

**REAKSI KONDENSASI ISOBUTANOL MENJADI  
1,1-DIISOBUTOKSIISOBUTANA MENGGUNAKAN KATALIS  
Zr/KARBON AKTIF**

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**INTISARI**

Telah dilakukan penelitian reaksi kondensasi isobutanol menjadi 1,1-diisobutoksiisobutana menggunakan katalis Zr/karbon aktif dalam atmosfer N<sub>2</sub>. Pembentukan produk dikaji berdasarkan kondisi optimal temperatur, massa katalis, dan laju gas N<sub>2</sub> menggunakan metode Taguchi.

Pembuatan karbon aktif dari tempurung kelapa dikarbonisasi pada temperatur 500 °C dilanjutkan dengan aktivasi pada temperatur 850 °C menggunakan gas CO<sub>2</sub> dengan laju alir 15-20 mL menit<sup>-1</sup>. Karbon aktif dicuci dengan aseton dan HCl 1,0 M tiga kali. Logam zirkonium diimbangkan pada karbon aktif dengan metode kering, kemudian direduksi pada temperatur 650 °C dialiri gas H<sub>2</sub> pada laju alir 15 mL menit<sup>-1</sup> selama 3 jam. Keasaman Zr/KA diuji dengan metode adsorpsi amonia. Desain penelitian setiap parameter dirancang menggunakan metode Taguchi. Proses konversi katalitik dilakukan dengan variasi massa katalis Zr/KA (5; 7,5; 10 g), suhu konversi katalitik (450; 500; 550 °C), dan laju alir gas N<sub>2</sub> (10; 15; 20 mL menit<sup>-1</sup>). Data hasil setiap konversi diolah dengan metode Taguchi untuk diketahui kondisi optimal setiap parameter. Karbon aktif dan Zr/KA diuji menggunakan AAS, SSA-BET, XRD, FT-IR, dan SEM. Kondisi optimal setiap parameter dikonversi dan dianalisis menggunakan GC-MS dan NMR.

Keasaman karbon aktif meningkat setelah ditambahkan logam Zr dari 4,73 mmol g<sup>-1</sup> menjadi 6,45 mmol g<sup>-1</sup>. Kondisi optimal reaksi kondensasi isobutanol menjadi 1,1-diisobutoksiisobutana yang diperoleh dengan metode Taguchi yaitu pada temperatur 500 °C, massa katalis 7,5 g dan laju alir gas N<sub>2</sub> 15 mL menit<sup>-1</sup> dengan persentase hasil konversi sebesar 81,52%.

Kata kunci: karbon aktif, katalis Zr/karbon aktif, metode Taguchi, konversi katalitik 1,1-diisobutoksiisobutana.

## **CONDENSATION REACTION OF ISOBUTANOL INTO 1,1-DIISOBUTOXYISOBUTANE USING Zr/ACTIVATED CARBON CATALYST**

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### **ABSTRACT**

This research on the condensation reaction of isobutanol into 1,1-diisobutoxyisobutane using Zr/activated carbon catalyst was conducted under N<sub>2</sub> atmosphere. The product formation was studied based on the optimum conditions of temperature, catalyst mass, and N<sub>2</sub> gas flow rate using Taguchi method.

Activated carbon was prepared from coconut shells through the carbonization process at a temperature of 500 °C followed by the activation process at 850 °C under CO<sub>2</sub> flow rate at 15-20 mL minute<sup>-1</sup>. The activated carbon was washed with acetone and 1.0 M HCl three times. Activated carbon was impregnated with zirconium using dry impregnation method, then reduced at a temperature of 650 °C flowed by H<sub>2</sub> 15 mL minute<sup>-1</sup> for 3 hours. Zr/AC acidity was determined by ammonia adsorption method. The design of experiment of each parameters was designed with Taguchi method. The catalytic conversion process was carried out at the variation of Zr/AC catalyst mass (5; 7.5; 10 g), catalytic conversion temperature (450; 500; 550 °C), and N<sub>2</sub> gas flow rate (10; 15; 20 mL minute<sup>-1</sup>). The results of each conversion were processed with Taguchi method to determine the optimum conditions of each parameter. Activated carbon and Zr/AC were characterized by AAS, SSA-BET, XRD, FT-IR, and SEM analyses. The optimum conditions for each parameters was converted and analyzed using GC-MS and NMR.

The acidity of activated carbon increased after Zr metal impregnated onto the activated carbon, from 4.73 mmol g<sup>-1</sup> to 6.45 mmol g<sup>-1</sup>. The optimum condition was obtained at temperature 500 °C, 7.5 g Zr/AC catalyst, and 15 mL minute<sup>-1</sup> N<sub>2</sub> carrier gas, analyzed by Taguchi method with the percentage of condensation reaction yield was 81.52%.

**Keyword:** activated carbon, Zr/activated carbon catalyst, Taguchi method, catalytic conversion of 1,1-diisobutoxyisobutane.