EGU2020-3612
https://doi.org/10.5194/egusphere-egu2020-3612
EGU General Assembly 2020

Detection and quantification of microplastic in soils using a 3D Laser Scanning Confocal Microscope

Tabea Zeyer[1] and Peter Fiener[2]
[1]Augsburg, Geography, Water and Soil Resource Research , Germany (tabea.zeyer@geo.uni-augsburg.de)
[2]Augsburg, Geography, Water and Soil Resource Research , Germany (peter.fiener@geo.uni-augsburg.de)

There is growing concern regarding the pollution of our environment with plastic materials, whereas especially the dimension of microplastic pollution and its ecological effect is widely discussed. Most studies focus on aquatic environments, while studies in terrestrial systems (mainly soils) are rare. This partly results from the challenges arising when microplastic particles need to be separated from organic and mineral particles. Key analytic techniques for microplastic detection in aquatic and terrestrial systems include Fourier transformation-infrared (FT-IR) and micro-Raman spectroscopy, as well as thermal extraction desorption-gas chromatography-mass spectrometry (TED-GC-MS) and pyrolysis-gas chromatography-mass spectrometry (pyr-GC-MS). While the mass spectrometric methods lack to determine particle sizes, the FT-IR and micro-Raman spectroscopy are very costly and time consuming. Moreover, the latter detection methods are very sensitive to organic matter particles, which are difficult to remove fully during soil sample preparation. Hence, a faster and more robust method to determine microplastic in soils is essential for a wider analysis of this environmental problem. In this study, we combine a density separation scheme with a 3D Laser Scanning Confocal Microscope (Keyence VK-X1000, Japan) analysis to determine the number and size of microplastic particles in soil samples. For the analysis a silty loam (16% sand, 59% silt, 25% clay, 1.3% organic carbon) and a loamy sand (72% sand, 18% silt, 10% clay, 0.9% organic carbon) were spiked with different concentrations of high density Polyethylene (HDPE), low density Polyethylene (LDPE) and Polystyrene (PS) microplastic (HDPE 50 - 100 and 250 - 300 µm, LDPE <50 and 200 - 800 µm, PS <100 µm). 3D Laser Scanning Confocal Microscopy show very promising results while using differences in optical characteristic and especially surface roughness, to distinguish between plastic and mineral as well as organic particles left after density separation. Overall, the 3D Laser Scanning Confocal Microscopy is a promising tool for relatively fast detection and quantification of microplastic in soils, which could perfectly complement the also relative fast mass-spectrometric methods to determine plastic types. However, to result in an operational and automated analyzation process further research based on the 3D Laser Scanning Confocal Microscopy analysis is needed.