ABSTRAK

PENGARUH PUTARAN DAN LAMA WAKTU TOREFAKSI TERHADAP KUALITAS PELET TANDAN KOSONG KELAPA SAWIT

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Indonesia memiliki potensi tanaman kelapa sawit yang berlimpah. Limbah tandan kosong kelapa sawit (TKKS) dapat dimanfaatkan untuk dijadikan energi terbarukan berupa pelet. Bioenergi pelet TKKS memiliki kendala untuk digunakan sebagai bahan bakar yaitu pada proses penyimpanan pelet bisa mengalami dekomposisi anaerobik yang akan meningkatkan suhu dan bisa memicu terjadinya kebakaran bahan. Selain itu, nilai kalor yang rendah memerlukan suatu metode untuk meningkatkan kualitas pelet TKKS melalui torefaksi, yang merupakan suatu proses degradasi termal dengan laju pemanasan rendah. Torefaksi dilakukan pada temperatur 200–300°C dengan membatasi udara pada tabung torefaksi. Pada proses torefaksi, putaran dan lama waktu penting untuk diperhatikan karena memberikan pengaruh terhadap kualitas pelet yang dihasilkan. Tujuan dari penelitian ini adalah mengetahui pengaruh RPM dan lama waktu proses torefaksi terhadap kualitas pelet seperti kadar air, kadar abu, nilai kalor dan kandungan ligneselulosa.

Penelitian dilakukan pada bulan Juni sampai dengan Agustus 2019 di Lab. Daya Alat dan Mesin Pertanian, Jurusan Teknik Pertanian, Fakultas Pertanian, Universitas Lampung. Eksperimen dilakukan dengan kombinasi perlakuan lama waktu torefaksi (20, 30, dan 45 menit) dan kecepatan putar reaktor torefaksi (16, 31, 37 RPM) dengan 3 kali ulangan. Setiap unit percobaan menggunakan 300 gram pelet yang dipanaskan dalam reaktor torefaksi yang diisi dengan 1,5 kg pasir. Pengukuran dilakukan terhadap *bulk density*, massa *density*, rendemen torefaksi, nilai kalor, kadar air, kadar abu, kadar *volatil*, *hidropobicity* dan kandungan ligneselulosa.

Hasil dari penelitian ini adalah proses torefaksi menghasilkan nilai rendemen antara 80,11% - 87,11%, nilai rata-rata *bulk density* pada pelet TKKS setelah proses torefaksi sebesar 0,35g/ml sedangkan sebelum torefaksi sebesar 0,43 g/cm^3, nilai massa *densit*y pada pelet TKKS sebelum torefaksi sebesar 1,49 g/cm^3, setelah torefaksi nilai massa *density* turun menjadi 1,25 g/cm^3. Nilai kadar air rata-rata pelet torefaksi sebesar 0,40%, turun dari kadar air pelet TKKS sebelum torefaksi sebesar 6,86%. Kandungan kadar abu pelet TKKS sebelum ditorefaksi sebesar 12,75% setelah proses torefaksi nilai rata-rata kadar abu mencapai 16,36% dan kandungan *volatile* sebelum torefaksi sebesar 87,24% dan setelah torefaksi sebesar 83,63%. Kandungan hemiselulosa pada pelet TKKS sebelum torefaksi sebesar 26%, setelah proses torefaksi kandungan hemiselulosa menurun sebesar 25%-17%. Pelet sebelum torefaksi pelet hancur dalam waktu 1 menit di dalam air dan setelah torefaksi pelet tidak hancur dalam waktu 24 jam di dalam air.

Kata kunci : kelapa sawit, limbah, pelet, TKKS, torefaksi

ABSTRACT

THE EFFECT OF ROTATION AND DURATION OF TOREFACTION ON THE QUALITY OF PELLET FROM OIL PALM EMPTY FRUIT BUNCHES

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Indonesia has abundant oil palm potential. Oil palm empty fruit bunches (OPEFB) can be used as renewable energy in the form of pellets. Bioenergy of OPEFB pellets has problems to be used as fuel, namely during storage pellets may undergo anaerobic decomposition which will increase the temperature and can trigger a fire of the material. In addition, the low heating value requires a method to improve the quality of OPEFB pellets through torrefaction, which is a process of thermal degradation with a low heating rate. Torrefaction is carried out at a temperature of 200-300 ° C by restricting the air in the torrefaction reactor. In the torrefaction process, rotation and duration are important to consider because they have an influence on the quality of the pellets produced. The purpose of this study was to determine the effect of reactor speed and duration of the torrefaction process on the quality of pellets such as water content, ash content, calorific value, hydrophobicity and lignocellulose content.

The study was conducted in June to August 2019 in the Lab. Agricultural Power and Machinery, Department of Agricultural Engineering, Faculty of Agriculture, University of Lampung. Experiment was conducted with treatment combination of torrefaction duration (20, 30, and 45 minutes) and rotational speed of the reactor (16, 31, 37 RPM) with 3 replications. Each experimental unit used 300 grams of pellets that are heated to temperature 200-250^{o}C in a reactor filled with 1,5 kg of sand. Measurements were made for bulk density, mass density, torrefaction yield, pellet's heating value, moisture content, ash content, volatile content, hydropobicity and lignocellulose content.

The results of this study show that yield of torrefaction process are 80.11% - 87.11%. The average bulk density of OPEFB pellets after the torrefaction process is 0.35 g/ml while before the torrefaction is 0.43 g/cm^{3}, the mass density of OPEFB pellets before torefaction was 1.49 g/cm^{3}, after torrefaction the mass density value dropped to 1.25 g/cm^{3}. The average water content of the torrefied pellet was 0.40%, down from the moisture content of the OPEFB pellet before the torrefaction of 6.86%. The ash content of OPEFB pellet before torrefaction was 12.75% and after the torrefaction process increase to 16.36%. The volatile content before torrefaction was 87.24% and after torrefaction was 83.63%. Hemicellulose content in OPEFB pellets before torrefaction is 26%, and after torrefaction decreased to 25%-17%. Pellets before torrefaction are destroyed within 1 minute in water and after torrefaction pellets withstand within 24 hours in the water.

***Keywords**: oil palm, OPEFB, pellets, torrefaction, waste.*