INTISARI

Analisis numerik dilakukan pada *Pulverized Coal* (PC) *Boiler* PLTU Bukit Asam Unit 4 dengan menggunakan delapan (8) variasi yaitu 100% batubara, *co-firing* biomassa berupa *hydro-thermal treatment empty fruit bunch* (HT-EFB), dengan persentase 5%, 10%, 15%, 20%, 25%, dan 30% serta 100% HT-EFB. Adapun aspek yang dikaji pada penelitian ini adalah: 1). Analisis kualitatif berupa kontur distribusi temperatur, 2). Analisis kualitatif berupa kontur distribusi dan vektor kecepatan, 3). Analisis kualitatif temperatur pada bagian *inlet* LTSH dan *outlet*, 4). Analisis emisi gas buang yang dihasilkan dari pembakaran *co-firing*, 5). Analisis dan evaluasi kualitas HT-EFB sebagai bahan bakar *co-firing*, 6) Analisis komposisi *co-firing* batubara dengan HT-EFB yang paling efektif.

Hasil dari simulasi numerik ini adalah distribusi temperatur *flue gas* dengan jangkauan 1300-2357 K pada daerah *furnace* diikuti kontur *fire ball* pada daerah *burner*. Bertambahnya persentase *co-firing* akan menurunkan temperatur pembakaran. Vektor kecepatan *flue gas* pada daerah *burner* membentuk aliran *swirl* dengan arah *clock-wise* yang seragam. Analisis temperatur *flue gas* memasuki modul LTSH menunjukkan *gap* terkecil 0,97992% pada kondisi 5% *co-firing* dengan nilai kalor 5432,25 kcal/kg dan *gap* terbesar sebesar 19,4088% pada kondisi 100% HT-EFB dengan nilai kalor 5000 kcal/kg. Analisis *gap* temperatur *outlet* antara data aktual *performance* dan *commissioning test* dibandingkan dengan data hasil simulasi menghasilkan *gap* terkecil sebesar 0,665% pada kondisi 5% *co-firing* dengan nilai kalor 5432,25 kcal/kg dan *gap* terbesar sebesar 20,683% pada kondisi 100% HT-EFB dengan nilai kalor 5000 kcal/kg. Emisi gas buang yang dihasilkan berupa CO_2, O_2, N_2, dan H_2O. kandungan CO_2 dan N_2 akan turun seiring bertambahnya persentase *co-firing*. Emisi berupa O_2 dan H_2O relatif kecil. Kecilnya O_2 pada gas buang menunjukkan pembakaran berlangsung sempurna. *Co-firing* batubara dengan HT-EFB efektif sampai dengan 30% persentase HT-EFB dalam campuran batubara tanpa perubahan operasi yang berarti.

Kata kunci : *Pulverized coal boiler*, CFD, *Co-firing* biomassa, Emisi gas buang.

ABSTRACT

Numerical analysis was performed on Pulverized Coal (PC) Boiler Bukit Asam Power Plant Unit 4 with eight (8) variation, such as 100% coal, hydro-thermal treatment empty fruit bunch (HT-EFB) biomass co-firing 5%, 10%, 15%, 20%, 25%, and 30% of percentage, and 100% HT-EFB. The aspects which were studied from this thesis are: 1). Qualitative analysis of temperature contour, 2). Qualitative analysis of velocity contour, 3). Qualitative analysis of temperature on LTSH and outlet area, 4). Analysis of emissions resulting from co-firing, 5). Analysis and evaluation of the quality of HT-EFB as a co-firing fuel, and 6). Analysis of the most effective composition of co-firing coal with HT-EFB.

The result of this numerical simulation form a flue gas flow with temperature range of 1300 – 2357 K on furnace followed by fire ball contour at each burner elevation. Increasing the percentage of co-firing will reduce the combustion temperature. The flue gas velocity vector in the burner area forms a swirl flow in a uniform clock-wise direction. Gap analysis on CFD vs actual data of LTSH resulted in 0,97992% smallest gap from 5% co-firing with calories 5432,25 kcal/kg and 19,4088% biggest gap from 100% HT-EFB with calories 5000 kcal/kg. Gap analysis on CFD vs actual data of outlet resulted in 0,665% smallest gap from 5% co-firing with calories 5432,25 kcal/kg and 20,683% biggest gap from 100% HT-EFB with calories 5000 kcal/kg. The resulting exhaust emissions are CO_2, O_2, N_2, and H_2O. CO_2 and N_2 content will decrease as the percentage of co-firing increases. Emissions in the form of O_2 and H_2O are relatively small. The small amount of O_2 in the exhaust gas indicates complete combustion. Co-firing of coal with HT-EFB is effective up to 30% percentage of HT-EFB in the coal mixture without significant operating changes.

Keyword : *Pulverized coal boiler*, CFD, *Biomass co-firing*, *Exhaust gas emissions*.