plastic waste every year from cosmetic, daily and industrial use. When this plastic waste is exposed to sun, water, and wind it causes it to degrade, eventually forming nanoplastics. The uptake of these nanoplastics by plants can contaminate the food chain and can be a risk to human health. However, a lot about the uptake of nanoplastics within plants is not understood. In this work we demonstrate a bottom-up approach to generate nanoplastics. Starting with polyethylene terephthalate (PET) from a water bottle, we used trifluoroacetic acid (TFA) to dissolve the plastic and create an organic solution of our dissolved polymer. Then we injected it into a solution of polyvinyl alcohol (PVA), which is a surfactant, and water while sonicating and stirring, to help stabilize our nanoplastics during formation. By tuning variables like concentration of PET and surfactant we managed to create nanoplastics from 150 nm to 500 nm. We used Dynamic Light Scattering (DLS) to measure the size and perform further analysis on our nanoplastics. In order to detect our nanoparticles, we incorporated our PET in TFA with a dye called nile red. To measure the quantity of nanoplastics we used a plate reader to read fluorescence, however, since plants are quite fluorescent themselves, we had to incorporate a bleaching step to remove the background signal without disrupting our nanoparticles. This research will enable further studies to be conducted on PET nanoplastics as well as evaluate their impact on human health.