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PLASTIC DEGRADATION INTO SECONDARY MICROPLASTICS IN COASTAL AREAS AFFECTED BY THE MV X-PRESS PEARL MARITIME DISASTER

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The MV X-Press Pearl maritime disaster has severely affected the sensitive marine and coastal environment on the west coast of Sri Lanka. Large quantities of plastic pellets (nurdles or plastic pellets < 5 mm and estimated at 1680 tonnes) were released into the Indian Ocean. A substantial proportion of plastic pellets/primary microplastics (MPs) can degrade to secondary MPs. This study aimed to understand the degradation of plastic pellets into secondary MPs under the extreme conditions of fire and chemicals during the MV X-Press Pearl maritime disaster. Beach sand samples were collected from mean sea level and berm at 40 locations covering the affected west coast of Sri Lanka and an additional 20 samples covering the entire coastline of Sri Lanka. Microplastics were separated using the Wet Peroxide Oxidation (WPO) process. The secondary MP quantities and microscopic observations were noted. Fourier Transform Infrared Spectroscopic (FTIR) analysis was carried out to identify functional groups of MPs. The difference in average values of secondary MPs at mean sea level (large MPs = 33 ± 56 items per 1 mm^2 and total MPs = 61 ± 66 items per 1 mm^2) and the berm (large = 61 ± 154 items per 1 mm^2 and total MPs = 106 ± 165 items per 1 mm^2) suggested that large quantities of MPs had spread in other areas in the Indian Ocean with oceanic currents. The baseline average value of secondary total MPs was about 53 ± 66 items per 1 mm^2 in other coastal areas of Sri Lanka. The positive correlation between large and total secondary MPs and plastic pellets pollution index indicates that a significant amount of plastic pellets were degraded into secondary MPs under the influence of nitric acid and heat/fire within six to eight days after the accident. Based on FTIR observations, these secondary MPs were mainly composed of low-density polythene (LDPE) and linear low-density polythene (LLDPE). Consequently, these lightweight polymers can spread over a wider region and can cause severe environmental threats on a global scale as transoceanic marine pollutants.

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Keywords: Coastal pollution, Maritime disaster, Microplastics (MPs), Secondary MPs, Wet peroxide oxidation (WPO).