Sintesis solar terbarukan dari minyak nabati melalui hidrodeoksigenasi berkatalis logam nanokristal berpenyangga = Synthesis of renewable diesel from vegetable oils through hydrodeoxygenation over supported metal nanocrystal catalysts

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Abstrak

[ABSTRAK
Industri bahan bakar bio berkembang dengan cepat sebagai konsekuensi dari naiknya harga minya dan meningkatnya kepedulian terhadapa perubahan iklim global. Produksi biodiesel dari transesterifikasi minyak nabati saat ini merupakan rute yang utama untuk menghasilkan bahan bakar nabati (BBN) untuk mesin diesel. Namun, biodiesel memiliki viskositas tinggi, titik kabaut dan tuang yang tinggi, emisi nitrogen oksida (NOx) yang lebih tinggi, densitas energi rendah dan keausan injektor/mesin tinggi. Beberapa rute telah dicoba untuk mengurangi viskositas, seperti blending minyak nabati dengan bahan bakar diesel, mikroemulsi dengan alkohol, pirolisis dan hidrodeoksigenasi (HDO). Solar terbarukan melalui HDO dapat dihasilkan dari beragam bahan baku minyak nabati seperti minyak sawit dan minyak jarak pagar tanpa mengorbankan kualitas bahan bakar. Reaksi pembentukan solar terbarukan melalui HDO minyak nabati melibatkan katalis untuk menurunkan energi aktivasi reaksi dan meningkatkan selektifitasnya. Jenis katalis yang digunakan didalam studi ini adalah katalis berbasi Pd dan berbasis NiMo yang disanggakan pada ZAL atau C. Metode microwave polyol process (MP) cocok untuk preparasi katalis berbasis Pd sedangkan metode rapid cooling (RC) cocok untuk preparasi katalis berbasis NiMo. HDO asam oleat sebagai senyawa model, minyak sawit dan minyak jarak pagar dilakukan pada suhu 375°C dan 400°C dengan tekanan H2 15 bar didalam reaktor autoclave 250 ml semibatch berpengaduk. Didalam HDO, katalis Pd/ZAL-1 selektif terhadap jalur dekarboksilasi sedangakan katalis NiMo/ZAL selektif terhadap jalur dekarboksilasi dan dekarbonilasi katalitik. Soalr terbarukan yang dihasilkan dari HDO memiliki densitas dan viskositas yang sesuai sesuai dan indeks setana yang lebih tinggi disertai dengan kesetaraan dalam kualitasnya dengan solar komersial turunan minyak bumi namun sedikit lebih rendah daripada solar terbarukan komersial (NExBTL®).;
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ABSTRACT
The biofuels industry is growing rapidly as a result of high petroleum prices and increasing concerns about global climate change. Biodiesel production from trans-esterification of vegetable oils is currently the primary route for production of diesel engine biofuels from vegetable oils. However, biodiesel still has higher viscosity, higher cloud point and pour point, higher nitrogen oxides (NOx) emissions, lower energy density, and higher injector/engine wear. Several routes have been tried for reducing this viscosity, such as diluted vegetable oil with diesel fuel, microemulsification with alcohols, pyrolysis and hydrodeoxygenation (HDO). Renewable diesel through HDO can be produced from many kind of vegetable oil feeed stock such as palm oil (edible oil) and jatropha curcas (non-edible oil)without compromising fuel quality. Forming reaction of renewable diesel through HDO vegetable oil involves catalyst to decrease the activation energy of the reaction and increase its selectivity. The type of catalyst used in this study is Pd and NiMo supported

on ZAL or C. Microwave polyol method (MP) is suitable for preparation of Pd-based catalyst while rapid cooling method (RC) is suitable for preparation of NiMo-based catalyst. The HDO of oleic acid as model compound, palm oil and jatropha curcas oil were carried out at temperature of 375°C and 400°C with H2 pressure of 15 bar in a 250 mL semibatch stirred autoclave reactor. In HDO, Pd/ZAL-1 catalyst was selective to decarboxylation route while NiMo/ZAL was selective to decarboxylation and catalytic decarbonilation. Renewable diesel synthesized through HDO have suitable density and viscosity and quite high cetane index with similar in their quality with comercial diesel derived from crude oil but slightly lower than comercial renewable diesel (NExBTL®).;The biofuels industry is growing rapidly as a result of high petroleum prices and increasing concerns about global climate change. Biodiesel production from trans-esterification of vegetable oils is currently the primary route for production of diesel engine biofuels from vegetable oils. However, biodiesel still has higher viscosity, higher cloud point and pour point, higher nitrogen oxides (NOx) emissions, lower energy density, and higher injector/engine wear. Several routes have been tried for reducing this viscosity, such as diluted vegetable oil with diesel fuel, microemulsification with alcohols, pyrolysis and hydrodeoxygenation (HDO). Renewable diesel through HDO can be produced from many kind of vegetable oil feeed stock such as palm oil (edible oil) and jatropha curcas (non-edible oil)without compromising fuel quality. Forming reaction of renewable diesel through HDO vegetable oil involves catalyst to decrease the activation energy of the reaction and increase its selectivity. The type of catalyst used in this study is Pd and NiMo supported on ZAL or C. Microwave polyol method (MP) is suitable for preparation of Pd-based catalyst while rapid cooling method (RC) is suitable for preparation of NiMo-based catalyst. The HDO of oleic acid as model compound, palm oil and jatropha curcas oil were carried out at temperature of 375°C and 400°C with H2 pressure of 15 bar in a 250 mL semibatch stirred autoclave reactor. In HDO, Pd/ZAL-1 catalyst was selective to decarboxylation route while NiMo/ZAL was selective to decarboxylation and catalytic decarbonilation. Renewable diesel synthesized through HDO have suitable density and viscosity and quite high cetane index with similar in their quality with comercial diesel derived from crude oil but slightly lower than comercial renewable diesel (NExBTL®)., The biofuels industry is growing rapidly as a result of high petroleum prices and increasing concerns about global climate change. Biodiesel production from trans-esterification of vegetable oils is currently the primary route for production of diesel engine biofuels from vegetable oils. However, biodiesel still has higher viscosity, higher cloud point and pour point, higher nitrogen oxides (NOx) emissions, lower energy density, and higher injector/engine wear. Several routes have been tried for reducing this viscosity, such as diluted vegetable oil with diesel fuel, microemulsification with alcohols, pyrolysis and hydrodeoxygenation (HDO). Renewable diesel through HDO can be produced from many kind of vegetable oil feeed stock such as palm oil (edible oil) and jatropha curcas (non-edible oil)without compromising fuel quality. Forming reaction of renewable diesel through HDO vegetable oil involves catalyst to decrease the activation energy of the reaction and increase its selectivity. The type of catalyst used in this study is Pd and NiMo supported on ZAL or C. Microwave polyol method (MP) is suitable for preparation of Pd-based catalyst while rapid cooling method (RC) is suitable for preparation of NiMo-based catalyst. The HDO of oleic acid as model compound, palm oil and jatropha curcas oil were carried out at temperature of 375°C and 400°C with H2 pressure of 15 bar in a 250 mL semibatch stirred autoclave reactor. In HDO, Pd/ZAL-1 catalyst was selective to decarboxylation route while NiMo/ZAL was selective to decarboxylation and catalytic decarbonilation. Renewable diesel synthesized through HDO have suitable density and viscosity and quite high cetane index with similar in their quality with comercial diesel derived from crude oil but slightly lower

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