DESIGN, CONSTRUCTION AND TESTING OF AN *ERYTHROPHLEUM SUAVEOLENS* CHARCOAL-FIRED CUPOLA FURNACE FOR FOUNDRY INDUSTRIES IN NIGERIA

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ABSTRACT

The need to reduce the cost of energy, recycle and productively reuse the abundant scrap metals in the country for a more efficient running of our foundry industries led to this paper. This work focuses on the design, construction and testing of an *erythrophleum suaveolens* charcoal-fired cupola furnace. In order to improve the efficiency of the furnace proper attention was given to the design of tuyere and oxygen enrichment was also introduced. From the design, 0.0585 m^3/s volume of air supplied to the cupola furnace with an available volumetric capacity of 0.0613 m^3 at the rate of 2652.34 W/m^2 produced an estimated melting heat of 255891.1 kJ/hr with a melting rate of 355kg/hr for the *erythrophleum suaveolens* charcoal as fuel. While the estimated melting heat of 326208.264 kJ/hr with a melting rate of 432 kg/hr for the *erythrophleum suaveolens* charcoal enriched with oxygen. The actual melt rate was determined based on the amount of iron tapped per hour. It was obvious that the melt rate of the furnace was not up to the designed value of 466 kg/hr., incomplete combustion could be responsible for this. Consequently, the fuel analysis performed showed that the stoichiometric air/fuel ratio obtained was 11.73, while the efficiency of the cupola furnace was calculated as 88.3% for an *erythrophleum suaveolens* charcoal as fuel against the 90.8% value of the oxygen enriched *erythrophleum suaveolens* charcoal. It is thus recommended that this design can be used as a foundation for building better and cheaper foundry industries in Nigeria.

Keywords: Cupola furnace, refractory materials, oxygen enrichment, critical radius of insulation, *erythrophleum suaveolens* charcoal, heat transfer, cupola zones, tuyere area.