
NATURAL DEGRADATION OF POLYETHYLENE AND POLYPROPYLENE IN THE ENVIRONMENT

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Abstract

Human activity is becoming the dominant influence in shaping the face of the earth. In 2020 we reached the crossover point where the anthropogenic mass reached approximately 1.1 teratonnes which is equal to all living biomass on Earth. The mass of plastic generated so far is nearly double the mass of all marine and terrestrial animals combined. Plastics enter the environment through plastic litter which gradually degrades into microplastics (MP). But there is little information about the lifespan of these materials and their degradation rates in the environment. For this reason, the degradation of plastic litter remains a fundamental question for MP research. In the present study forty-four, naturally degraded lobster trap tags made of polyethylene (PE) were collected from the marine environment and several naturally aged polypropylene (PP) items were studied in respect of their degradation in the environment. The manufacturing dates printed on lobster tags were used as a temporary indication of being present in the environment as plastic litter. The oldest PE tag was manufactured in 1983 whereas some PP items were more than forty years old. The results revealed an extreme degradation of several PP items that has a very pronounced effect on fragmentation. The thickness of the items allowed us to assess the state of the material that was not exposed to environmental influences. The PE tags do not show a direct degradation correlation with their time of manufacturing. The oldest PE tag made in 1983 seems to be robust whereas a lobster tag manufactured in 2007 shows the highest degradation as confirmed by ATR-FTIR. One interesting pattern observed was the red-colored lobster tags were showing more degradation while blue-colored tags were showing the least degradation. There seems to be an effect of item coloring suggesting an important role of additives in the degradation.

Keywords: additives, degradation, environment, plastic litter, polyethylene, polypropylene

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