

DEVELOPMENT OF PHOTODEGRADABLE POLYMER FILM HAVING ANTIBACTERIAL ACTIVITY

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Polymers; plastics and rubber, have become indispensable to mankind because of their extraordinary properties and low cost. Polymeric waste causes serious environmental problems because of their lack of degradability, and as a result they tend to accumulate in the environment. Our attempt here, is to report the development of an environmentally degradable novel polymer film having antibacterial activity. This study was focused on the preparation of a photodegradable copolymer, polystyrene-co-cinnamaldehyde, where cinnamaldehyde acts as a photosensitizer. Commercially available cinnamon oil was used as the source of cinnamaldehyde. The oil was characterized by FT-IR and GC-MS analysis. Commercially available cinnamon oil 75% (w/w) incorporated styrene-co-cinnamaldehyde copolymer was synthesized by free radical polymerization and was characterized by FTIR spectroscopy and DSC analysis. Both outdoor weathering and accelerated tests were performed to evaluate the extent of photo degradation of synthesized copolymers and those were assessed by FTIR spectroscopy, percentage weight loss and morphological changes. FTIR analysis showed the appearance of new peaks of carbonyl and hydroxyl groups with increasing radiation exposure time. Results confirm the photodegradable mechanism of copolymer film as Norrish I, Norrish II and photo-oxidation. Extreme weight loss was observed at outdoor weathering with 33.9% weight loss for 75% (w/w) cinnamon oil incorporated copolymer with respect to 2.2% weight loss for the reference polystyrene homopolymer. Embrittlement and color variations of 75% (w/w) cinnamon oil incorporated copolymer were higher than that of polystyrene homopolymer with radiation exposure time. Surface cracks were clearly observed in SEM micrographs of 75% (w/w) cinnamon oil incorporated copolymer after exposing for 2 months in outdoor weathering which confirm the photodegradable nature of the novel copolymer film. Furthermore, it was discovered that the synthesized copolymer has antibacterial activity against *Escherichia coli* and *Staphylococcus aureus* following overlay diffusion test by observing inhibition zones for 75% cinnamon oil incorporated copolymer. According to all the results, it is confirmed that synthesized copolymer films are photodegradable and also possess antibacterial activity. The developed copolymer could have potential