(190)

Degradation Potential of Some Biodegradable Polymers: Do they Degrade?

Wijetunge D.S.[1, 2], Ranatunga R.R.M.K.P.[1]*, Manage P.M.[2]

[1]Center for Marine Science and Technology, Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[2]Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
**ranatunga@sci.sjp.ac.lk*

Abstract

Biodegradable products were invented and commercially introduced to curb the catastrophic impacts of non-degradable plastics. These intend to act as a green solution since they are manufactured to degrade in the environment without accumulating as waste plastics. Three commercially available products labeled as "biodegradable" i.e. salad plate (SPL), lunch sheet (LS), and garbage bag (GB), were tested for degradation potential in six different exposure media i.e. seawater (SW), beach-sand (BS), freshwater (FW), freshwater sediment (FWS), compost, and ultra-violate (UV) rays, with controlled and uncontrolled conditions simulating the natural environment. Cellulose filter paper (CFP) was the positive control. SW, FW, FWS, and BS were placed in four separate glass tanks while compost was prepared in a 100L plastic storage box. A UV chamber was fabricated to expose samples to UV radiation. SW tank was equipped with a wave pump, and FW tank was continuously aerated. All samples were cleaned, cut into manageable sizes, inserted in synthetic mesh pockets (except for those exposed to UV), labeled, and placed inside the media in triplicates. UV-exposed samples were directly placed in boiling tubes inside the chamber equipped with 15 W LED UV bulbs providing 280-320 nm irradiation. Initial weights were measured and the weight loss over five months was recorded. Physical parameters including temperature, pH, salinity, and conductivity were measured in each sampling. RAMAN spectroscopy and Scanning Electron Microscopy were performed initially to find out the test samples' chemical composition and surface structure. CFP and SPL contained cellulose, LS contained Poly Lactic Acid (PLA) and Poly Butylene Adipate Terephthalate (PBAT), and GB contained Poly Ethylene (PE) as major components. Degradation potential was calculated in terms of percentage weight loss with time, and visual remarks of degradation were recorded. The highest weight-loss percentages of CFP (100%), and SPL (100%) were observed in FWS (both in 122 days) and compost (in 92 days, and in 122 days respectively) media. LS showed faster degradation (20% weight loss in 92 days) in compost while GB showed slight fragmentation (2% weight loss in 57 days) under UV during the first five months of sampling. Comparatively minimum signs of degradation were observed in GB in all exposures. CFP, SPL, and LS samples were discoloured and fragmented into small pieces during the degrading process. All products showed lesser degradation potential in SW, FW, and UV exposures. The experiment will be continued further to understand the degradation process.

Keywords: Degradation, Biodegradable products, Abiotic degradation, Plastic pollution