

PYROLYSIS OF CASSAVA BAGASSE INTO BIO-OIL USING Ni/NZA CATALYSTS

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Abstract - Cassava bagasse is a solid tapioca industry waste that can be used as an energy source. In this study, cassava bagasse was pyrolysed to produce bio-oil and studied the effect of Ni/NZA catalysts on yield, heating value and distribution of bio-oil products. The making of Ni/NZA catalyst starts with the process of activating natural zeolite to produce natural zeolite activated (NZA). Furthermore, impregnation of Ni metals in NZA with Ni levels 1, 2 and 3% w/w (Ni/NZA). The next step is calcination, oxidation and reduction. Cassava is peeled, shredded, washed, filtered and dried and then mashed and screened with a 60 and 80 mesh sieve to obtain cassava bagasse biomass with a size of -60+80 mesh. 50 grams of cassava bagasse with 500 ml silinap and 1.5 g Ni/NZA catalyst are pyrolyzed at 320°C with nitrogen gas flow of 80 mL/min. Bio-oil products are analyzed by the heating value and distribution of the products. The yield of bio-oil obtained on pyrolysis using 0% Ni/NZA was 54.27% and pyrolysis using 2% Ni/NZA obtained the highest yield of 61.87%. The highest bio-oil heating value was obtained in pyrolysis using 0% Ni/NZA which is 46.78 MJ/kg and lower with increasing Ni levels in NZA. The results of GC-MS analysis of the bio-oil products showed that the use of 1% Ni/NZA catalyst significantly increased the percent area of several components i.e. 2,4,4-trimethyl-1-Pentene, 2,5-dimethyl-2,4-Hexadiene, and 2,4,4-trimethyl-2-Pentene and decreases the percent area of some other components i.e. 1-bromo-3-methyl-Cyclohexane, 2-methyl-1-Propene, tetramer, 1-(1,1-dimethylethoxy)-3-methyl-Cyclohexene and 3-(3,3-dimethylbutyl)-Cyclohexanone.

Keywords: bio-oil, cassava bagasse, Ni/NZA catalyst, pyrolysis

PIROLISIS AMPAS UBI KAYU MENJADI BIO-OIL MENGGUNAKAN KATALIS Ni/NZA

Abstrak- Ampas ubi kayu merupakan limbah padat industri tapioka yang dapat dimanfaatkan sebagai sumber energi. Pada penelitian ini akan dilakukan pirolisis ampas ubi kayu untuk menghasilkan bio-oil dan dipelajari pengaruh kadar pengembunan logam Ni pada NZA terhadap yield, nilai kalor dan distribusi produk bio-oil. Pembuatan katalis Ni/NZA dimulai dengan proses aktivasi zeolit alam sehingga dihasilkan natural zeolite activated (NZA). Selanjutnya impregnasi logam Ni pada NZA dengan kadar pengembunan Ni 1, 2, dan 3% b/b terhadap NZA (Ni/NZA). Langkah berikutnya dilakukan kalsinasi, oksidasi dan reduksi. Ubi kayu dikupas, diparut, dicuci, disaring, dikeringkan, dihaluskan dan disaring dengan ayakan 60 dan 80 mesh sehingga diperoleh biomassa ampas ubi kayu dengan ukuran -60+80 mesh. Ampas ubi kayu sebanyak 50 gram beserta 500 ml silinap dan 1,5 gram katalis Ni/NZA dipirolisis pada suhu 320°C dengan mengalirkan gas nitrogen 80 mL/menit. Produk bio-oil dianalisis nilai kalor dan distribusi produknya. Yield bio-oil yang diperoleh pada pirolisis menggunakan NZA tanpa pengembunan Ni adalah 54,27% dan diperoleh yield tertinggi 61,87% pada pirolisis menggunakan NZA dengan pengembunan Ni 2%. Nilai kalor bio-oil tertinggi diperoleh pada pirolisis menggunakan 0% Ni/NZA yaitu 46,78 MJ/kg dan semakin rendah dengan meningkatnya kadar pengembunan Ni pada NZA. Hasil analisis GC-MS dari bio-oil menunjukkan bahwa pengembunan 1% Ni pada NZA meningkatkan persen area beberapa komponen yaitu 2,4,4-trimethyl-1-Pentene, 2,5-dimethyl-2,4-Hexadiene, dan 2,4,4-trimethyl-2-Pentene serta menurunkan persen area beberapa komponen yaitu 1-bromo-3-methyl-Cyclohexane, 2-methyl-1-Propene, tetramer, 1-(1,1-dimethylethoxy)-3-methyl-Cyclohexene dan 3-(3,3-dimethylbutyl)-Cyclohexanone.

Kata kunci : bio-oil, ampas ubi kayu, katalis Ni/NZA, pirolisis