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Title : STUDIES OF BIODEGRADABLE PROPERTIES OF STARCH BASED FILM AS POLYBAG FOR AGRICULTURAL APPLICATION

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Plastic have many advantages including good water resistance, ease of processing and low cost. The problem with plastic bag is that, it has great environmental impact as millions of plastic wastes were discarded. Polybag for example can take up from 500 to 1000 years to decay or degrade in agricultural farm which can create serious environmental pollution. The purpose of this study was to investigate the degradable properties of Liner Low Density Polyethylene (LLDPE) filled with Sago SS (SS) and Polyvinyl Alcohol (PVOH). Two processing stage were performed in this research. The first stage covers the preparation and testing on properties of Hybrid Master Batch (MB) film of SS/PVOH formulation. Hybrid MB films were formulated by varying ratios of maximum SS/PVOH of 70%. The second stage covers the preparation and testing of Hybrid Blend Film (BF) of SS/PVOH. For the first stage, combination of LLDPE, SS and PVOH first compounded using twin screw extrusion and fabricated into Hybrid MB films with fixed amount of LLDPE with SS and PVOH varies between 10% to 60%. The Hybrid MB films then test for their tensile properties (ASTM D-1780), Water Absorption (ASTM D-570-95) and Thermal Properties (ASTM D 3418) and Biodegradability (ASTM D5338-98). Tensile properties test shows that increasing the amount of SS in LLDPE films will reduce the tensile strength of the blends as Hybrid MB A exhibited the highest tensile strength of 6.7 MPa while lowest strength was found for Hybrid MB E of 5.1 MPa corresponding to highest starch content of 60% and PVOH 10%. Increasing water absorption of Hybrid MB films were observed with increasing of SS amount in SS/PVOH formulation. Degradability of Hybrid MB films after soil burial for 30 days were observed to be increased with increasing amount of SS due to enzymatic attack of microorganism on the film. DSC result had shown films filled with higher amount of SS exhibited reduction in the melting temperature of the blends. For second stage experimental, Hybrid BF were fabricated using film blowing extrusion and formulated employing 10% Hybrid MB with PE resin and then tested for Carbon Dioxide (CO2) Measurement (ASTM D 6400), Soil Burial (ASTM D 5338-98), Fourier Transform Infrared Spectroscopy (FTIR – ASTM 1252-98) and Scanning Electron Microscope (SEM). Hybrid blend films were exposed to free Carbon Dioxide atmosphere for 45 days, whereas Soil Burial test was carried out for 1 year. Increasing SS amount on LLDPE films also increase the Carbon Dioxide generation by microorganism after 45 days. From FTIR spectrum displayed after 360 days of degradation, the intensity of the peaks significantly decreased and broadens at peak 3302, 1462, 1261, and 1020 cm-1due to OH and C-O bend as a result from degradation of SS by microorganism. Morphological structure of Hybrid BF was viewed using SEM shown that after 360 days of degradation, there was a lot of detachment of SS from LLDPE matrix as degradation has taken place in the blend films. Hybrid BF A which has 20% of SS exhibits only 3 % of CO2generation compare to Hybrid BF E which contain 60% of SS display more active decomposition activity of 12 % CO2 generation. The optimum filler content was found to be 60% (Hybrid E) which drop in mechanical properties showing high degradability occurred.This is a useful formulation for bio degradable polybag bags and agricultural mulch application.