The analysis of nanoplastic in soils

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Nanoplastics (NP) are in the size range <1µm and might either be emitted directly (e.g. from cosmetics) or from bigger plastics by decomposition, UV induced breakdown or physically forced breakdown. As NP show negative effects on a variety of soil organisms, their occurence might effect soil ecology and fertility. The research about NP is still at its very beginning due to technical limitations in the analysis of NP. The preperation of the samples is more sophisticated compared to microplastics and infrared or Raman spectroscopy, which are normally used in microplastic research, are limited to particle sizes >1µm.

We tested the extraction of NP from soil samples, density seperation, the oxidation of natural organic substances by Fentons reagent and ultrafiltration to extract and concentrate NP from soil samples. The analysis of the NP was done by scanning transmission X-ray microscopy (STXM). The STXM method can image NP with a resolution of about 30 nm and identify the plastics via the characteristic near edge X-ray absorption fine structure (NEXAFS) at the carbon K-edge[1].

The extraction method was suitable to extract colloids with mean diameter of around 1 µm from the soil. A first analysis showed that the pure extracts contained far too much natural soil particles to allow for the analysis of NP. Thus, further sample treatment was necessary. The extracts after density seperation showed better results and allowed for the identification of some NP. The use of the Fenton reagent caused obvious effects of the shape and size of the artificial polystyrene particles used for testing and also influenced the NEXAFS spectra, indicating that the Fentons reagent is not suitable for the analysis of NP.

The sample preperation for the anaysis of NP from soil samples is still challenging and requires further work. However, the STXM method allows for imaging and identification of NP and thus offers the possiblity for a characterisation of NP in the environment.

[1] Bigalke et al. (2018) *Chimica* **72**, 901-901.