

Development of a bench-scale fluidized bed combustor (FBC) for coal and biomass combustion.

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Abstract

The high technological level of equipment for combustion of fuels, as well as the necessity for rational and efficient use of non-renewable energy resources, has resulted demanding requirements that must be fulfilled by equipment for energy production, via combustion. These requirements form the characteristics of Fluidized bed Combustor (FBC). The objective of this work is to design and fabricate a Circulating FBC for the combustion of coal and biomass and present the design criteria considered in the combustion process. The Designed FBC was then tested by combusting coal (Lafia Obi) and biomass (coconut shell) using the relevant ASTM guidelines. For coal combustion, the characteristic quantities measured from the bench-scale fluidized bed combustion include a mean NO_x emission of 455.35, 376.69, 323.35 and 277.35 ppm for a coal feed size of 10, 15, 20 and 25 mm respectively. NO_x emission from the combustion of coconut shell in fluidized bed is low and further reduced by the introduction of secondary air. Secondary air increases the recoverable energy level from this biomass, while average CO emission was 13,080 16,620 17,040 and 19,140 ppm for a coal feed size of 10, 15, 20 and 25mm. The temperature in the fluidized bed at $\geq 1100^{\circ}\text{C}$ was sustained.

Keywords: Combustion emissions; fluidized-bed combustion; Design; Lafia-Obi Coal Biomass; Temperature.

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