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Utilisation of Photo Activators to Produce of Low Density Polyethylene Based Photodegradable Composite Materials

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Abstract

Polymeric materials are branch of our daily life and have found in a wide variety of applications. Synthetic polymers now constitute one of the most successful and useful classes of materials and possess a broad range of useful physical properties. Today, there is an increasing concern about the protection of our ecological systems. Most of today's synthetic polymers are produced from petrochemicals and are not degradable. Many polymers do not readily decompose due to some natural factors like high temperatures or sunlight. In some ways, this non degradation is a positive aspect of some polymers since it permits to design durable and long lasting polymer items but it provides negative effect when polymers use for short term applications like packaging. They create significant problems by piling up in landfills. About twenty five percent of all domestic waste products in landfill sites are composed of various polymer packaging items. There is a world-wide research effort to develop phodegradable polymers as a waste management option for polymers in the environment. Photodegradable polymers are especially designed in order to control their degradability when exposed to sunlight in the environment. The failure of photodegradable polymer depends on indiscretions in the polymers. These abnormities cause polymers to gradually degrade when exposed to ultraviolet (UV) light, normally sunlight. In photodegradable polymers, the speed of degradation is increased by adding photo - activators. The objective of this research is to produce photodegradable Low Density Polyethylene (LDPE) based composite materials with the help of photo - activators. ZnO was used as a photo - activator in this research.

ZnO is a material which is of great interest for a variety of applications due to its unique properties and the availability of a variety of growth methods resulting in a number of different morphologies and a wide range of material properties. ZnO (p-type) of band – gap 3.24 eV with 0 -150 µm particles were used to produce composite in this research. Laboratory scale blender was used to mix the LDPE and ZnO particles by varying 1 wt% to 5 wt% of ZnO. Mixing parameters were temperature 150^0C, speed of the rotor 60 rpm and10 minutes mixing time. Mixtures were prepared without significant phase separation. LDPE - ZnO based composite samples were prepared by using hydraulic press. Ultraviolet exposure test, water absorption test and tensile test were performed to evaluate the degree of photo-degradability. Additionally, colour changes also observed during the ultraviolet exposure test. ZnO containing samples showed the reduction of tensile properties and higher water absorption properties during the ultraviolet exposure testing period. Pure LDPE did not show the significant tensile strength varialtion during the testings. Significant colour changes also observed in ZnO containing samples with compared to pure LDPE during the testing time. According to these experimental results developed LDPE - ZnObased photodegradable composite materials can be used as an alternative material to the conventional polymer products to build a green environment.

***Keywords*:** LDPE, Phodegradable, ZnO, Composite