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Effect of natural waxes and surfactants on mechanical, optical, thermal and water vapor permeability of banana flour composite films

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Banana flour edible film has shown potential as good selective barriers to gas and UV light due to its natural chemical compounds (starch, protein, lipids and fibers). Nonetheless, the hydrophilicity of the biodegradable banana flour film showed poor resistance to water vapor and limit the application. To improve this drawback, the addition of each natural wax (beeswax; BW and carnauba wax; CW) and surfactant (stearic acid; SA and Tween-80; TW) at different ratios of wax and surfactant (20:80, 50:50 and 80:20 w/w) was investigated on banana composite film properties. As shown, the addition of wax and surfactant changed the microstructure of the film and also decreased the mechanical properties of films compared to the neat banana flour film. In addition to the hydrophobicity of wax, the compatibility of components added also played a major role on the film thermal and water barrier properties. CW had a higher degree of hydrophobicity than BW, however, the films containing CW showed lower effectiveness in water vapor barrier. This might be attributed to its incompatibility with the hydrophilic polymer resulting in the presence of some small voids and agglomerated particles on the surface of the film as shown in the SEM micrograph. Nevertheless, the best candidate of the banana flour composite film incorporated with BW: SA at a ratio of 50:50 showed 12% reduction in the water vapor permeability compared to the control film. Therefore, the banana flour composite film might be considered as a bio-based food packaging material and edible coating as alternative green food packaging application.

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