YOURS 2022

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Different approaches to microplastic extraction from soils

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Microplastic particles (MPs) emergence and expansion have occurred rapidly and almost imperceptibly on a worldwide basis. Its presence and persistence in terrestrial environments recently started attracting considerable attention from scientific researchers, policymakers, the media, and the general public. Several methods were developed in order to isolate MPs from complex soil samples. Density separation demonstrated to be the most efficient and cost-effective to date It consists of the following steps: soil sieving, grinding and measuring, MPs extraction using the saturated salt solution of the appropriate density higher than the MPs that need to be isolated, supernatant filtration, and visualization of MPs adhered to filter. Several approaches could be applied to soil MPs separations, considering the utilization of different extracting solutions, working conditions, and phases order, which we investigated herein. As soil samples contained around 5% of organic matter (OM), the first protocol implied organic matter digestion using 30% H_2O_2 before the extraction, while the second one was performed vice versa. In both protocols, the extraction solvent that was used was saturated NaCl solution, density 1.2 g cm^{-1}. According to the obtained results, and bearing in mind the fact that MPs could be entrapped in soil aggregates, OM digestion before the extraction was considered suitable to continue the investigation. In the following protocol, digestion was conducted at different temperatures and durations of 7 days at 25˚C (room temperature) and 24h at 60˚C, respectively, which enabled more efficient OM removal. The temperature and time of exposure may need additional tuning according to the soil type. While using NaCl solution, only polymers with a density lower than 1.2 g cm^{-1} could be extracted, so in the next procedure, it was replaced by a saturated solution of $ZnCl_2$, which density could go up to 1.9 g cm^{-1}. Hence, the final protocol based on the previous optimization involved digestion with H_2O_2 at 60˚C for 24h, followed by covering the dry residue with saturated $ZnCl_2$ solution. The mixture was left overnight for density separation. The upper layer of the solvent where the MPs tend to concentrate was taken by a glass dropper and filtered through a Whatman glass filter (pore size 1.6 µm, diameter 25 mm). Achieved efficiency regarding OM reduction rate and MPs extraction on examined soils was satisfactory for further investigations.

Keywords: microplastic, soils, extraction, organic matter, density**.**

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