

Extraction and characterization of hemicellulose from oil Palm Empty Fruit Bunches (OPEFB) using alkaline extraction.

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Structured Abstract

Background: One of the major categories of solid waste that are regularly produced from palm oil mills is OPEFB. Hemicellulose is a second abundant biopolymer in the OPEFB. One major challenges of hemicellulose extraction is due to its complex and diversified structure. Herein, the extraction process such as alkaline treatment was introduced to extract hemicellulose from OPEFB. The aims of this study are to investigate the effect of NaOH concentration on the hemicellulose yield and subsequently determine the physicochemical properties of hemicellulose from OPEFB.

Methods: The hemicellulose was extracted from OPEFB using two different NaOH concentration (0.5M and 1.0M) and designated as H_{0.5} and H₁. The ratio of OPEFB and NaOH solution was 1:10(w/v%) and mixed in a beaker. The mixture was heated at temperature of 55°C for 2 hours while being constantly stirred. Then, 6M HCl was added to adjust the pH to 5.5 and it is stored in refrigerator at 4.0°C overnight. The mixture was centrifuged at 3500 rpm for 15 minutes and filtered. The supernatant was added with 4 volumes of 10% acetic acid and let stand for 2 hours and then filtered. The hemicellulose extract was dried in an oven at 40°C until constant weight obtained. Hemicellulose was designated as H_{0.5} and H₁ for 0.5M and 1.0M respectively.

Results: The yield of hemicelluloses; H_{0.5} and H₁ were 3.46% and 11.93% respectively. It shows that the yield of hemicellulose increased when NaOH increased. FTIR spectra indicates that both H_{0.5} and H₁ has a similar structure and functional group of C=O at 1702.3 cm⁻¹. The SEM analyses showed that the morphology structure of H_{0.5} and H₁ had smooth surface, without avoids holes and cracks. The XRD results demonstrated that the amorphous nature of the hemicellulose sample was shown at 18.99° and 18.88° for H_{0.5} and H₁ respectively. The TGA analyses indicates that H_{0.5} and H₁ decomposed at 373.02°C and 304.73°C respectively. The higher concentration of NaOH can cause a loss in thermal stability.

Conclusion: The high yield of hemicellulose (11.93%) was obtained at 1.0M NaOH concentration. The physicochemical properties of hemicellulose from OPEFB were successfully characterised by FTIR, SEM, TGA and XRD analyses.

Keywords: OPEFB, Hemicellulose.

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