

## ABSTRACT

In the process of converting biomass into a fuel source, gasification technology is needed. For this reason, in this capstone design, a cement-based updraft type gasification furnace was designed to be used for the biomass conversion process. The aim of this capstone design is not only to convert wood pellets into biomass energy, but also to test the quality of the designed gasification stove in terms of producing heat for the cooking process or boiling water and to compare the designed updraft type gasification stove with the updraft type gasification stove that is already circulating on the market. . Testing of the gasification furnace designed using the water boiling test method. Tests were carried out in 3 schemes, namely scheme 1 using an updraft gasification furnace made from cement designed using a blower, scheme 2 using an updraft gasification furnace made from cement designed without using a blower, and scheme 3 using an updraft gasification furnace that is already on the market. Tests were carried out with variations in the amount of fuel in each test scheme and the amount of water used in each scheme, namely 2kg. In scheme 1, variations in the amount of fuel are: 1,599; 1,561 and 1,467 kg, in scheme 2 variations in the amount of fuel, namely: 1,051; 1,175 and 1,527 kg, and in scheme 3 variations in the amount of fuel, namely: 1,192; 1,159 and 1,494 kg. Based on the tests carried out, data results were obtained in the form of values for the amount of water used, the amount of fuel put into the furnace, the remaining fuel, the amount of fuel used, the initial temperature of the water, the final temperature of the water, fuel start up, boiling time, the number of water after combustion, ash after combustion, total operating time and output parameter values in the form of the average amount of fuel used, FCR (fuel consumption rate), SH (sensible heat), LH (latent heat), and QF. The output parameter values are taken from the average value of each test result carried out. Based on the testing, the overall results were obtained in the form of the fastest start up occurring at the 5th minute in testing scheme 1, the longest time being in testing schemes 2 and 3, namely at the 19th minute, the FCR (fuel consumption rate) resulting from the three schemes was 1.54 kg/ h; 1.25 kg/h; and 1.28 kg/h. The power input generated from the three schemes is 10 kwh; 9.1 kWh; and 10 kwh. The power output produced by the three schemes is 1.2 kwh; 0.8 kWh; and 0.7 kwh. The average value of the total operating time produced by each furnace is 49.6; 47; 43.6 minutes. Meanwhile, the thermal efficiency produced in scheme 1 is 12.23%, scheme 2 is 9.7% and scheme 3 is 7.96%.

**Keywords: Gasification Furnace, Biomass, Water Boiling Test**