

## Abstract

This study presents the investigation of material composition and energy characteristics of *B. spiciformis*, *B. boehmii*, *C. molle*, *P. maprouneifolia*, and *S. birrea* indigenous tree species at Kitulungalo forest reserve in Tanzania. The energy content of the individual species is largely dependent on its chemical composition (C, H and O) and it is negatively affected by the inclusion of inorganic elements and moisture. Biomass chemical composition was done by proximate and ultimate analyses. On the basis of elemental composition, *P. maprouneifolia* and *C. molle* exhibited high energy content of 18.62 and 18.30 MJ/Kg, respectively due to their higher H:C ratio and relatively low O:C ratio. Carbon, oxygen, and hydrogen were found to be highest in *P. maprouneifolia* with 46.71, 41.96, and 5.7%, respectively. In contrast, *P. maprouneifolia* had the lowest N:C ratio of 0.014, implying good efficiency for nitrogen use to fix carbon. On the other hand, ash, moisture, and volatiles were highest at 4, 55, and 85% for *S. birrea*, *B. spiciformis*, and *S. birrea*, correspondingly.

The ratio of macronutrients to carbon for each species was also calculated. Results show that all species have high demand for nitrogen followed by potassium and calcium, in that order. Finally, heating values have been shown to decrease with increasing moisture content. These experimental findings form a basis for ranking these materials for energy generation. They also provide vital biomass information equipment and process designers.