Pembuatan bio oil dari ampas tebu melalui pirolisis gelombang mikro = Microwave pyrolysis of sugarcane bagasse for bio oil production

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Abstrak

[ABSTRAK
Deposit ampas tebu di Indonesia yang mencapai 8,5 juta ton per tahun menjadikan biomassa ini potensial untuk dikembangkan sebagai pensubstitusi bahan bakar minyak berbasis crude oil. Gelombang mikro merupakan salah satu metode pemanasan yang lebih efisien untuk mempirolisis biomassa, karena metode ini memanfaatkan prinsip konversi energi dan partikel biomassa mengalami pemanasan volumetrik. Ampas tebu dipirolisis dengan variasi daya gelombang mikro sebesar 380, 620, dan 850 Watt dan variasi bio-char dalam umpan sebanyak 0, 10, dan 20%. Karakterisasi yang dilakukan meliputi profil suhu pirolisis, yield produk pirolisis, dan kandungan senyawa di bio-oil dengan metode GC/MS. Peningkatan daya gelombang mikro akan meningkatkan laju pemanasan dan suhu pirolisis ampas tebu, walaupun efeknya tidak terlalu signifikan jika umpannya tidak ditambahkan bio-char. Penambahan bio-char sebagai absorber gelombang mikro secara signifikan meningkatkan laju pemanasan dan suhu pirolisis ampas tebu. Yield bio-oil maksimum, yaitu 42,75 dan 42,40%, diperoleh pada laju pemanasan 805oC/menit dan suhu pirolisis 515oC serta laju pemanasan 59oC/menit dan suhu pirolisis 398oC. Kondisi operasi untuk memperoleh kedua parameter laju pemanasan dan suhu pirolisis tersebut adalah daya gelombang mikro sebesar 380 Watt dengan 20% kandungan bio-char di umpan serta daya gelombang mikro sebesar 850 Watt tanpa kandungan bio-char di umpan. Bio-oil yang diperoleh dari pirolisis ampas tebu yang umpannya mengandung bio-char ternyata mengandung lebih banyak senyawa non-oksigenat dan tidak mengandung PAH. Namun, senyawa non-oksigenat tersebut juga memiliki kandungan rantai karbon panjang (C22+) yang cukup tinggi.
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ABSTRACT
Sugarcane bagasse waste in Indonesia reaching 8.5 million tons per year is potential to be developed as a substituent for petroleum-based fuel oil. Microwave is an efficient heating method for biomass pyrolysis, since this method utilizes the principle of energy conversion and biomass undergoes volumetric heating. Sugarcane bagasse was pyrolyzed at the microwave power variation of 380, 620, and 850 Watt and bio-char loading variation of 0, 10, and 20%. Characterizations were conducted on the pyrolysis temperature profile, pyrolysis products yield, and bio-oil content by GC/MS method. The microwave pyrolysis of sugarcane bagasse gave results that increasing microwave power would increase the heating rate and pyrolysis temperature, however this phenomenon was insignificant if the feed contained no bio-char. The addition of bio-char as microwave absorber in the feed significantly increased the heating rate and temperature pyrolysis. The highest bio-oil yields, i.e. 42.75 and 42.40%, were obtained at the heating rate of 805oC/min and pyrolysis temperature of 515oC and heating rate of 59oC/min and pyrolysis temperature of 398oC. Those pyrolysis heating rates and temperatures were achieved at the microwave power of 380 Watt with bio-char loading of 20% and the microwave power of 850 Watt with no bio-char loading. Bio-oil derived from the microwave pyrolysis of sugarcane bagasse which had no bio-char loading in fact contained more

non-oxygenated compounds and less PAHs. However, those non-oxygenated compounds have a quite high content of long carbon chains (C22+).;Sugarcane bagasse waste in Indonesia reaching 8.5 million tons per year is potential to be developed as a substituent for petroleum-based fuel oil. Microwave is an efficient heating method for biomass pyrolysis, since this method utilizes the principle of energy conversion and biomass undergoes volumetric heating. Sugarcane bagasse was pyrolyzed at the microwave power variation of 380, 620, and 850 Watt and bio-char loading variation of 0, 10, and 20%. Characterizations were conducted on the pyrolysis temperature profile, pyrolysis products yield, and bio-oil content by GC/MS method. The microwave pyrolysis of sugarcane bagasse gave results that increasing microwave power would increase the heating rate and pyrolysis temperature, however this phenomenon was insignificant if the feed contained no bio-char. The addition of bio-char as microwave absorber in the feed significantly increased the heating rate and temperature pyrolysis. The highest bio-oil yields, i.e. 42.75 and 42.40%, were obtained at the heating rate of 805oC/min and pyrolysis temperature of 515oC and heating rate of 59oC/min and pyrolysis temperature of 398oC. Those pyrolysis heating rates and temperatures were achieved at the microwave power of 380 Watt with bio-char loading of 20% and the microwave power of 850 Watt with no bio-char loading. Bio-oil derived from the microwave pyrolysis of sugarcane bagasse which had no bio-char loading in fact contained more non-oxygenated compounds and less PAHs. However, those non-oxygenated compounds have a quite high content of long carbon chains (C22+)., Sugarcane bagasse waste in Indonesia reaching 8.5 million tons per year is potential to be developed as a substituent for petroleum-based fuel oil. Microwave is an efficient heating method for biomass pyrolysis, since this method utilizes the principle of energy conversion and biomass undergoes volumetric heating. Sugarcane bagasse was pyrolyzed at the microwave power variation of 380, 620, and 850 Watt and bio-char loading variation of 0, 10, and 20%. Characterizations were conducted on the pyrolysis temperature profile, pyrolysis products yield, and bio-oil content by GC/MS method. The microwave pyrolysis of sugarcane bagasse gave results that increasing microwave power would increase the heating rate and pyrolysis temperature, however this phenomenon was insignificant if the feed contained no bio-char. The addition of bio-char as microwave absorber in the feed significantly increased the heating rate and temperature pyrolysis. The highest bio-oil yields, i.e. 42.75 and 42.40%, were obtained at the heating rate of 805oC/min and pyrolysis temperature of 515oC and heating rate of 59oC/min and pyrolysis temperature of 398oC. Those pyrolysis heating rates and temperatures were achieved at the microwave power of 380 Watt with bio-char loading of 20% and the microwave power of 850 Watt with no bio-char loading. Bio-oil derived from the microwave pyrolysis of sugarcane bagasse which had no bio-char loading in fact contained more non-oxygenated compounds and less PAHs. However, those non-oxygenated compounds have a quite high content of long carbon chains (C22+).]