Geophysical Research Abstracts
Vol. 21, EGU2019-19090, 2019
EGU General Assembly 2019

Detection of microplastics in compost samples using a thermal decomposition method

Yosri-Kamal Hassanein (1), Paul Eisentraut (1), Caroline Goedecke (1), Axel Müller (1), Maria Kittner (1), Claus Gerhard Bannick (2), Anne Katrin Barthel (2), and Ulrike Braun (1)

(1) Bundesanstalt für Materialforschung und –prüfung (BAM), Unter den Eichen 87, 12205 Berlin, Germany, (2) Umweltbundesamt (UBA) , Corrensplatz 1, 14195 Berlin, Germany

The ubiquitous presence of unwanted plastics in the environment, especially microscale particles, has been an issue in scientific studies and public debate in the last years. It is well known that oxidative degradation and subsequent fragmentation, caused by UV-radiation, oxidative aging and abrasion lead to the decomposition of larger plastic products into microplastics (MP). Possible effects of these MP on ecosystems are still unclear. Recent studies on MP findings are focused mainly on aquatic systems, while little is known about MP in terrestrial ecosystems.
A possible source of MP input into the soil is compost from domestic bio-waste. Inappropriate waste separation causes plastic fragments in the bio-waste, some of which end up in the compost. In Germany compost is used as fertilizer in agriculture, hence MP could enter the soil by this pathway. So far, there have been only a few studies on this object. For this reason, analysis of compost as a sink and source of MP in ecosystems is of high interest.
To estimate and monitor the MP content in compost and soil, fast and harmonised analytical methods are essential, which not only measure the polymer type and number of particles, but also the mass content. The most common spectroscopic methods are very time-consuming, often require complex sample preparation steps and cannot determine mass contents. Therefore, we used ThermoExtractionDesorption-GasChromatography-MassSpectrometry (TED-GC-MS) as a fast, integral analytical technique. The sample is pyrolyzed to 600°C in a nitrogen atmosphere and an excerpt of the pyrolysis gases is collected on a solid phase adsorber. Afterwards, the decomposition gases are desorbed and measured in a GC-MS system. Characteristic pyrolysis products can be used to identify the polymer type and determine the mass contents. This method is well established for the analysis of MP in water filtrate samples.
In the present work we optimized the TED-GC-MS method for compost and compost/soil matrix and very common polymers, such as polyethylene, polypropylene, polyethylene-terephthalate and polystyrene (sample mass, detection limits, interfering signals, etc.). Additionally, specific pyrolysis products of polymers used for bio-waste bags, such as polylactide (PLA) and polybutylenadipat-terephthalat (PBAT) had to be identified and evaluated.
First measurements were carried out on model and real samples from prepared mixtures and composting plant. The samples were sterilized, fractionated, filtered and dried. In addition, half of the sample material was treated with hydrogen peroxide to investigate a possible effect on detection.