

ABSTRAK

CO-FIRING BATUBARA SUB-BITUMINOUS B DAN TANDAN KOSONG KELAPA SAWIT TERTOREFAKSI: ANALISIS TERMOGRAVIMETRI, EFISIENSI PEMBAKARAN, EMISI DAN INDEKS *SLAGGING*

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Ketergantungan penggunaan bahan bakar fosil dan menipisnya persediaan bahan bakar fosil dalam satu dekade terakhir membuat pelaku energi mencari solusi energi alternatif. Penelitian ini menyajikan studi pembakaran bersama (*co-firing*) batubara sub-bituminous B dan tandan kosong kelapa sawit tertorefaksi menggunakan metode *pulverized coal* skala laboratorium dengan komposisi campuran tandan kosong kelapa sawit mencapai 30%. Sebelum melakukan pembakaran, dilakukan pengujian bahan meliputi *thermogravimetry*, kandungan abu dan *ash fusion temperature*. Pembakaran dilakukan untuk mengetahui temperatur dan efisiensi pembakaran serta pembentukan gas SO₂ dan NO_x. Hasil uji termogravimetri menunjukkan batubara sub-bituminous B mengalami gradien kehilangan massa tinggi pada temperatur 400-520°C senilai 65 µg/menit dan tandan kosong kelapa sawit tertorefaksi mengalami gradien kehilangan massa tinggi pada temperatur 200-400°C senilai 473 µg/menit. Peningkatan persentase tandan kosong kelapa sawit dalam *co-firing* telah menurunkan temperatur dan meningkatkan efisiensi pembakaran serta mereduksi SO₂ dan NO_x. *Excess air* pembakaran *single firing* batubara dan *co-firing* dapat mengurangi emisi CO, SO₂ dan NO_x. Komposisi kimia abu tandan kosong kelapa sawit banyak mengandung logam K₂O, Fe₂O₃, CaO dan Mg. Tandan kosong kelapa sawit tertorefaksi memiliki nilai AFT rendah dengan nilai *deformation temperature* (DT) 1005°C. Batubara sub-bituminous B memiliki nilai *deformation temperature* (DT) 1520°C. Hasil skenario perhitungan *slagging index* menggunakan indeks Rb/s, Rs, AFI, Ai dan SR diperoleh proporsi penggunaan tandan kosong kelapa sawit dalam sistem *co-firing* yang masih aman mencapai 20%.

Kata kunci: Batubara, Tandan Kosong Kelapa Sawit (TKKS), Torefaksi, *Co-firing*, Emisi, *Slagging*

ABSTRACT

STUDY OF CO-FIRING CHARACTERISTICS OF SUB-BITUMINOUS COAL AND TORREFACTION OIL PALM EMPTY FRUIT BUNCH (THERMOGRAVIMETRY, COMBUSTION EFFICIENCY, POLLUTANT EMISSIONS, SLAGGING INDEX)

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Dependence on the use of fossil fuels and the depletion of fossil fuel supplies in the last decade has made energy players look for alternative energy solutions. This study presents a study of co-firing of sub-bituminous coal B and torrefaction oil palm empty fruit bunches using the laboratory scale pulverized coal method with a mixture composition of empty palm fruit bunches reaching 30%. Prior to burning, material testing is carried out including thermogravimetry, ash content and ash fusion temperature. Combustion is carried out to determine the temperature and combustion efficiency as well as the formation of SO₂ and NO_x gases. The results of the thermogravimetric test showed that sub-bituminous coal B experienced a high mass loss gradient at a temperature of 400-520°C worth 65 µg/minute and torrefaction oil palm empty fruit bunches experienced a high mass loss gradient at a temperature of 200-400°C worth 473 µg/minute. The presence of empty palm oil bunches in co-firing has lowered temperature and increased combustion efficiency and reduced SO₂ and NO_x. Excess air for single firing coal and co-firing can reduce CO, SO₂ and NO_x emissions. The chemical composition of empty palm fruit bunch ash contains a lot of metal K₂O, Fe₂O₃, CaO and Mg. Torrefied empty fruit bunches of oil palm have a low AFT value with a deformation temperature (DT) of 1005°C. Sub-bituminous coal B has a deformation temperature (DT) value of 1520°C. The results of the slagging index calculation scenario use the Rb/s index. Rs, AFI, Ai and SR found that the proportion of using empty palm fruit bunches in the co-firing system is still safe, reaching 20%.

Keywords: Coal, Oil Palm Empty Fruit Bunch (EFB), Torrefaction, Co-firing, Emission, Slagging