Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.27968

Analysis of Microplastics in Soil Using Pyr-GC/MS and Their Transport by Rainfall

JEONG YEON KIM[1] AND JIN HEE PARK[2]

[1]Chungbuk National University
[2]Chungbuk National Unviersity

The increasing global consumption of plastics has intensified microplastic pollution in the environment. While most studies focus on aquatic systems, research on soil microplastics remains limited. This study aims to quantitatively and qualitatively analyze various types of soil microplastics, including polypropylene (PP), high-density polyethylene (HDPE), polystyrene (PS), and polyethylene terephthalate (PET), using pyrolysis-gas chromatography/mass spectrometry (pyr-GC/MS). The four types of microplastics were sequentially separated based on density differences using 40% ethanol, deionized water, 5 M NaCl, and 7.5 M NaI solutions. After filtration , recoveries were assessed through weight measurement, followed by qualitative analysis using pyr-GC/MS. A single-density separation method using only 7.5 M NaI was also applied for simultaneous quantitative and qualitative analysis, and the two methods were compared. A rainfall simulation experiment was conducted using soil treated with 0.05% of each microplastic type. The runoff and leachate were collected and analyzed for microplastic content. The sequential density separation results showed that the recovery for each plastic type were 133.3% for PP, 70.6% for HDPE, 103.5% for PS, and 101.4% for PET. The pyr-GC/MS analysis revealed that pyrolysates such as 2,4-dimethyl-1-heptene from PP and 1-decene from HDPE were found in PP fraction, indicating that the sequential density separation did not achieve clear separation of PP and HDPE. Simultaneous quantitative and qualitative analysis using pyr-GC/MS showed high correlation coefficients (R^2 = 0.97 for PP, 0.99 for HDPE, PS, and PET) for calibration curve. Based on the calibration curve, 0.25% of microplastics were leached and 0.15% transported via runoff in the first rainfall event. In the second and third events, leaching decreased to 0.027% and 0.045%, while runoff was 0.075% and 0.046%, respectively. These results suggested that less than 0.5% of soil microplastics were mobilized by rainwater, with most microplastics remaining in the soil, potentially affecting ecosystems and plant health.