

Characterization of Microcrystalline Cellulose Isolated From *Murraya Koenigii* Petiole and Citrus Macrocarpa Peel

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Structured Abstract

Background: Cellulose, a natural, biodegradable, and renewable polymer, is abundant in various plants, fungi, algae, bacteria, and sea animals. It is known for its high stability, toughness, and water resistance due to its long chains of glucose molecules connected by beta-1,4-glycosidic bonds. Microcrystalline cellulose (MCC) is a refined form of cellulose obtained through methods like acid hydrolysis, commonly used for its high-quality applications. This study explores the viability of extracting MCC from *Murraya koenigii* petiole and *Citrus macrocarpa* peel, aiming to characterize its properties.

Methods: Dried *Murraya koenigii* petiole (CP) and *Citrus macrocarpa* peel (KLP) were ground into powder, soaked overnight in a toluene-ethanol mixture (2:1) to remove waxes and oils, and air-dried. For cellulose extraction, 30 g of *Citrus macrocarpa* peel was treated with 6% NaOH, filtered, neutralized, treated with H₂O₂, and heated at 80°C. *Murraya koenigii* petiole followed a similar process without dewaxing. The purified cellulose from both sources was hydrolyzed with 2.5 M HCl at 80°C, filtered, sonicated, and oven-dried at 50°C to produce MCC. The resulting MCC was characterized using FTIR for functional group analysis, FESEM for surface morphology observation, and XRD for crystallinity assessment, and compared with commercial MCC.

Results: The study revealed that cellulose extraction from *Murraya koenigii* petiole and *Citrus macrocarpa* peel yielded 32.88% and 17.41%, respectively, with MCC yields of 19.33% and 6.74%. FTIR analysis confirmed the removal of lignin and hemicellulose, as evidenced by the absence of their characteristic peaks in MCC samples. FESEM images showed a smoother, fibrous structure in MCC compared to raw and cellulose samples, indicating successful purification. XRD analysis demonstrated increased crystallinity in MCC samples, with MCC-CP and MCC-KLP showing crystallinity indices of 64.10% and 62.59%, respectively, compared to the commercial MCC at 77.07%. These results confirm that *Murraya koenigii* petiole and *Citrus macrocarpa* peel are viable sources for producing high-quality MCC.

Conclusion: This research successfully isolated and characterized MCC from *Murraya koenigii* petiole and *Citrus macrocarpa* peel, highlighting their potential as sustainable sources for MCC production. The findings underscore the feasibility of utilizing underutilized agricultural waste for high-quality MCC, promoting sustainability and cost-effectiveness in MCC production.

Keywords: Microcrystalline cellulose (MCC), *Murraya koenigii* petiole, *Citrus macrocarpa* peel, agricultural waste

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