



Analysis and risk evaluation of soil microplastics in the Rohingya refugee camp area, Bangladesh: A comprehensive study

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Abstract

The global concern over the pollution-induced by microplastics (MPs) has intensified due to its adverse effects on the environment, particularly in terrestrial ecosystems, where it poses potential threats to soil quality and resident species. However, there is a noticeable research gap regarding soil MPs in dumping sites, specifically within the Rohingya Refugee Camp (RRC), the world's largest humanitarian crisis located in Bangladesh. The main objective of this study is to assess soil MPs' abundance, spatial distribution, and inherent risks in the RRC. The investigation involved extracting MPs from ten soil sampling sites in Kutupalong RRC, home to Rohingya refugees who sought refuge in Bangladesh following the 2017 ethnic atrocities in Northern Rakhine State, Myanmar. Stereomicroscopy and Fourier transform infrared spectroscopy were employed for identification purposes. The concentration of MPs in the study area varied from 67 to 126 (items/kg) (dry weight), with a mean concentration of 103.80 ± 20.671 (items/kg). MPs with sizes <0.5 mm constituted the majority at 83%, with fragments (68%) being the prevailing shape, and transparent (63%) as the most abundant color. Predominant polymers included polyethylene (53%) and polypropylene (46%). Negative correlations were observed between MP abundance and pH and moisture content ($p < 0.05$), while a positive correlation was found between MP abundance and organic matter. PCA results suggested that human-induced inappropriate waste and air deposition are the primary sources of soil MP pollution. Contamination factor values suggested moderate pollution with MPs in the study area. According to the geo-accumulation index (I_{geo}), the area was classified as pollution grade II, signifying 'uncontaminated to moderately contaminated.' However, pollutant load index and potential ecological risk index indicated Hazard Level-I and Pollution Grade-I, respectively. This study illuminates the contamination scenario with MPs, underscoring concerns for eco-environmental safety and providing crucial data for future investigations into MPs in terrestrial dumping habitats.