EPA United States Environmental Protection Agency

epa.gov/research

Emerging Issues in Food Waste Management: Plastic and Persistent Chemical Contaminants

Innovative Science for a Sustainable Future

Overview

EPA encourages the recycling of food waste for several reasons. Recycling food waste can reduce methane emissions from landfills, and it can recover valuable nutrients and energy. However, there are concerns about the levels of plastic and persistent chemical contaminants, including per- and polyfluoroalkyl substances (PFAS), in food waste streams. Food waste streams consist of food and other items (such as compostable food packaging) that get collected – intentionally and unintentionally – for composting or anaerobic digestion.

This fact sheet provides an overview of two EPA reports synthesizing the published science about contamination in food waste streams, the effects of this contamination on composting and anaerobic digestion (two common ways to recycle food waste), and potential risks to human health and the environment of applying compost or digestate (the product from anaerobic digestion) made from food waste streams to land as soil amendments. The reports also discuss efforts by multiple stakeholders to prevent and mitigate plastic and PFAS contamination in food waste streams.

Persistent Herbicides

Food waste streams are likely not a major source of contamination by the persistent herbicides clopyralid, aminopyralid, picloram, and aminocyclopyrachlor. All documented cases of compost contamination by these herbicides in the literature identified leaves and grass, manure, or hay as the source of the contamination.

Plastic in Food Waste Streams

Plastics, including microplastics, have been repeatedly observed in composts made from food waste streams. Plastics may break down into smaller particles during processing, expanding the types of risk they may cause to human health and the environment. Recent studies have shown that food waste streams collected for composting had levels of plastic contamination of up to 2.8 percent by weight. A recent study of grocery store food waste found 300,000 pieces of microplastics per kilogram waste. Available data indicate food waste streams are a greater contributor to plastic contamination in compost than yard waste streams, due to contamination with food packaging. Food itself is also a source of microplastic particles, with levels of up to 3.84 microplastic particles per gram and 325 microplastic particles per liter observed in food in the United States.

PFAS in Food Waste Streams

PFAS have been reported in food, food packaging, food waste streams and compost made from food waste streams. Only one study was identified that measured PFAS concentrations in food waste streams, finding levels between 0.11 and 1 microgram per kilogram (µg/kg). The limited data available indicates food packaging (<1 to 485 µg/kg) may contribute more than food (generally <10 µg/kg) to PFAS concentrations in food waste streams. PFAS concentrations were demonstrated to be higher in composts with compostable food packaging. Composts made from a variety of materials, such as food waste, leaves and grass, and manure, show a range of contamination levels and suggest that biosolids have the highest concentration of PFAS, followed by food waste, then yard waste and other organic wastes.

Risks from Contamination

Much remains unknown about the fate of PFAS and plastics during composting and anaerobic digestion and when applied to land in compost and digestate, making it challenging to evaluate risks to human health and the environment. When present in biosolids, PFAS can be taken up by plants and crops and/or leach into groundwater, which can be consumed by people and animals or used for agriculture. Microplastics can alter soil health, run off into and harm other terrestrial and aquatic environments, and degrade into nanoplastics which may be taken up by plants. However, the available literature does not provide evidence of environmental or human health effects occurring as a result of contamination in compost and digestate made from food waste streams.

Prevention and Mitigation Measures

Efforts are underway to decrease plastic and PFAS levels in food waste streams and associated composts. Some states have set standards for plastic in compost. Cities are trying a variety of approaches (e.g., education, hauler contract provisions) to limit plastic contamination in compost, as are composters and anaerobic digestion facilities (e.g., manual picking, screens). It is unclear to what extent technologies (e.g., shredders, grinders, de-packagers) may inadvertently introduce microplastics into the end products by breaking down larger pieces of plastic. To address PFAS contamination, some locations require collection and treatment of contact water from composting sites that accept food waste or prohibit PFAS in food packaging. Some manufacturers are voluntarily phasing out particular PFAS from food packaging, and compostable food packaging certified by the Biodegradable Products Institute can no longer contain intentionally added fluorinated chemicals.

Priority Research Needs

Better understanding the risks posed by compost or digestate contaminated by microplastics or PFAS may allow for more composting and anaerobic digestion of food waste, with appropriate prevention and mitigation measures, and lead to reduced methane emissions from landfills. Currently the presence of visible plastic particles in soil amendments and concerns about microplastic and PFAS contamination reduces the value and marketability of compost and digestate made from food waste. Therefore, composting and anaerobic digestion facilities sometimes prohibit or reject food waste streams, thus reducing the amount of food waste diverted from landfills. Also, the presence of plastic particles may alter biogas potential during anaerobic digestion and emissions during composting. Priority research needs to inform policies and decisions include:

- Field data on concentrations and types/ sizes of PFAS and plastic particles in food waste streams and associated composts and digestates.
- Impacts of technologies (e.g., shredders, grinders, de-packagers) commonly used on food waste streams on the size and concentrations of plastic particles.
- Potential exposure and risks to human health and the environment from land application of contaminated compost and digestate.

More Information:

Emerging Issues in Food Waste Management:
Plastic Contamination (August 2021)
Persistent Chemicals (August 2021)
www.epa.gov/land-research/food-waste-research