

## Biodegradation of Thermoplastic Polyester Polyurethanes Produces Microplastic-free, Plant-Enhancing Compost Under Home Composting Conditions

As concern increases regarding the health and environmental consequences of traditional plastics and microplastics, so has interest in alternatives with the potential for safer end-of-life scenarios. Biodegradable plastics offer an attractive opportunity to reduce the buildup of persistent plastic waste and microplastics. Concerns have been raised that the biodegradation of these polymers may release toxins into the environment, such as microplastics, hazardous chemical byproducts, or additives. Biodegradable polyester polyurethanes pose a unique challenge in that industrialized polymerization requires isocyanates, chemicals which are themselves classified as hazardous and have been speculated to produce potentially toxic amines through biodegradation. However, direct evidence of the ecotoxicity of these polymers throughout biodegradation is sparse and highly debated in the scientific literature. To address this knowledge gap, a biodegradable polyester polyurethane thermoplastic (BTPU), either in the form of a coating on cotton fabric or as microplastics, was biodegraded under home composting conditions and monitored via disintegration, microplastic visualization, and respirometry experiments. The resulting composts were tested for phytotoxic effects on the germination and growth of *Zea mays* seeds. The composted BTPUs elicited no phytotoxic effects when compared to untreated compost. Contrary to expectations, *Z. mays* grown in compost derived from the BTPU microplastics showed statistically significant improvements in stalk height and sprout mass compared to the control group. These findings suggest that the ultimate biodegradation of isocyanate moieties in polyester polyurethanes is not only possible but can also contribute to improved early plant growth.