Synthesis of a Sustainable Bio-Nanocomposite Coating to Reduce Post-Harvest Agriculture Losses

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World hunger is a growing issue and affects up to 820 million people globally. Although there are increasing efforts to increase sustainability, approximately ⅓ of food produced globally is never consumed. A leading cause of food waste is fresh produce ripening too quickly, where 40-50% of crops are lost in the supply chain before reaching retail markets. Primary causes of fresh produce ripening too quickly are attributed to moisture loss, oxidation, and microbial growth. Traditional methods to control these factors often adversely affect the produce or are expensive. In this study, a bio-nanocomposite coating was synthesized using mango seed starch and cellulose nanocrystals to coat fresh produce to extend its shelf life. The coating's effectiveness was tested on fresh bananas, strawberries, and avocados and displayed excellent ability to retard decay of the produce, slowing down weight loss significantly ($p<0.05$) compared to the control groups and reducing stiffness loss ($p<0.05$) over time. To further understand the coating's ability to preserve the shelf life of fresh produce, microscopy of samples was taken at 0 days and 12 days. Additionally, water vapor transmission rate and film solubility were assessed, reducing water vapor transmission by 91% on filter paper compared to a control film. The coating was easily dissolved in distilled water with gentle stirring. In conclusion, the coating is edible, easily washable, and derived from waste materials making it a promising alternative to traditional coatings and a solution to reduce global food waste.

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