Contribution ID: **327** Type: **Poster Presentation**

Microplastics Effects on Evaporation Dynamics and Cracking Morphology in Drying Porous Media

Thursday, 2 June 2022 10:10 (1h 10m)

Global production of plastics has increased exponentially over the past few decades. Annual production of plastics increased nearly 200-fold in 2015 compared to the production of nearly 2 million tones per year in 1950 (1). Estimates suggest that of the estimated 6.3 billion tones of plastics produced up to 2015, almost 80 percent has not been disposed of properly (2). Soil represents a large reservoir for plastics disposal. The improperly disposed plastics could serve as a major and long-term source of contamination. Degrading into microplastics (MP), they can affect soil properties and structure. The accumulated MP could enter food chains posing serious risks to food security and environmental health.

Within this context, the present study aims at analyzing effects of MP on water evaporation from porous media and cracking morphology induced by drying. A series of evaporation experiments were conducted under laboratory conditions. Quartz sand (particle size: 0.4-0.8 mm) and bentonite clay were used for evaporation experiments. Powders of Polyethylene (PE) with particle size ranges of 34-50 μm and Polyvinylchloride (PVC) were used as MP. Dry sand particles were mixed with PE and PVC at the concentration of 0.75% and 1.5% (by mass). The mixture of sand and MP was saturated by water and packed into cylindrical glass containers (200mm in height and 80 mm in diameter). An additional sand column was prepared without MP serving as the reference. Sand columns were mounted on digital balances to record evaporation dynamics in a climate chamber at constant temperature of 30℃ and relative humidity of 30%. Each experiment lasted nearly 16 days and repeated four times. For the cracking analysis, the drying sample composed of 1:2 ratios of sand and bentonite clay (by mass). Sand-bentonite mixtures were mixed with PE and PVC at the concentration of 0.75%, 1.5%, 4.5%, 6%, 8% and 10% (by mass). Reference samples were also prepared without MP. Mixtures of sand-bentonite-MP were mixed with water at two different ratios of 1:4 and 1:5 (solid to water ratio by mass). Resulting pastes were poured into Petri dishes (15 mm in height and 145 mm in diameter) placed in the climate chamber at constant temperature of 30℃ and relative humidity of 40%. Each experiment was replicated three times (resulting in 78 drying samples). After nearly one week of drying, the crack morphology was recorded using a digital camera. To analyze cracks patterns and characteristics, a code was developed in MATLAB. Our preliminary results confirm evaporation dynamics and cracking morphology in desiccating clays are influenced not only by MP concentration but also by MP physical and chemical characteristics. Our results will show how the cumulative mass loss as well as the length, density and area of cracks formed as a result of drying are influenced by type and concentration of MP and will shed new lights on effects of MP on soil water evaporation.

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References

1. Crawford, C.B., Quinn, B. (2017). Microplastic Pollutants, Elsevier, https://doi.org/10.1016/C2015-0-04315-5.
2. FAO (2021). Assessment of agricultural plastics and their sustainability –A call for action. Rome. https://doi.org/10.4060/cb7856en

Time Block Preference

Time Block B (14:00-17:00 CET)

Participation

Online

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