



SINTESIS KATALIS Ce-SILIKA MESOPORI DAN PENENTUAN UMUR KATALIS PADA HIDRORENGKAH PELUMAS BEKAS

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INTISARI

Telah dilakukan sintesis katalis Ce-silika mesopori (Ce-SM) dan penentuan umur katalis untuk hidrorengkah pelumas bekas. Tujuan penelitian adalah mempelajari karakter dan umur katalis Ce-SM untuk proses hidrorengkah pelumas bekas. Silika mesopori disintesis menggunakan *tetraethyl orthosilane* (TEOS) sebagai sumber silika dan gelatin tulang sapi sebagai cetakan. TEOS dan gelatin diaduk selama 24 jam kemudian dimasukkan kedalam *autoclave* dan dipanaskan pada suhu 100 °C selama 24 jam, selanjutnya dikalsinasi pada suhu 450 °C selama 5 jam. Karakterisasi silika (SM) dilakukan dengan menggunakan FT-IR, TEM, dan *GSA (Gas Sorption Analyzer)*. Logam Ce diimpregnasikan pada SM dengan menggunakan larutan garam $Ce(NO_3)_3$ kemudian direduksi menggunakan gas H_2 pada suhu 450 °C dan diperoleh katalis Ce-SM. Karakterisasi Ce-SM dilakukan menggunakan FT-IR, TEM, SEM-EDS, dan GSA. Penentuan umur katalis Ce-SM pada hidrorengkah pelumas bekas dilakukan secara berulang dan fraksi cair yang didapat dianalisis komposisinya menggunakan GC-MS.

Hasil penelitian menunjukkan bahwa silika mesopori berhasil disintesis dengan diameter pori 3,43 nm, luas permukaan 286,45 m²/g dan volume pori 0,44 cm³/g. Katalis Ce-SM memiliki diameter pori 3,83 nm, luas permukaan 260,99 m²/g dan volume pori 0,42 cc/g. Hasil fraksi cair hidrorengkah pelumas bekas secara berulang sebanyak 3 kali adalah 21,42, 17,23, dan 10,54% (b/b) berturut-turut untuk pengulangan 1, 2 dan 3 kali dimana waktu perengkahan adalah 2,5 jam/uji. Melalui regresi linear hubungan persentase produk cair versus waktu uji diperoleh umur katalis Ce-SM sebesar 12,53 jam.

Kata kunci: Hidrorengkah, pelumas bekas, silika mesopori, gelatin, umur katalis



SYNTHESIS OF Ce-MESOPOROUS SILICA AND ITS LIFETIME DETERMINATION FOR THE HYDROCRACKING OF USED LUBRICANT

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ABSTRACT

The synthesis of Ce-mesoporous silica (Ce-MS) and its lifetime determination for the hydrocracking of used lubricant has been done. The purpose of this research was to study the character and life-time of Ce-MS in the process of waste lubricant hydrocracking. Mesoporous silica was synthesized using tetraethyl orthosilane (TEOS) as a precursor of silica and gelatin extracted from bovine bone as a template. TEOS and gelatin was mixed for 24 hours and heated using autoclave at the temperature of 100 °C then calcinated at the temperature of 450 °C for 5 hours. The characterization of mesoporous silica (MS) was done using FTIR, TEM, and GSA. Cerium was impregnated using $\text{Ce}(\text{NO}_3)_3$ solution and reduced using H_2 gas at the temprature of 450 °C. The Ce-MS catalyst then analyzed using FT-IR, TEM, SEM-EDS, and GSA (Gas Sorption Analyzer). The determination of life-time of Ce-MS was done by using the catalyst in hydrocracking of waste lubricant 3 times repetitively, and the liquid fraction produced from the process was analyzed using GC-MS.

The results showed that mesoporous silica was synthesized successfully with a pore diameter of 3.43 nm, surface area of 286/45 m^2/g , and pore volume of 0.44 cm^3/g . Ce-SM catalyst was synthesized with a pore diameter of 3,83 nm, surface area of 260.99 m^2/g , and pore volume of 0.46 cc/g . liquid fraction produced from the waste lubricant hydrocracking that was 21.42, 17.23 and 10.54% for the first, second, and third repetition respectively for 2.5 hours per 1 process of hydrocracking. Lifetime of Ce-MS catalyst was determined using linear regression of liquid fraction persentage vs hydrocracking time, resulting 12.53 hours.

Keywords: Hydrocracking, waste lubricant, mesoporous silica, catalyst life-time