Density Separation of Microplastics from Solid Sample Matrices

Berit Schütze[1\2]; Daniela Thomas[1], PD Dr. habil. Joachim Brunotte[1]
[1] Thuenen-Institute for Agricultural Technology, Bundesallee 47, 38116 Braunschweig
[2]TU Braunschweig, Hagenring 30, 38106 Braunschweig

Aim of the Study

A reliable method for the analysis of MPs in environmental samples, especially in Solid Sample Matrices (e.g. soil), was not established until today, leading to a lack of comparability of studies. The aim of this study was to examine and improve previously applied methods based on Density Separation to isolate conventional and biodegradable MPs (> 500 µm) from different Solid Sample Matrices with solutions of varying density.

Material & Methods

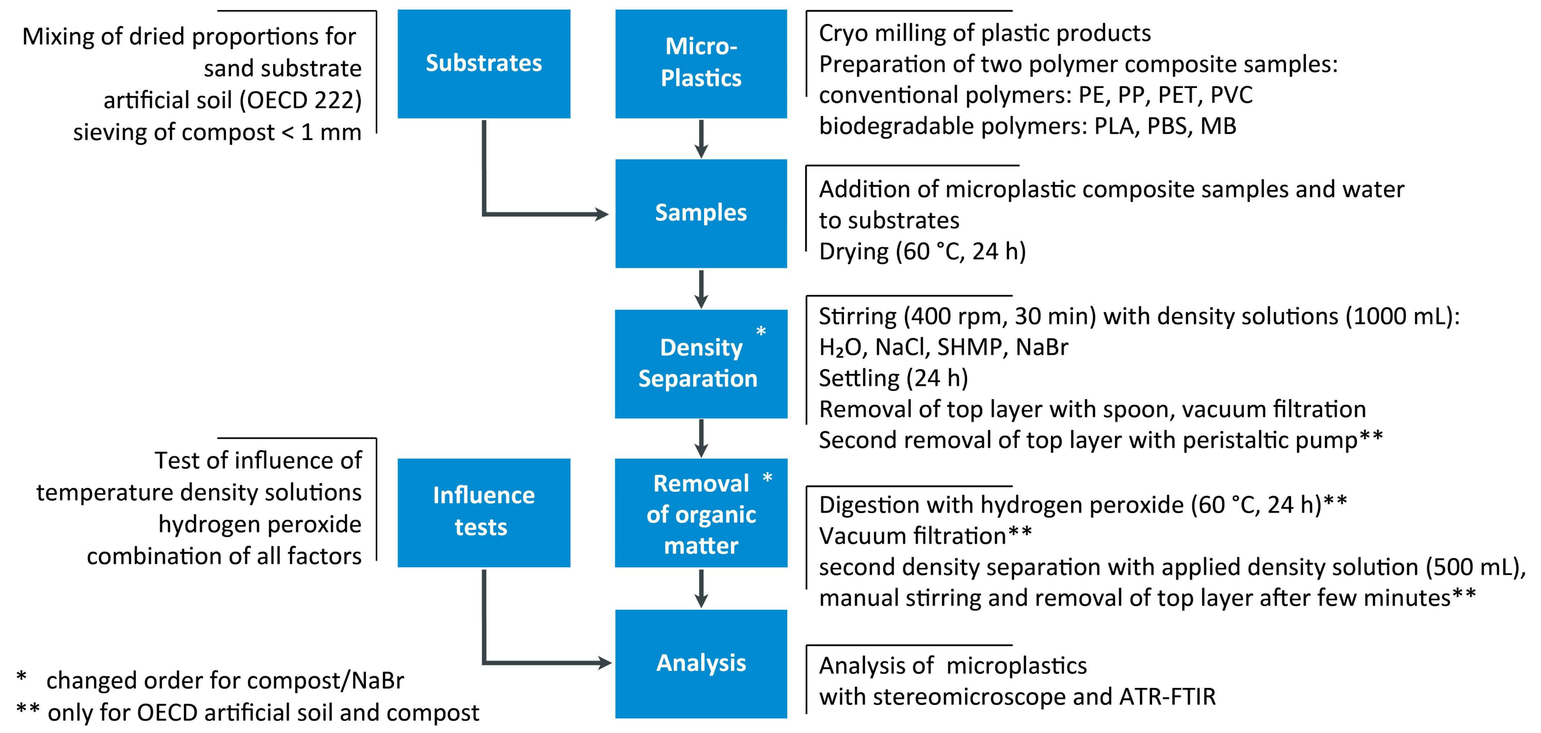

FIG 1: Method procedure for the recovery tests of MPs in Solid Sample Matrices by Density Separation.

Results

- Highest recovery rates were achieved with NaBr (ρ = 1.53 g/cm ^{3})
- Conventional polymers (colored): 94.7 % ± 10 %
- Biodegradable polymers (translucent): 57.6 % ± 32 %
- Influence of the method on some polymers (PE, MB) by treatment with H_2O_2 at 60 °C and by mechanical influence
- Density of density solution ↑ recovery rates
- Content of organic matter ↑ recovery rates

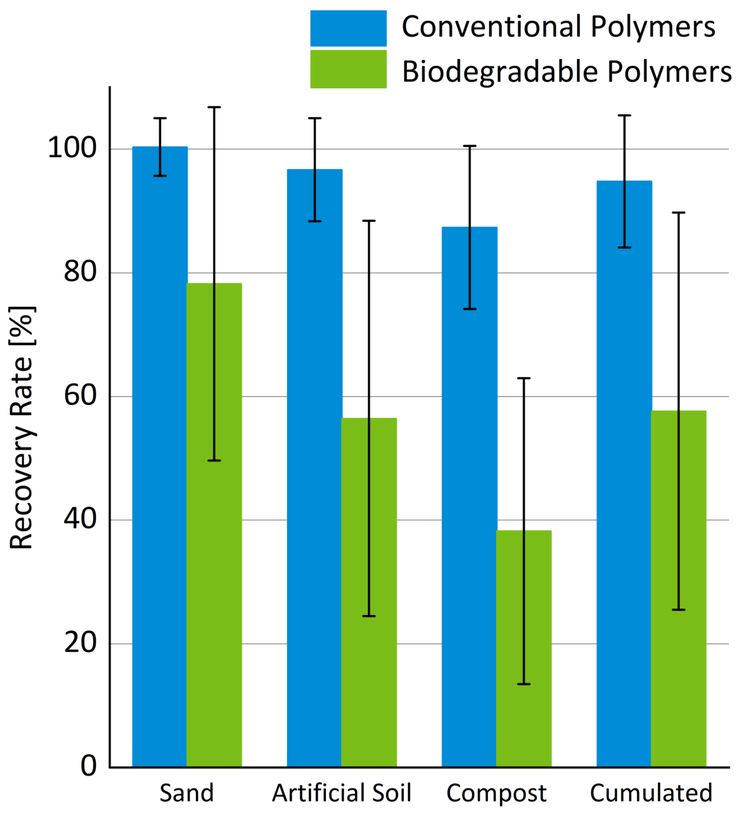

FIG 2: Results for the recovery tests of MPs in different Solid Sample Matrices by Density Separation with NaBr.

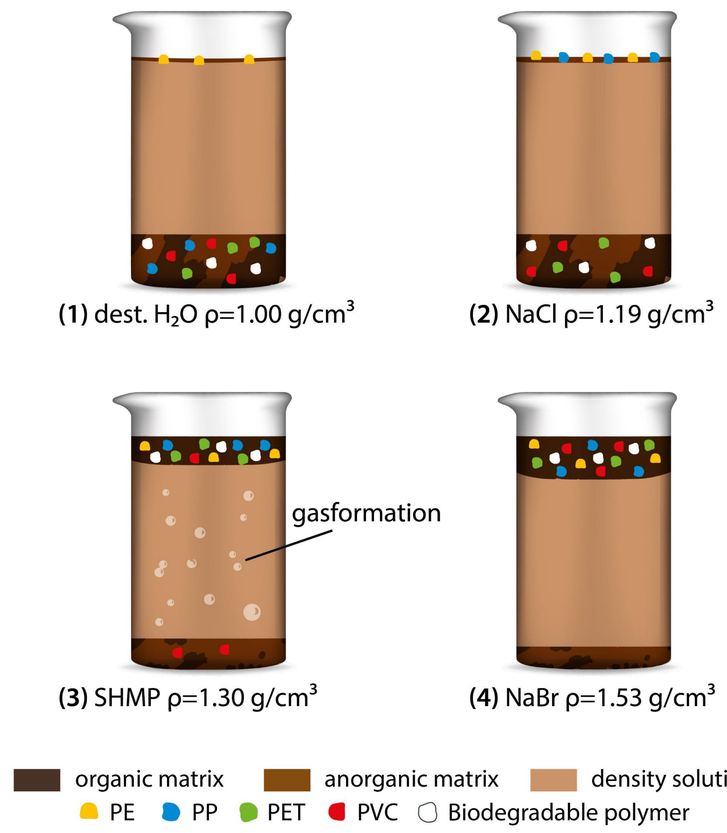

FIG 3: Results for the recovery tests of MPs in artificial soil (OECD 222) by Density Separation with different solutions of varying density.

Conclusion

Complex solid matrices with increasing organic content (Compost > OECD 222 > Sand) make separation of Microplastics (MPs) more challenging. Consequently, removal of organic matter is a crucial step for sample preparation. Furthermore, recovery rates were higher for conventional than for biodegradable polymers. Due to the results of influence tests, it is concluded that lower recovery rates of biodegradable polymers mainly depend on appearance of polymers with reduced visibility during analysis of samples and not on chemical properties of the polymer. An automated chemical analysis could improve the method by decreasing visual dependency. Besides, beakers were not detected to be suitable for density separation as stirring led to fragmentation of Microplastics and corrosion of beakers. For further experiments, application of density solutions with $\rho \geq 1.5$ g/cm^3 are recommended.

Daniela Thomas
Thuenen-Institute of Agricultural Technology
daniela.thomas@thuenen.de
Phone +49 (0)531 596-4138
www.thuenen.de