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Comparative study of the percentage degradability of food wrapping polythene films manufactured from different virgin materials

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The polythene industry in Sri Lanka is being shifted towards the use of compostable raw materials to manufacture food wrapping - films (lunch sheets) after the prohibition of films which are less than 20 microns. Nevertheless, no studies have been carried out to assess the degradability of such films in natural conditions. The present study was therefore focused on assessing the percentage degradability in ambient air, soil and compost of three types of films F001, F002 and F003 available in supermarkets and films manufactured from Poly-L-Lactic Acid (PLLA) (28%) + dimethyl ester (38%) + starch (26%) + auxiliaries (8%) (F004), Poly Lactic Acid (PLA) (F005) and Poly Butylene Adipate Terephthalate (PBAT) (F006). The material properties; tensile strength (MD-machine direction & TD-transverse direction), % elongation, moisture and water absorption of all the films (n=10 for each test) were analyzed at the beginning of the experiment. Half of each film type (n=144) was immersed in food waste contaminated water while the other half (n=144) was used as controls without subjecting to any processes. One third of the food waste contaminated films (n=28) was kept in ambient air while another one third was buried at 10 cm depth in soil. The remaining one third was buried in compost. The same procedure was carried out for control films. The percentage degradability was assessed after two and four months' time interval and the percentage degradability was calculated with respect to weight losses of films with time. The highest MD and TD tensile strengths (25 Nm⁻² and 12 Nm⁻²) were shown by F001 and the highest MD and TD elongations (148 mm and 175 mm) were shown by F002 respectively. In addition, all films showed 85-88% water absorption. The food waste contaminated F005 kept in ambient air showed 0.56% degradability after 4 months and it was not significant from its control (p > 0.05; ANOVA). Nevertheless, the food waste contaminated F006 showed 94% (non-contaminated- 77%) degradability in soil followed by F005 (92%; non-contaminated-65%) and F002 (89%; non-contaminated-82%). The non-contaminated films showed cracks, distortions, de-coloration, irregular patches etc. and the severity of such morphological changes was increased in food contaminated films buried in soil. Nevertheless, the non-contaminated F005 showed 61% (37%-contaminated) degradability in compost followed by F002 (42%). The results further revealed that the films contaminated with foods (buried in soil) degraded more than the other types. The overall results conclude that food wrapping polythene available in supermarkets were more or less similar to the films manufactured from known virgin materials (PLA and PBAT) except F004 and showed a significant degradation potential within four months.

Keywords: Food wrapping, degradability, polyethylene, PLA, PBAT