

SINTESIS SILIKA MESOPORI MENGGUNAKAN CETAKAN GELATIN TULANG SAPI DAN IMPREGNASI Cr UNTUK KATALIS HIDRORENGKAH PELUMAS BEKAS

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INTISARI

Telah dilakukan sintesis silika mesopori (SM) menggunakan cetakan gelatin tulang sapi dan impregnasi Cr untuk katalis hidrorengkah pelumas bekas. Ekstraksi gelatin dari tulang sapi dilakukan menggunakan metode gabungan asam dan basa. Tulang sapi direndam dengan larutan asam asetat 4% selama 3, 6, dan 9 hari, sodium hidroksida 0,1 M selama 24 jam dan asam klorida 1,0 M selama 1 jam. Gelatin hasil ekstraksi dianalisis dengan FTIR dan SDS-PAGE. Sintesis silika mesopori dilakukan dengan menambahkan larutan TEOS sebagai sumber silika kedalam larutan gelatin dan diaduk selama 24 jam. Larutan gel yang terbentuk kemudian dimasukkan kedalam *autoclave* dan dipanaskan pada temperatur 100 °C selama 24 jam. Hasil padatan dikalsinasi pada temperatur 550 °C selama 5 jam. Silika mesopori dikarakterisasi dengan FTIR, XRD, TEM, GSA dan uji keasaman. Sampel silika mesopori kemudian direndam dalam larutan garam prekursor Cr ($\text{Cr}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$) selama 24 jam, selanjutnya dikeringkan dan direduksi dengan gas H_2 sehingga didapatkan katalis Cr/SM. Katalis Cr/SM dikarakterisasi dengan SEM-EDS, GSA dan uji keasaman serta dilakukan uji aktivitas katalis dalam hidrorengkah pelumas bekas. Rasio berat katalis/umpan pelumas bekas adalah 1/75, 1/50, dan 1/25 (b/b). Produk cair hasil hidrorengkah dianalisis dengan menggunakan GC-MS.

Hasil penelitian menunjukkan bahwa gelatin dengan berat molekul yang menandakan adanya kolagen rantai α terdapat pada gelatin hasil perendaman asam asetat selama 3 hari dengan distribusi berat molekul 83-182 kDa. Silika mesopori hasil sintesis memiliki diameter pori 3,42 nm, luas permukaan spesifik 279,06 m^2/g , dan volume pori 0,46 cm^3/g . Katalis Cr/SM memiliki diameter pori, luas permukaan spesifik, volume pori berturut-turut adalah 3,41 nm, 233,77 m^2/g dan 0,42 cm^3/g . Hidrorengkah pelumas bekas dengan katalis Cr/SM(1/75) menghasilkan produk cair terbanyak yaitu 37,12% (b/b) dengan selektivitas fraksi bensin sebesar 13,73% (b/b) dan fraksi solar sebesar 16,90% (b/b).

Kata kunci: gelatin, silika mesopori, impregnasi, hidrorengkah, pelumas

SYNTHESIS OF MESOPOROUS SILICA BY USING GELATIN TEMPLATE FROM BOVINE BONE AND IMPREGNATION Cr FOR HYDROCRACKING CATALYST OF USED LUBRICANT OIL

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ABSTRACT

The synthesis of mesoporous silica (MS) by using gelatin template from bovine bone and impregnation of Cr for hydrocracking catalyst of used lubricant oil had been carried out. Extraction of gelatin from the bovine bone was done by using a combined method of acids and bases. Bovine bone was pretreated with a solution of 4% acetic acid for 3, 6, and 9 days, 0.1 M sodium hydroxide for 24 hours and 1.0 M hydrochloric acid for 1 hour. Gelatin extracted was analyzed by FTIR and SDS-PAGE. Synthesis of mesoporous silica was done by adding a solution of TEOS as silica source into the gelatin solution and stirred for 24 hours. The formed gel solution was filled into autoclave and hydrothermally treated at 100 °C for 24 hours. The products was calcined at 550 °C for 5 hours. Mesoporous silica was characterized by FTIR, XRD, TEM, GSA and acidity test. Mesoporous silica samples then treated in a solution of Cr salt precursor ($\text{Cr}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$) for 24 hours, then dried and reduced with H_2 gas to obtain Cr/SM catalyst. Cr/SM catalyst characterized by SEM-EDS, GSA and acidity test as well as test the activity of the catalyst in the hydrocracking lubricant oil. The weight ratio of catalyst/feed lubricant oil was 1/75, 1/50, and 1/25 wt. The results of liquid product hydrocracking was analyzed by GC-MS.

The results showed that the gelatin with a molecular weight that indicate the presence of α chain collagen contained in gelatin results of pretreated acetic acid for 3 days with a molecular weight distribution 83-182 kDa. Synthesized mesoporous silica has a pore diameter of 3.42 nm, the specific surface area of 279.06 m^2/g , and a pore volume of 0.46 cm^3/g . Cr/SM catalyst has a pore diameter, specific surface area, pore volume respectively 3.41 nm, 233.77 m^2/g and 0.42 cm^3/g . The lubricant oil hydrocracking using Cr/SM(1/75) catalyst produced highest liquid products of 37.12% (w/w) with selectivity for gasoline fraction was 13.73% (w/w) and diesel fraction was 16.90% (w/w).

Keywords: gelatin, mesoporous silica, impregnation, hydrocracking, lubricant