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Characterisation of Corn Starch/PVA (Polyvinyl Alcohol) Film Incorporated with Citrus Peel Powder

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Structured Abstract

Background: Plastic is widely used in food packaging for its versatility and barrier properties, but concerns about its non-biodegradability and environmental impact have spurred exploration of sustainable alternatives. Biopolymer-based films, such as those made from corn starch and polyvinyl alcohol (PVA), have gained attention due to their film-forming ability and biodegradability. However, they have limited functional properties. This research focuses on developing and characterising a film blend of corn starch and polyvinyl alcohol (PVA) incorporating lime peel powder, which contains antioxidants in varying concentrations.

Methods: Corn starch/PVA films were prepared by solution casting using different concentrations of citrus peel powder. The films were evaluated for their physical and chemical properties, including thickness, optical properties, water solubility, and antioxidant activity, using total phenolic content (TPC) and the DPPH radical-scavenging assay. Mechanical properties such as tensile strength and elongation at break were also determined. In addition, the film surface and cross-section were analysed using scanning electron microscopy (SEM).

Results: The incorporation of citrus peel powder significantly influenced the properties of the corn starch/PVA films. Films containing citrus peel powder showed increased antioxidant activity, as indicated by higher TPC (7091.83 ± 30.34 µg GA/ml extract) and DPPH (86.36 ± 0.03 %) values compared to the control film. Mechanical properties were affected by the concentration of citrus peel powder, with higher concentrations reducing tensile strength (655.30 ± 14.50 MPa) and elongation at break (42.95 ± 2.46%) due to particle aggregation. Morphological analysis reveals a relatively heterogeneous structure at higher citrus peel concentrations, characterised by a rougher surface and less uniform dispersion.

Conclusion: The results show that corn starch/PVA films incorporating citrus peel powder exhibit enhanced antioxidant properties and potential as active packaging materials. The results indicate that citrus by-product has greater potential to be evaluated as an added-value product for functional packaging applications (active packaging). This film will be a new alternative for food-preservation materials in food packaging.

Keywords: Corn starch, Polyvinyl alcohol (PVA), Citrus peel powder, Antioxidant activity, Active packaging

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