

What really happens to bioplastics when we throw them away?

Experimental bioplastic degradation tests in the open environment and waste management systems.

Even though bioplastics are often regarded as more sustainable than conventional, fossil-based plastics, there may be hidden effects related to bioplastics, especially after their use. As a Ph.D. student at DTU Sustain, I am researching the fate of commercial bioplastic products in the waste management system and the open environment. During my research, I have conducted several experimental tests to measure the degradation of biodegradable plastics in different environmental settings, including industrial composting. Currently, I am investigating the potential adverse effects of the breakdown of biodegradable plastics, including whether microplastics are produced due to the degradation process.

At present, there are no standardized methods for extracting, detecting, and quantifying microplastics, and there is especially a significant knowledge gap regarding biodegradable microplastics (bio-microplastics) because these can easily be degraded during the extraction process. To address this knowledge gap, I did a joint external research stay at the Ca' Foscari University and the National Research Council, Institute of Polar Sciences (CNR-ISP) in Venice, Italy, which COWIfonden financially supported.

The primary objective of my research stay was to learn a microplastic extraction method developed by these institutions and to apply this method to samples from my prior degradation tests in compost. This method is very gentle compared to other presently available methods because it mainly uses oil, rather than harsh chemicals, to separate plastic particles from the test environment. However, the method had never been tested on bio-microplastics or compost matrices; thus, adjustments to the method were anticipated. During my stay, I efficiently adapted the method to extract aged bio-microplastics from compost matrices, as the original method proved too aggressive. Using the modified method, I successfully extracted bio-microplastics from my previous degradation tests with commercial biodegradable plastics in compost. Thus, with the newly developed method, it is possible to assess whether bio-microplastics are formed during the degradation of biodegradable plastic products.

With the knowledge I gained during my external research stay, we can now carry out bio-microplastic analyses at DTU Sustain, thus helping close the knowledge gaps regarding biodegradable plastics and their possible adverse environmental effects. I am currently writing a scientific article detailing the development of this newly developed method, and the work will also be communicated at international conferences later this year.