

## Modular and 3D-Design of a Fluidised Bed Boiler with Agricultural Residue for Steam Energy Production

Muyideen B. Balogun<sup>a,Ψ</sup>, Clement O. Folayan<sup>b</sup>, Dangana M. Kulla<sup>c</sup>, Fatai O. Anafi<sup>d</sup>, Samaila. Umaru<sup>e</sup> and Nua O. Omisanya<sup>f,g</sup>

<sup>a,b,c,d,e,f</sup>Department of Mechanical Engineering, Ahmadu Bello University, P.M.B 1045, Zaria, Kaduna State Nigeria;

<sup>g</sup>National Automotive Design and Development Council, P.M.B 320, Garki, Abuja, Nigeria;

<sup>a</sup>E-mail: balo.muyi@gmail.com;

<sup>b</sup>E-mail: clementfolayan@yahoo.com;

<sup>c</sup>E-mail: dmkulla2@yahoo.com;

<sup>d</sup>E-mail: fataianafi@yahoo.com;

<sup>e</sup>E-mail: bnumar@yahoo.com;

<sup>f,g</sup>E-mail: ominua@yahoo.com

<sup>Ψ</sup> Corresponding Author

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**Abstract:** *In this study, a miniature fluidised bed boiler for steam generation was designed and constructed. The boiler is made up of a steam drum, combustion chamber, downcomer and riser tubes as a heat exchanger, a non-return valve and superheater tube. Experimental investigation on the fuel distribution was carried in two-dimensional chamber with cross-section of 500 mm x 1000 mm and bed height of 77 mm, 47 mm and 27 mm. The results obtained from the performance evaluation of the fluidised bed boiler operated with corncob at constant feed rate of 6kg/h for various bed heights of 77 mm, 47 mm and 27 mm recorded stability in the saturation temperature of 121 °C at 50 minutes, 144 °C at 45 minutes and 153 °C at 30 minutes, respectively. In additional, saturation pressures of 2.0 bar from 50 to 55 minutes for bed height of 77 mm, 2.1 bar from 45 to 50 minutes for bed height of 47 mm and 3.6 to 3.7 bar from 45 to 55 minutes for bed height 27 mm were obtained. The effect of fuel particle size on emissions and over all combustion efficiency of corncobs has proven to be efficient in a fluidised bed boiler as the emission analysis of the flue gas has shown to be low in various percentages of 0.0003% of NO<sub>x</sub>, 0.001% HC, 0.02% of CO and 0.93% of Nitrogenm, respectively.*

**Keywords:** *Solid fuels, Bed height, Heat transfer, Steam, Saturated temperature, Saturated pressure, Flue gas*