

UNIVERSITI TEKNOLOGI MARA

**MECHANICAL, MELT FLOW,
MORPHOLOGICAL,
THERMOSTRUCTURAL AND
ANTIBACTERIAL PROPERTIES OF
CHITOSAN/ LINEAR LOW-DENSITY
POLYETHYLENE BLEND FOR
SELECTED FOOD (BANANA)
PACKAGING FILM**

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ABSTRACT

The world are facing excessive dumping of plastics wastes especially from packaging food industries. The food industries also need long shelf life as food degradation caused by the growth of microorganism, had reduced the quality of food products. Fresh food product packaging during import and export process especially for fruit product need proper packaging. In this study, an antimicrobial agent and polymer which are in demand for food packaging application had been developed. This research is related to the production of an antibacterial packaging which use chitosan and cinnamaldehyde acting as antibacterial (AM) agent. Different varying compositions 5 to 15wt% of chitosan with fixed 1% cinnamaldehyde were compounded with 85-95wt% of Linear Low- Density Polyethylene (LLDPE) using Twin Screw extruder and Blown film process, to produce two different antibacterial packaging, LLDPE/Chitosan/Cinnamaldehyde and LLDPE/Chitosan. The effects of chitosan incorporation on LLDPE were tested for physical, mechanical, thermal, morphology, antibacterial and rheological behaviour. For first stage blending process, increase percentage of chitosan/LLDPE with cinnamaldehyde had resulted in increased melt flow index (MFI) than Chitosan/LLDPE blend. The MFI value showed two different composites suitable for film blowing process which are in range of 0.34 g/10min to 0.78 g/10min. In general, addition of increase chitosan in LLDPE film blend with and without cinnamaldehyde showed an increase in 21% to 32% of tensile strength and young modulus. 15wt% chitosan/LLDPE with 1% cinnamaldehyde showed highest increase in tensile strength and young modulus, and decrease in elongation at break. From Zone of inhibition test, antibacterial action were found to exhibit Gram-negative bacteria (*E.coli*) with the presence of chitosan in the film blend. The highest zone of inhibition was found for 5% chitosan/LLDPE film without cinnamaldehyde having zone inhibition at 11.25mm compared to 15% chitosan. For thermal properties, chitosan/LLDPE composite with cinnamaldehyde showed good in thermal stability with 15% chitosan composition. Meanwhile, observation from field emission scanning electron microscope (FESEM) revealed that the increase percentage of chitosan with cinnamaldehyde formed rougher surface and numerous small holes. At second stage, the process of modification onto the chitosan/LLDPE film surface were performed via sulfuric acid immersion with various time between 20, 40, 60 and 80 minutes. For both Fourier Transform Infrared Spectroscopy (FTIR) and Atomic Force Microscope (AFM) tests, the treatment time at 40 minutes showed increase in surface roughness with Root Means Square (RMS) value of 41.0 nm, with new formation of bands from sulfonation and carbonyl groups. In the third stage, the shelf life of the banana selected for investigation of fabricated chitosan/LLDPE with cinnamaldehyde film from uncoated and coated chitosan layer with various thicknesses (40, 60, 70, 80 micron). Analysis of the coated and uncoated chitosan of the fabricated chitosan/LLDPE film with Water vapour transmission rate (WVTR) test and Colour Peel test. For WVTR test, it was found that higher chitosan coating thickness of 80 micron resulted in lower WVP and lower total colour difference indicating prolong shelf life of banana until days 15 were analysed compared to uncoated Chitosan/LLDPE film with cinnamaldehyde.

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