

Extraction and Characterization of Cellulose from Cassava Peel: Effect of Hydrogen Peroxide and Sodium Chlorite at Different Concentrations

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Structured Abstract

Background: Cassava peel is an underutilized agro-industrial by-product with high cellulose content and low pectin, making it a promising raw material for cellulose extraction. This study aimed to assess the conversion of cassava peel waste into purified cellulose by comparing the bleaching performance of hydrogen peroxide (H_2O_2) and sodium chlorite (NaClO_2) at two concentrations (4% and 6%).

Methods: Cassava peels were pretreated with 4% NaOH, then bleached using 4% and 6% concentrations of H_2O_2 and NaClO_2 , respectively. The chemical composition of raw cassava peel was evaluated, and extracted cellulose was characterized using Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), and scanning electron microscopy (SEM).

Results: The results indicated that cassava peel contains a significant amount of holocellulose (38.01%). Among all treatments, the 6% sodium chlorite (CPSC6) sample exhibited the highest cellulose yield (37.72%) and showed better delignification, as evidenced by the absence of lignin peaks in FTIR and a clean, fibrillar morphology in SEM images. XRD analysis confirmed that CPSC6 had a higher crystallinity index (56.73%) than the other treatments. In contrast, 6% hydrogen peroxide (CPHP6) achieved a higher yield but showed only moderate delignification and a lower crystallinity index of 43.04%. While the 4% treatments generally yielded cellulose with lower purity and less defined fibre structures, higher concentrations showed improved effectiveness. These results validate the effectiveness of 6% sodium chlorite in enhancing cellulose extraction from cassava peel under controlled conditions.

Conclusion: This study highlights cassava peel as a viable feedstock for high-quality cellulose extraction and demonstrates that sodium chlorite, particularly at a concentration of 6%, is more effective than hydrogen peroxide in achieving higher yield, greater purity, and better structural preservation. The findings support the enhancement of sustainable agricultural waste and contribute to green chemistry practices in cellulose production.

Keywords: Cassava peel, cellulose extraction, sodium chlorite, hydrogen peroxide

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