
Study the effect of ZnO and TiO₂ to develop photo-degradable LDPE based composite materials

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Low Density Polyethylene (LDPE) is widely used for packaging applications due to their exceptional properties. However, it does not readily decompose in an environmental friendly manner after the usage due to high chemical stability. LDPE based photo-degradable polymers are especially designed by controlling their degradability by adding photocatalysts. The degradation occurred when exposed to sunlight. Photo-degradable polymers are produced with the help of photocatalysts. TiO₂ and ZnO can be used as photocatalysts. Titanium dioxide is mainly available as Rutile (TiO₂) and Ilmenite (FeTiO₃) deposits in Sri Lanka. These minerals containing sand deposits are available in Pulmoddai in the North East of Sri Lanka. In this research, 0 -150 μm particles of TiO₂ (3.06 eV), ZnO (3.0 eV) and LDPE were used to develop photo-degradable composite material. 1-5 % wt. of ZnO and constant 4% wt. TiO₂ were blended with LDPE and test pieces were prepared. Photo-degradation behavior was tested by using variation of tensile strength and percentage elongation, water absorption, weight loss measurements and FTIR spectroscopy for initial samples and after exposure to UV for 50 hours, 100 hours, 150 hours, 200 hours and 250 hours. Melt Flow Index (MFI) was measured to analyze the processability of the product. According to experimental results, developed LDPE + 4% wt. TiO₂ + 5% wt. ZnO system showed the required tensile strength, percentage elongation, minimum water absorption and good processability. This composite material can be used as an alternative material to replace non-degradable LDPE product to create green environment.

Key words: LDPE, ZnO, TiO₂, Photo-degradable

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