

Biodegradable Polymer Film Incorporated with Polyphenols for Active Packaging

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Abstract : The key features of any active packaging film are its biodegradability and antimicrobial properties. Biological macromolecules such as polyphenols (ferulic acid (FA) and tannic acids (TA)) are naturally found in plants such as grapes, berries, and tea. In this study, antimicrobial activity screening of several polyphenols was carried out by using minimal inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) against two strains of gram-negative bacteria - *Salmonella typhimurium*, *Escherichia coli*, and two-gram positive strains - *Staphylococcus aureus* and *Listeria monocytogenes*. FA and TA had shown strong antibacterial activity at the low concentration against both gram-positive and gram-negative bacteria. The selected polyphenols FA and TA were incorporated at various concentrations (1%, 5%, and 10% w/w) in the poly(lactide) - poly (butylene adipate-co-terephthalate) (PLA-PBAT) composite film by using the solvent casting method. The effect of TA and FA incorporation in the packaging was characterized based on morphological, optical, color, mechanical, thermal, and antimicrobial properties. The thickness of the FA composite film was increased by 1.5 - 7.2%, while for TA composite film, it increased by 0.018 - 1.6%. FA and TA (10 wt%) composite film had shown approximately 65% - 66% increase in the UV barrier property. As the FA and TA concentration increases from 1% - 10% (w/w), the TS value increases by 1.98 and 1.80 times, respectively. The water contact angle of the film was observed to decrease significantly with the increase in the FA and TA content in the composite film. FA has shown more significant increase in antimicrobial activity than TA in the composite film against *Listeria monocytogenes* and *E. coli*. The FA and TA composite film has the potential for its application as an active food packaging.

Keywords : active packaging, biodegradable film, polyphenols, UV barrier, tensile strength

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