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The development of novel photodegradable linear low-density polyethylene (LLDPE) and investigation of the antibacterial properties

D. P. H. Kandambi[1]*, T. Kuruwita Mudiyanselage[2], C. S. Udawatte[1]

[1]*College of Chemical Sciences, Institute of Chemistry Ceylon, Rajagiriya, CO 10107, Sri Lanka*

[2]*Department of Chemistry, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka*

Plastic does not decompose easily under natural conditions and the need for degradable polyethylene has become an important area of research. In this study, the suitability of using cinnamaldehyde, in its natural and synthetic forms, and benzophenone, as photo oxidative sensitizers were evaluated. The results showed that oxidative degradation of linear low density polyethylene (LLDPE) increased significantly with the incorporation of these materials. Oxidative sensitization increased significantly with incorporation of natural cinnamaldehyde, Best results for oxidative sensitization were obtained by incorporation of 20% by mass natural cinnamaldehyde. The polymer composite films were prepared using a polymer solution in toluene and 2 cm x 2 cm films were caste between glass slides. 10 samples of each type were analyzed. The extent and nature of degradation was evaluated using FTIR spectroscopy, percentage weight loss and surface analysis techniques. The auto oxidative degradation of the composite films was carried out by accelerated UV initiated degradation, and also under natural rooftop conditions. Embrittlement and color development with aging in the photosensitizer incorporated polymer films were noticeably evident, when compared with the non-incorporated polymer films under similar conditions. Since polymer films are used for food and drug packing applications, antibacterial properties of the composite films were evaluated for four bacterial strains, *Escherichia coli* (ATCC 25922), *Staphylococcus aureus* (ATCC 25923), *Pseudomonas aeruginosa* (ATCC 27853) and *Bacillus cereus* (ATCC 11778) using agar disc-diffusion method. Cinnamaldehyde containing composite films displayed significant antibacterial properties against all four bacterial strains, whereas benzophenone containing films did not show antibacterial properties against these strains.

Keywords: Low-Density Polyethylene, Photodegradation, Cinnamaldehyde, Benzophenone, Photosensitizer

*Corresponding author. Institute of Chemistry Ceylon, Rajagiriya, CO 10107, Sri Lanka.
Email address: kandambidulshani@gmail.com