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Kivumbi, Bernard

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# Water Boiling Test of carbonized briquettes produced from charcoal fines using African Elemi (*Canarium schweinfurthii*) resin as an organic binder

Bernard Kivumbi, Yusufu A. C. Jande, John B. Kirabira & Thomas T. Kivevele

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## Abstract

The study evaluated carbonized briquettes produced from charcoal fines using African Elemi (*Canarium schweinfurthii*) resin as a binder. Briquette samples (B25, B30, B35, B40) with the ratio of charcoal fines:binder of 3:1, 7:3, 13:7, and 3:2, respectively, were produced. The phases of the Water Boiling Test (WBT) considered were Cold start high power (CSHP), Hot start high power (HSHP), and simmer phases. Ignition properties, combustion properties, gas temperature, water temperature, ambient temperature, emissions, and WBT performance metrics were investigated using the Laboratory Emission Monitoring System. The ignition properties evaluated included ignition time, flame, and incandescence. The combustion properties included smoke, flame, soot, and ash. The emissions measured were PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub>, C<sub>x</sub>H<sub>y</sub>, CO, and CO<sub>2</sub>. The WBT performance metrics evaluated were time to boil, burning rate, thermal efficiency, specific fuel consumption (sfc), firepower, total emissions, emissions per MJ, specific emissions, and emissions rate. The ash from charcoal fines was analysed using x-ray diffraction. The results showed that ignition time was 6.47–7.01 min, time to boil was 14.7–41.9 min, burning rate was 1.1–8.2 g/min, thermal efficiency was 21.79–54.61%, sfc was 21.7–70.1 g/L, and firepower was 535.9–4123.2 W. The ash was found to contain CaCO<sub>3</sub> (76.6 wt%) followed by CaO (13.1 wt%) and the remainder was the amorphous compounds (10.3 wt%). The briquettes can be used as an alternative source of fuel to wood fuel since they exhibit similar combustion properties.

Keywords:

African Elemi; Carbonized briquettes; Ignition; Combustion; Emissions; Water Boiling Test