



Spring/Summer 2023

Master/Bachelor theses in Soil Ecology

Master students and highly motivated Bachelor students are welcome to apply for a thesis topic in the SFB Microplastic working group A06: Microplastics in the Rhizosphere of Agricultural Plants - effects on physical, chemical, and microbiological processes in the soil.

Topic #1: Degraded plastics interaction with cation exchange capacity (CEC) in soils:

The chemical properties of different types of plastic and differently weathered plastic surfaces change the natural soil chemistry. In particular, the surface charges of different types of plastics control the interaction with charged soil components such as clay minerals, organic material, and dissolved substances. This can lead to preferential accumulation of MP particles on charged soil particles, as well as reduce the sorption behavior of the soil and the availability of cationic plant nutrients (NH_4^+ , K^+), resulting in reduced plant growth and reduced fertilization efficiency. For this, we conduct a cation exchange capacity experiment comparing charge of plastic surfaces between degraded (400 and 2000 hours) and pristine plastics in two soil types (sandy and silty), possibly with clay addition, in relation to soil nutrient exchange and base saturation. Degraded plastics are hypothesized to have rougher and larger surface areas for cation adsorption. Literature on cation exchange and microplastics in soil, as well as implications of MP effect on soil fertility will be researched and discussed.

Topic #2: Microplastic extraction and clean-up methods from organic material in soil:

Soil samples have organic material that cause issues for microplastic detection in many analytical methods. To continue developing our microplastic detection in soil methods, we need to test multiple extraction/purification/separation methods in the lab and see which 'cleaning' methods benefit the most in reducing the soil matrix noise from the plastics we are trying to detect using our pyrolysis + TD-GC-MS/MS method. The tested clean up methods would include a density separation apparatus, speed extraction, digestion with Fenton's reagent, and/or combinations of clean-ups. Results will be primarily recovery calculations and should be performed via use and development of internal/external standards.

Contact:

Ryan Bartnick
Soil Ecology, BayCEER, University of Bayreuth
Dr. Hans-Frisch-Str. 1-3, 95448 Bayreuth
tel: +49 0176 65294387
email: ryan.bartnick@uni-bayreuth.de