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### **Degradability of biodegradable polymers in freshwater, and sediment under laboratory conditions**

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Freshwater rivers, streams, and canals carry waste plastics from inland areas to the sea. These plastics may physically break into smaller fragments and float in the water column, deposit in the sediment, and/or reach the sea causing detrimental impacts on the environment, wildlife, and humans. Biodegradable products were introduced as a green alternative to curb the harmful effects of waste plastic accumulation. The present study evaluated the degradation potential of three commercially available products with “compostable”, “oxo-degradable”, and/or “biodegradable” labels on them under freshwater (FW), and freshwater sediment (FWS) in an experimental setup. A garbage bag (GB), lunch sheet (LS), and a salad plate (SP) were tested for degradability against a filter paper (FP) as the positive control. FW and FWS were placed in separate glass tanks, and kept near a window allowing the day-night rhythm of the sun. FW was aerated continuously, and FWS was kept wet with freshwater to simulate natural environmental conditions. Prepared samples were placed inside Nylon mesh pockets, and put in the medium in triplicates. Initial dry weights, physical characteristics, RAMAN spectra, and SEM images were obtained. Monthly sampling was carried out. Temperature, salinity, pH, and conductivity readings as well as remaining dry weights, and visual changes of degradation were recorded for 12 months. Degradability was assessed as a percentage of Mean Weight Loss (MWL). Cellulose, polybutylene adipate terephthalate, polylactic acid, and polyethylene were among the major polymers detected in the initial RAMAN spectra of samples. Comparatively, FWS facilitated degradation than FW where the control and SP showed the fastest degradation, 100% in 120 days. LS and GB showed partial degradation, and the percentage of MWL ranged between 2.15%-56.61%, and 0.18%-1.96%, respectively. The percentages of MWL recorded from samples in FW ranked between 2.56% - 61.59%, 4.42% - 36.44%, 1.32% - 6.77%, and 0.21%-7.11%, in the control, SP, LS, and GB respectively. Filter paper, SP, and LS in FWS fragmented and discolored while GB showed slight discoloration only. Filter paper and LS, discolored and torn in FW while SP and GB showed insignificant changes in shape, size, and/or color. Prolonged times taken by the samples to show signs of degradation, alarms the potential of products with “biodegradable”, “oxo-degradable”, and “compostable” labels, to accumulate in the natural environment as waste plastics.

**Keywords:** Biodegradability, Polyethylene, Percentage mean weight loss, RAMAN spectroscopy

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