

## **ABSTRAK**

### **KONVERSI NANOSELULOSA MENJADI GULA ALKOHOL MENGGUNAKAN NANOKOMPOSIT $\text{Ni}_{0,1}\text{Cu}_{0,9}\text{Fe}_2\text{O}_4$ YANG DIIRADIASI SINAR UV**

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Telah dilakukan preparasi dan karakterisasi nanokatalis  $\text{Ni}_{0,1}\text{Cu}_{0,9}\text{Fe}_2\text{O}_4$  dengan menggunakan metode sol-gel dan pektin sebagai pengemulsi kemudian sampel dikeringkan dengan *freeze-dry* dan terkalsinasi pada temperatur  $600^\circ\text{C}$ , dilanjutkan dengan uji aktivitas fotokatalitik. Proses karakterisasi katalis meliputi analisis fasa kristal menggunakan difraksi sinar-X (XRD), analisis keasaman menggunakan metode gravimetri, analisis situs asam menggunakan FTIR, dan analisis morfologi permukaan dengan *Transmission Electron Microscopy* (TEM). Hasil analisis difraksi sinar-X (XRD) katalis  $\text{Ni}_{0,1}\text{Cu}_{0,9}\text{Fe}_2\text{O}_4$  terdiri dari beberapa fasa kristal yakni fasa  $\text{CuFe}_2\text{O}_4$ ,  $\text{NiFe}_2\text{O}_4$  sebagai fase mayor serta  $\text{Fe}_3\text{O}_4$  dan  $\text{CuO}$  sebagai fasa minor. Analisis keasaman nanokatalis menggunakan metode gravimetri, didapatkan keasamaan nanokatalis  $\text{Ni}_{0,1}\text{Cu}_{0,9}\text{Fe}_2\text{O}_4$  pada katalis yang telah dikalsinasi  $600^\circ\text{C}$  adalah sebesar 2,295 mmol piridin/gr katalis. Analisis situs asam menggunakan metode *Fourier Transform Infra Red* (FTIR) menunjukkan situs asam Lewis lebih dominan. Hasil analisis morfologi katalis menggunakan TEM dapat dikatakan fase yang terbentuk cukup terdistribusi secara merata (homogen) dan masih terdapat sedikit aglomerasi dengan ukuran rata-rata yang diperoleh sebesar 21,74 nm. Hasil uji konversi nanoselulosa dengan variasi waktu penirinan (30, 45, dan 60 menit) disertai aliran gas  $\text{H}_2$  dan uji Fehling mengindikasikan bahwa terdapat gula pereduksi dalam sampel di setiap variasi waktu. Analisis menggunakan Kromatografi Cair Kinerja Tinggi (KCKT) mengungkapkan bahwa nanoselulosa dikonversi menjadi sorbitol dan manitol dengan konsentrasi sorbitol lebih besar daripada manitol, yakni 550,8 ppm pada waktu penirinan 60 menit.

**Kata Kunci:** Nanokatalis, nanokomposit, pektin, dan gula alkohol.

## **ABSTRACT**

### **NANOCELLULOSE CONVERSION INTO SUGAR ALCOHOL USING NANOCOMPOSITE $\text{Ni}_{0.1}\text{Cu}_{0.9}\text{Fe}_2\text{O}_4$ IRRADIATED BY UV-LIGHT**

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The preparation and characterization of nanocatalyst  $\text{Ni}_{0.1}\text{Cu}_{0.9}\text{Fe}_2\text{O}_4$  was made by using sol-gel method and pectin as an emulsifying agent then sample was dried using freeze-dryer and calcined at 600°C, followed by photocatalytic activity test. The catalyst characterization was done includes crystal phase analysis using X-ray diffraction (XRD), acidity analysis using gravimetric method, acid site analysis using FTIR, and surface morphology analysis with Transmission Electron Microscopy (TEM). The X-ray diffraction (XRD) analysis of  $\text{Ni}_{0.1}\text{Cu}_{0.9}\text{Fe}_2\text{O}_4$  catalyst showed several crystalline phases such as  $\text{CuFe}_2\text{O}_4$ ,  $\text{NiFe}_2\text{O}_4$  as phase major and  $\text{Fe}_3\text{O}_4$  and  $\text{CuO}$  as phases minor. Acidity analysis of nanocatalyst  $\text{Ni}_{0.1}\text{Cu}_{0.9}\text{Fe}_2\text{O}_4$  using gravimetric method, is obtained 2.295 mmol pyridine/g catalyst. The other more acid site analysis using the Fourier Transform Infra Red (FTIR) method resulted that the properties of Lewis acid site was more dominant than of Bronsted Lowry acid site. The result of catalyst morphology analysis using Transmission Electron Microscope (TEM) method can be said to be quite distributed evenly (homogeneous) and there is still a slight agglomeration with average grain size obtained of 21.74 nm. The result of nanoselulose conversion test with the variation of radiation time (30, 45, and 60 minutes) with  $\text{H}_2$  gas flow which was showed by Fehling test indicated that there was reducing sugar formation in the sample at any time variation. Analysis using High Performance Liquid Chromatography (HPLC) reveals that nanocellulose is converted to sorbitol and mannitol with the sorbitol a highest concentration, which was 550 ppm at 60 minutes time rasio irradiation.

**Keywords:** Nanocatalyst, nanocomposite, pectin, and sugar alcohol.