Pengaruh tekanan gas hidrogen terhadap karakteristik biofuel pada reaksi hidrogenasi fraksi non-oksigenat bio-oil = The effects of hydrogen gas pressure on biofuel characteristic in hydrogenation reaction of non-oxygenated fraction of bio-oil

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Abstrak

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Hidrogenasi dilakukan terhadap fraksi non-oksigenat bio-oil hasil slow co-pyrolysis bonggol jagung dan plastik polipropilena. Dalam reaksi hidrogenasi, terjadi proses adisi gas hidrogen pada ikatan rangkap bio-oil sehingga diperoleh biofuel dengan karakteristik berupa viskositas, disstribusi berat molekul, dan branching index yang kemudian dibandingkan dengan diesel komersial. Penjenuhan dengan hidrogenasi dilakukan dalam suatu tangki berpengaduk 300mL dengan jenis down-flow 45o pitched blade turbine pada tekanan rendah akibat dominasi bio-oil fasa cair Konfigurasi tersebut mampu menarik dan mempertemukan gas hidrogen dengan bio-oil dan katalis berupa Ni/Al2O3 yang memiliki selektivitas yang baik serta mampu memberikan yield yang tinggi. Percobaan dilakukan pada berbagai variasi tekanan gas hidrogen untuk menganalisis hubungan kedua variabel tersebut terhadap karakteristik biofuel yang dihasilkan. Variabel lain berupa durasi reaksi dikontrol selama 2 jam, sedangkan laju alir gas hidrogen dan temperatur hidrogenasi disesuaikan dengan nilai tekanan gas hidrogen. Pada variasi tekanan gas hidrogen bernilai antara 4 hingga 10 bar, peningkatan tekanan gas hidrogen menghasilkan biofuel dengan penurunan persentase senyawa alkena dari 4,14% hingga 0,00%, namun terjadi peningkatan nilai branching index dari 1,29 hingga 1,56, distribusi berat molekul, dan viskositas dari 9,06 hingga 10,86 cSt yang semakin menjauhi bahan bakar komersial.<hr>
ABSTRACT
Hydrogenation is implemented on non-oxygenated fraction of bio-oil produced from slow co-pyrolysis of corncob and popypropylene plastic. The process is conducted by addition of hydrogen gas on bio-oil double bonds occured to produce biofuel whose quality is compared to those of commercial diesel fuel which is characterized by its viscosity, molecular weight distribution and branching number. The saturation process is conducted in 300 mL stirred tank reactor with down-flow 45o pitched blade turbine impeller operated in low pressure due to the domination of liquid phase of bio-oil. This configuration enables pullout and mixing of hydrogen gas with bio-oil and catalyst. Ni/Al2O3 catalyst is used to obtain high selectivity and yield of hydrogenation reaction. The experiment is performed on several variation of hydrogen gas pressure to analyze their effects on characteristics of produced biofuel. The hydrogenation duration is controlled in 2 hours, while the hidrogen gas flow and hydrogenation temperatur are adjusted by the hydrogenation gas pressure. At the low pressure of hydrogen gas range from 4 to 10 bar, the increasing of hydrogen gas pressure produces biofuel with decreasing alkene compound from 4.14% to 0.00%, yet has increasing branching index from 1.29 to 1.56, low molecular weight distribution, and viscosity from 9.06 to 10.86 cSt which move further from commercial fuel characteristics.