Fakulti Sains Gunaan

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BIONANOCOMPOSITE FILM BASED ON POLYSACCHARIDES FROM *MUSA ACUMINATA* PEELS

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This Final Year Project Report entitled "**Bionanocomposite Film Based on Polysaccharides from *Musa Acuminat*a Peel**" was submitted by Nor Alisa Nadhirah binti Mohd Khiri in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Chemistry with Management, in the Faculty of Applied Sciences, and was approved by

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ABSTRACT

BIONANOCOMPOSITE FILM BASED ON POLYSACCHARIDES FROM *MUSA ACUMINATA* PEELS

The growing environmental worries over petroleum-based plastic packaging, combined with the growing amount of agricultural waste, has increased the demand for sustainable and biodegradable materials made from renewable biomass resources. This research focused on the use of *Musa Acuminata* (banana) peel waste as a low-cost and ecologically beneficial raw material for the creation of biodegradable bionanocomposite films, thereby contributing to waste reduction and circular bioeconomy practices. Pectin and cellulose nanocrystals (CNC) were extracted from banana peel via acid-assisted chemical treatment and hydrolysis processes, yielding 6.02% pectin (3.0089 g from 50 g dried peel) and 7.74% CNC (3.8684 g from 50 g dried peel), demonstrating the technical feasibility of converting agro-waste into value-added functional biopolymers. The solvent casting process was used to create three different film formulations: 100% pectin film, 50:50 pectin–CNC composite film, and 100% CNC film. To improve the integrity and durability of the films, glycerol was used as a plasticizer and calcium chloride as a crosslinking agent. The Fourier Transform Infrared (FTIR) spectroscopy, Scanning Electron Microscopy (SEM), Optical Microscopy (OM) and Tensile Testing have been employed on all retrieved materials and produced sheets. The FTIR spectrum provides proof of the presence of any polysaccharides' functional groups that may have been deformed or lost from the physical structure during extraction or composite processing, both of which confirm that no structural changes have occurred to the polymer backbone of the polysaccharides. Morphological examination demonstrated that the pectin–CNC composite film has a consistent and flat surface that provides evidence of a high degree of interfacial interaction between the polymer matrix and reinforcing filler, as well as the good dispersion of CNC throughout the film. In comparison to neat pectin film (1.11 ± 0.37 MPa) and pure CNC film (0.95 ± 0.36 MPa), mechanical testing revealed that the 50:50 pectin and CNC composite film had the highest tensile strength (1.21 ± 0.23 MPa). The increased elastic modulus showed improved stiffness from CNC reinforcement. Overall, these findings indicate that CNC and pectin from banana peels can be used to create biodegradable bionanocomposite films with better mechanical performance and structural integrity. This offers a sustainable alternative to traditional plastic packaging and promotes resource efficiency, waste recycling, and the creation of eco-friendly materials.

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