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Starch Film Reinforced with Microcrystalline Cellulose from Tongkat Ali Petiole: Effect of Glycerol Composition

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Structured Abstract

Background: Starch-based films provide favourable characteristics such as biodegradability, non-toxicity, and simplicity in forming films. However, films composed only of starch often suffer from brittleness and demonstrate insufficient mechanical capabilities, hence limiting their practical usefulness. To enhance the flexibility and mechanical properties of starch-based films, plasticizers and microcrystalline cellulose (MCC) are commonly added. The study examines the impact of adding glycerol to biodegradable starch films that are strengthened with microcrystalline cellulose (MCC) obtained from Tongkat Ali petiole waste. Tongkat Ali, scientifically known as Eurycoma longifolia, is a medicinal plant that originates from Southeast Asia and is renowned for its therapeutic qualities. Nevertheless, the investigation of the cellulose-rich petioles, which are frequently thrown as agricultural waste, has not been extensively explored.

Methods: The process of creating starch films strengthened with microcrystalline cellulose (MCC) from Tongkat Ali petiole (SBTAP) and using glycerol as a plasticizer was carried out using the solvent casting technique. By varying glycerol composition from 1 ml to 2.0 ml, the study examines the films' properties, using techniques such as Fourier-transform infrared spectroscopy (FTIR), Scanning electron microscopy (FESEM), and biodegradability testing.

Results: The FTIR measurement demonstrates substantial interactions and alterations in the starch matrix because of incorporating MCC and glycerol. The incorporation of glycerol into SBTAP blended films resulted in noticeable variations in surface properties. Specifically, the SBTAP film containing 2.0ml of glycerol had rough surfaces and demonstrated the longest fracture propagation. Meanwhile, the SBTAP starch film achieved the highest level of biodegradability, with a breakdown rate of 40.5% when subjected to a glycerol amount of 1.0 ml.

Conclusion: SBTAP blended films, when combined with plasticizers such as glycerol, showed excellent physical characteristics and biodegradability. This study highlights the potential of utilizing starch-MCC and glycerol for the development of eco-friendly packaging alternatives, which can aid in reducing the environmental consequences of plastic waste.

Keywords: Tongkat Ali petioles, starch films, microcrystalline cellulose, glycerol, plasticizers.

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