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Rethinking Compostability: Why we need environmentally biodegradable plastics

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We examine the concept of compostability in the context of the waste hierarchy and its potential contribution to environmental sustainability. The role of industrial composting as an end-of-life option is discussed with respect to resource efficiency and the promotion of circular plastic use. While compostable plastics offer advantages for controlled organic waste collection and treatment systems, their effectiveness in reducing environmental plastic pollution is limited, particularly in scenarios where plastics escape into the open environment.

We categorize four principal pathways through which plastics enter natural ecosystems, leading to the accumulation of persistent macro-, micro-, and nanoplastics. In most of these cases, compostability cannot contribute to the underlying challenges. To enhance the environmental relevance, we propose a broader framework that considers the intrinsic degradation properties of biodegradable plastic polymers as a complement to mechanical recycling and other circular strategies along the waste hierarchy.

The integration of scientifically defined criteria for environmental biodegradability into policy and certification schemes is essential. This includes aligning definitions across composting, soil, freshwater, and marine environments, and addressing the need for acceptable biodegradation timelines under realistic conditions. A "Safe and Sustainable by Design" approach can provide guidance for transition via innovation, regulatory clarity, and can ensure the responsible development of biodegradable plastic materials within systemic market and environmental constraints.