

Evaluating Contaminants of Emerging Concern in Commercial Biosolid-based Fertilizers

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ABSTRACT

The production and popularity of commercially available biosolid-based fertilizers are increasing because of their economic, environmental, and plant nutrition benefits, particularly in urban and suburban areas. Because biosolid-based fertilizers are derived from waste water treatment plant residuals, we hypothesized that there is the potential for micropollutants to persist in these products. Their presence would be of particular concern due to their potential impact on human and ecological health and risk of bioaccumulation. This study involves quantifying contaminants of emerging concern in three biosolid-based fertilizers, and 2 non-biosolid-based fertilizers, a composted animal manure and an organic compost. Our extraction method employed ultrasonic assisted solid-liquid extraction followed by a 20 h equilibration during which samples were rotated end-over-end. Prior to analysis, all solvent extracts were concentrated under nitrogen and cleaned up with ENVI-carb to minimize matrix effects during sample analysis. High performance liquid chromatography tandem mass spectrometry (LC-MSMS) and quadrupole time of flight liquid chromatography mass spectrometry (QTOF-LCMS) were used to identify and quantify a suite of micropollutants including perfluoroalkyl substances (PFASs), hormones, parabens, pharmaceuticals, and personal care products. Variable levels of contaminants ranging from 8.22 to 11,300 ppb were found in the biosolid fertilizers, while the nonbiosolid fertilizers contained much smaller concentrations. Milorganite had 14 contaminants, OceanGRO had 13, Elite Lawn had 16, New Plant Life Composted Manure had 1, and Pro-Mix Ultimate Organic Mix had 3. Although many of these chemicals persist in commercially available biosolid-based fertilizers, future research is still needed to determine what, if any, potential risk these contaminants may pose to human or ecological health at the concentrations detected.

KEYWORDS

Biosolid, Contaminants of Emerging Concern, Fertilizer, Extraction