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Effect of $CaCO_3$ on mechanical properties and degradability of polythene manufactured from low density polyethylene

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One of the major drawbacks of polythene manufactured from low density polyethylene is its poor degradability in the environment. The present study was therefore planned to assess how the addition of $CaCO_3$ effect on the mechanical properties and on the degradability in ambient air, soil and in compost. Two types of polythene films, one with 100% polyethylene (P001) and another with 86% polyethylene + 14% $CaCO_3$ (P002) were manufactured by a film extruder machine. The mechanical properties including thickness, tensile strength, elongation, moisture and water absorption of the two types of films were analyzed at the beginning of the experiment (n=10 for each test). Half of each film (n=144) was immersed in food waste contaminated water while the other half (n=144) was used as the control. One third of each of food waste contaminated film (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 intervals and the percentage degradability was calculated with respect to weight losses of films with time. A significant reduction of machine direction (MD) and transverse direction (TD) of both tensile strengths and elongations were shown by P002 ($p< 0.05$; student t-test). In addition, P001 showed 0.20% moisture content while P002 showed 0.01% moisture. Both films showed 0.03 mm initial thickness and P002 showed a significantly highest water absorption. The food waste contaminated P002 kept in ambient air showed 0.13% degradability while P001 showed 0.12% degradability after 4 months. Nevertheless, the food waste contaminated P002 showed 2.4% (non-contaminated- 2.1%) degradability while the food waste contaminated P001 showed 0.8% (non-contaminated- 0.6%) in soil. The food waste contaminated P002 showed 0.8% (non-contaminated- 0.7%) degradability while the food waste contaminated P001 showed 0.5% (non-contaminated- 0.3%) in compost. Nevertheless, transparency reduction and dark spots were also observed from food waste contaminated P002 buried in both soil and compost. The results further revealed that the films contaminated with foods (buried in both soil and compost) degraded more than those of the non-contaminated films but their percentage degradability were less than 2.5% by 04 months. The overall results conclude that $CaCO_3$ was able to significantly reduce the mechanical properties; but unable to increase the degradability in the environment. Therefore, the present study implies that the addition of $CaCO_3$ to polyethylene only makes the manufacture cost effective.

Keywords: Polyethylene, Calcium carbonate, Degradability, Mechanical properties