ABSTRAK

STUDI PENGARUH EXCESS AIR DAN RASIO CAMPURAN PADA CO-FIRING BATUBARA DAN TANDAN KOSONG KELAPA SAWIT BERBASIS COMPUTATIONAL FLUID DYNAMIC (CFD)

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Salah satu transformasi bahan bakar yang memungkinkan untuk mengurangi emisi Gas Rumah Kaca adalah mengkombinasikan (*co-firing*) batu bara dengan biomassa tertorefaksi pada pembakaran ketel uap *(boiler)* PLTU. Untuk mendapatkan titik optimal dari *co-firing* batu bara sub-bituminous B dan TKKS Tertorefaksi, dilakukan penelitian melalui simulasi mengingat banyaknya variabel yang perlu dipertimbangkan seperti variasi kehadiran *excess air* dan rasio campuran bahan bakar serta model tungku pembakaran (*burner)* yang digunakan. Simulasi pada penelitian ini menggunakan metode *Computational Fluid Dynamics* (CFD) dengan software *Ansys Fluent*. Tujuan penelitian ini adalah mengetahui pengaruh geometri dari burner, rasio campuran bahan bakar, dan kehadiran *excess air* terhadap distribusi temperatur dan emisi pembakaran. Rasio campuran TKKS tertotrefaksi ke dalam batu bara sub-bituminous B adalah 10%, 20% dan 30%. Kehadiran *excess air* yang ditentukan pada penelitian ini adalah sebesar 0%, 10%, 20% dan 30%. Temperatur rata-rata terendah ditemukan di bahan bakar BB-SBB 70% dengan tanpa kehadiran *excess air* yakni di 901 °C, dan temperatur rata-rata tertinggi ditemukan di bahan bakar BB-SBB 90% dengan *excess air* 30% yakni di 1172 °C. Konsentrasi CO dan HC terendah sekaligus CO_2 tertinggi ditemukan pada BB-SBB 70% dengan *excess air* 30% yakni CO 3197 ppm, HC 1,6 %, dan CO_2 1,6%. Penambahan TKKS-TRF pada bahan bakar berhasil menurunkan kadar SO_2 dan NOx pada outlet ruang bakar. Sedangkan penambahan *excess air* berdampak pada teroksidasinya SO_2 menjadi SO_3 dan meningkatnya NOx.

Kata kunci: torefaksi, *co-firing, excess air*, *Computational Fluid Dynamics*

ABSTRACT

STUDY OF THE EFFECT OF EXCESS AIR AND MIXING RATIO ON CO-FIRING OF COAL AND TERROEFACTED EMPTY FRUIT BUNCH BASED ON COMPUTATIONAL FLUID DYNAMIC

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One of the fuel transformations that makes it possible to reduce greenhouse gas emissions is combining (co-firing) coal with torrefaction biomass in the combustion of PLTU boilers. To obtain the optimal point for co-firing sub-bituminous B coal and torrefacted Empty Fruit Bunch (EFB), research was carried out through simulation considering the many variables that need to be considered, such as variations in the presence of excess water and the fuel mixture ratio as well as the burner model used. The simulation in this research uses the Computational Fluid Dynamics method with Ansys Fluent software. The aim of this research is to determine the effect of burner geometry, fuel mixture ratio, and the presence of excess air on temperature distribution and combustion emissions. The mixture ratio of torrefacted EFB and sub-bituminous B is 10%, 20% and 30%. The presence of excess air determined in this study was 0%, 10%, 20% and 30%. The lowest average temperature was found in 70% BB-SBB fuel with no excess air, namely at 901 °C, and the highest average temperature was found in 90% BB-SBB fuel with 30% excess air, namely at 1172 °C. The lowest CO and HC concentrations as well as the highest CO_2 were found at BB-SBB 70% with excess air of 30%, namely CO 3197 ppm, HC 1.6% and CO2 1.6%. The addition of TKKS-TRF to the fuel succeeded in reducing SO_2 and NOx levels at the combustion chamber outlet. SO_2, while the addition of excess water has an impact on decreasing SO_2 and increasing NOx.

Keywords: torrefacted EFB, co-firing, excess air, Computational Fluid Dynamics, HC