

ABSTRACT

CONVERSION OF CORN COB CELLULOSE INTO SUGAR ALCOHOL USING $\text{Ni}_{(1-x)}\text{Zn}_x\text{Fe}_2\text{O}_4$ NANOCATALYST

By

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In this research, conversion of corn cob cellulose into sugar alcohol using nanosize $\text{Ni}_{(1-x)}\text{Zn}_x\text{Fe}_2\text{O}_4$ (with $x = 0,1-0,3$) as catalyst was performed. Catalyst was prepared by sol-gel method using pectin as emulsifier. XRD and TEM data showed formation of nickel zinc ferrite with spinel cubic shape. Particle size according to Debye-Sherrer equation is in the range of 7,42-9,28 nm. Catalyst has Brønsted-lowry and Lewis acid site with acidity in the range of 0,9289-1,0636 mmol/gram. The catalysts were found to have band-gap energy ranging from 2.02 to 2.07 eV, in which the band-gap energy increases with increased Zn concentrations. Corn cob nanocellulose was prepared by stepwise process of delignification, bleaching, and sulfuric acid hydrolysis. The product with cellulose content of 90.09% and crystallinity of 67.12% was obtained, in the form of nanofibrilated cellulose with diameter 20-25 nm. Conversion of corn cobs nanocellulose with $\text{Ni}_{(1-x)}\text{Zn}_x\text{Fe}_2\text{O}_4$ catalyst was performed by irradiating the sample with UV lamp of 125 Watt with irradiation times of 30, 45 and 60 minutes. The experimental results demonstrated that the catalyst exhibited activity to breaks the glycosidic bond of cellulose, led to formation of glucose, with the concentration of 0,05-0,10% according to HPLC analysis.

Keywords: corn cob, nanocellulose, nanocatalyst, sugar alcohol, spinel ferrite.

ABSTRAK

KONVERSI SELULOSA LIMBAH TONGKOL JAGUNG MENJADI GULA ALKOHOL MENGGUNAKAN NANOKATALIS $\text{Ni}_{(1-x)}\text{Zn}_x\text{Fe}_2\text{O}_4$

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Dalam penelitian ini telah dilakukan konversi selulosa limbah tongkol jagung menggunakan nanokatalis $\text{Ni}_{(1-x)}\text{Zn}_x\text{Fe}_2\text{O}_4$ (dengan $x = 0,1-0,3$). Katalis dibuat menggunakan metode sol gel dengan pektin sebagai pengemulsi. Data XRD dan TEM menunjukkan sudah terbentuknya katalis nikel seng ferrit dengan bentuk kubus spinel. Ukuran partikel berdasarkan persamaan Debye-Scherrer berkisar antara 7,42-9,87 nm. Katalis memiliki situs asam Brønsted-Lowry dan situs asam Lewis dengan jumlah situs asam sebesar 0,9289-1,0636 mmol/gram. Nilai energi *band-gap* katalis dengan DRS sebesar 2,02-2,07 eV. Nilai energi *band-gap* akan meningkat seiring bertambahnya konsentrasi Zn. Nanoselulosa tongkol jagung dipreparasi melalui tahapan delignifikasi, bleaching, dan hidrolisis dengan asam sulfat. Kadar selulosa didapatkan sebesar 92,12% dengan kristalinitas 67,12%. Nanoselulosa yang dipreparasi merupakan nanofibril selulosa dengan diameter 20-25 nm. Konversi nanoselulosa tongkol jagung dengan katalis $\text{Ni}_{(1-x)}\text{Zn}_x\text{Fe}_2\text{O}_4$ dilakukan dengan irradiasi lampu UV 125 watt dengan waktu 30, 45 dan 60 menit. Katalis aktif memutuskan ikatan glikosidik selulosa menjadi glukosa. Hasil analisis KCKT dari sampel hasil uji fotokatalitik menghasilkan glukosa dengan konsentrasi 0,05-0,10 %.

Kata kunci : gula alkohol, nanokatalis, nanoselulosa, spinel ferit, tongkol jagung,