

Weathering of Plastic Nurdles Discharged from the X-press Pearl Ship Disaster

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Abstract

This study assessed the weathering and size reduction of plastic nurdles discharged during the X-press Pearl ship accident in May 2021. Sand samples were collected from Sarakkuwa Beach, Sri Lanka, at three time points: 1 month, 4 months, and 16 months after the accident. Nurdles were extracted from the sand using NaCl density separation followed by wet peroxide digestion and analyzed with stereomicroscopic image, and Fourier transform infrared (FTIR) analysis. The volume reduction of weathered nurdles was determined via the densitometric titration method. Microscopic images of weathered nurdles exhibited higher surface roughness, cracks, and voids where FTIR spectra of them demonstrated several new bands, attributed to $-C=O$, $-S=O$ stretching vibrations, and $-CO-O-CO-$ bending vibrations, which did not appear in pristine nurdles. The presence of $-S=O$ in yellow-colored pellets may be due to the surface adsorption of elemental S, which was onboard the X-press Pearl ship. The mean volume reduction of nurdles collected in June and September 2021 was 44.59% and 53.67%, respectively, while the nurdles collected in September 2022 exhibited a 57.53% volume reduction, indicating size reduction due to weathering. The rapid weathering process was attributed to UV irradiation, atmospheric oxygen exposure, and wave action. This study highlights the rapid weathering of plastic nurdles at Sarakkuwa Beach and emphasizes the risk of generating nanoplastics from microplastic pellets through photoaging. Future studies are recommended to continue monitoring the size reduction of these nurdles and their presence in seagrass beds, seaweeds, and fish.

Keywords: *Marine microplastics, Nurdle spillages, Polyethylene, Photo-oxidation, Nanoplastics, X-press Pearl*