Comparison of temperature, radiation rate, heat loss, furnace and thermal efficiencies of different plates in the fbc combustion chamber

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ABSTRACT

The conversion of solid biomass waste into energy continues to be developed at this time to reduce dependence on fossil energy. Energy conversion can be carried out using several technologies commercialized by several industries, including the fluidized-bed combustor (FBC). This FBC technology has also been developed in several ways, such as the modification or unique modelling. In particular, the perforated plate modelling applied in this study is to provide excess air supply so that complete combustion can be achieved. In addition, modifying the perforated plate increases efficiency and radiation and reduces heat loss in the FBC combustion chamber. This research was conducted with combustion experiments using palm kernel shell (PKS), oil palm midrib (OPM), and empty fruit bunches (EFB) against different plates. Experimental results show that the maximum temperature achieved on the modified four guide plates is 975°C for PKS fuel, 850°C OPM, and 883°C EFB with 20%-70% excess air. The results of the highest furnace efficiency on the four guide plate modifications were 91.44% PKS, 73.48% OPM, and 77.63% EFB. Meanwhile, the highest efficiency recorded from modifying the four guide plates for each fuel was 84% PKS, 73% OPM and 74% EFB. The highest radiation rates were recorded at 7745.21 W/sec PKS, 5971.17 W/sec OPM, and 6356.12 W/sec EFB. The perforated plate modification applied in the FBC combustion chamber can reduce heat loss significantly compared to when implementing standard plates.

KEYWORDS

Biomass; Furnace efficiency; Heat loss; Radiation; Temperature; Thermal efficiency

ACKNOWLEDGEMENT

This research is supported by the KEMENRISTEK DIKTI and Higher Education Syiah Kuala University, Research institutions, and community services with contract number (166/UN11/SPK/PNBP/2021).