ABSTRAK

KARAKTERISTIK EMISI PEMBAKARAN TANDAN KOSONG KELAPA SAWIT DENGAN CO-FIRING BATU BARA VARIASI AIR FUEL RATIO (AFR)

Oleh

Andreas Novendra Dwiyanto Marbun

Permintaan listrik yang terus meningkat mengakibatkan kenaikan permintaan batu bara. Permintaan batu bara terus meningkat karena pembangkitan daya masih bergantung pada batu bara. Selain itu efek gas rumah kaca paling tinggi diakibatkan dari pembangkit listrik berbahan bakar batu bara. Disisi lain biomassa dapat menjadi pengganti atau pendamping batu bara sebagai bahan bakar pembangkit listrik. Salah satu biomassa yang berpotensi adalah limbah tandan kosong kelapa sawit (TKKS). Sebagai pendamping batu bara (*co-firing*), TKKS dapat mengurangi laju emisi gas rumah kaca dan penggunaan batu bara pada pembangkit listrik. Penelitian c*o-firing* batu bara dan TKKS pada *pulverized burner* dilakukan untuk mengetahui dampak *co-firing* terhadap emisi pembakaran. Penelitian ini diawali dengan menyiapkan TKKS tertorefaksi dan batu bara dalam bentuk serbuk ukuran *mesh* 100. Perbandingan batu bara dan TKKS yang diamati adalah 80:20. Selanjutnya dilakukan pengujian pengaruh *air fuel ratio* (AFR) terhadap emisi *co-firing* yang dihasilkan. Emisi pembakaran diukur menggunakan *gas analyzer*. Hasil penelitian menunjukkan *co-firing* TKKS 20% dapat menurunkan kadar emisi CO 22,58% (1490 ppm), SO_2 14,96% (70 ppm) dan NO_2 10,49% (43 ppm). Analisis data yang dilakukan menunjukkan bahwa penambahan AFR mempengaruhi emisi pembakaran. Pada *co-firing* dengan AFR 30% emisi CO yang dihasilkan 4003 ppm, SO_2 298 ppm, dan NO_2 334 ppm.Hasil ini lebih baik dibandingkan dengan variasi tanpa *excess air*, *excess air* 10, dan 20%. *Co-firing* TKKS 20% dengan AFR 30% berhasil menurunkan emisi yang signifikan sekaligus menaikkan efisiensi pembakaran.

Kata Kunci : Biomassa, Pembakaran, Emisi, *Co-firing* , Biomassa

ABSTRACT

EMISSION CHARACTERISTICS OF OIL PALM EMPTY COMBUSTION WITH CO-FIRING VARIATION OF AIR FUEL RATIO (AFR)

By

Andreas Novendra Dwiyanto Marbun

The increasing electricity demand has led to a rise in coal demand. The demand for coal keeps increasing because power generation still relies on coal. Furthermore, the highest greenhouse gas effects are caused by coal-fired power generation. On the other hand, biomass can serve as a substitute or companion to coal as a fuel for power generation. One potential biomass is empty palm oil fruit bunch (EFB) waste. As a coal companion (co-firing), EFB can reduce the rate of greenhouse gas emissions and the use of coal in power generation. Research on coal and EFB co-firing in a pulverized burner was conducted to determine the impact of co-firing on combustion emissions. The study began by preparing torrefied EFB and coal in powder form with a mesh size of 100. The observed coal-to-EFB ratio was 80:20. Subsequently, tests were performed to examine the influence of the air-fuel ratio (AFR) on the emissions produced by co-firing. Combustion emissions were measured using a gas analyzer. The research results indicate that a 20% EFB co-firing can reduce CO emissions by 22.58% (1490 ppm), SO2 by 14.96% (70 ppm), and NO2 by 10.49% (43 ppm). Data analysis shows that the addition of AFR affects combustion emissions. In co-firing with a 30% AFR, the resulting CO emissions were 4003 ppm, SO2 was 298 ppm, and NO2 was 334 ppm. These results are better compared to variations without excess air, with 10% excess air, and with 20% excess air. Co-firing 20% EFB with a 30% AFR successfully reduced emissions significantly while increasing combustion efficiency.

Keywords: Biomass, Combustion, Emissions, Co-firing, Biomass