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Evaluation of Temperature and Energy Requirements for Gari Processing at standard quality parameters in Togo

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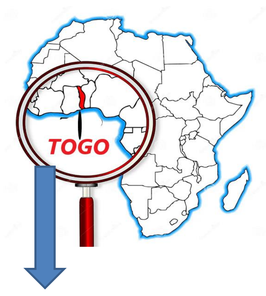
Background

- Cassava is recognized to be the main source of calories for more than 300 million people in Sub Sahara Africa (SSA), but with limited shelf life of one to two days.
- Processing it into a shelf-stable, Cyanide stabilized (below 10 ppm-WHO) and partially pre-gelatinized dry granulated cassava product (gari a staple food for millions of people in West Africa), is energy intensive (mostly at roasting stage accounting for more than 90 % total energy) and drudgery.
- Roasting, the last stage in gari processing, is one of the major bottlenecks.
- Mechanization of the traditional process and energy-efficient system design have been hindered by a dearth of data on temperature/energy requirements and process length.

Study Area



- Genève
- Vogan

Maritime region-Togo

Objectives

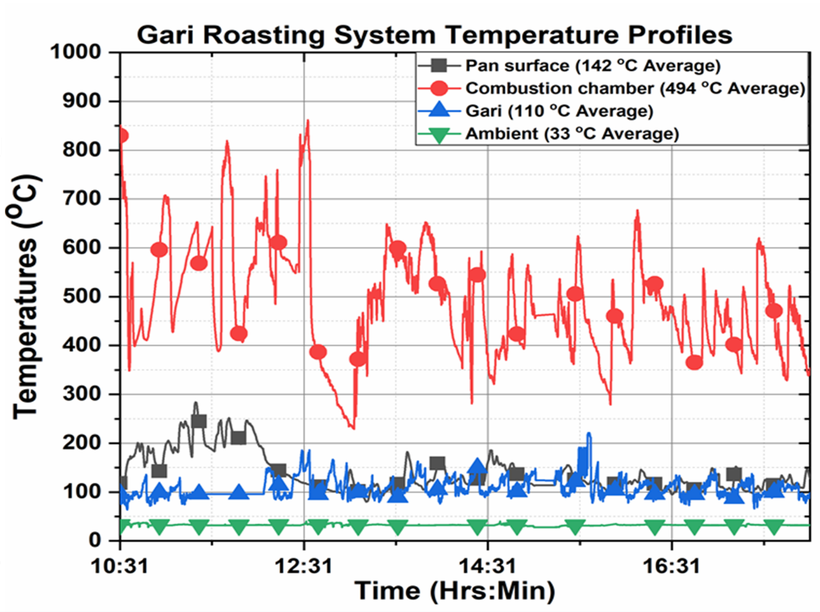
- To determine the duration, temperature and energy requirements for the gari roasting process at the traditional and cooperative level in Togo

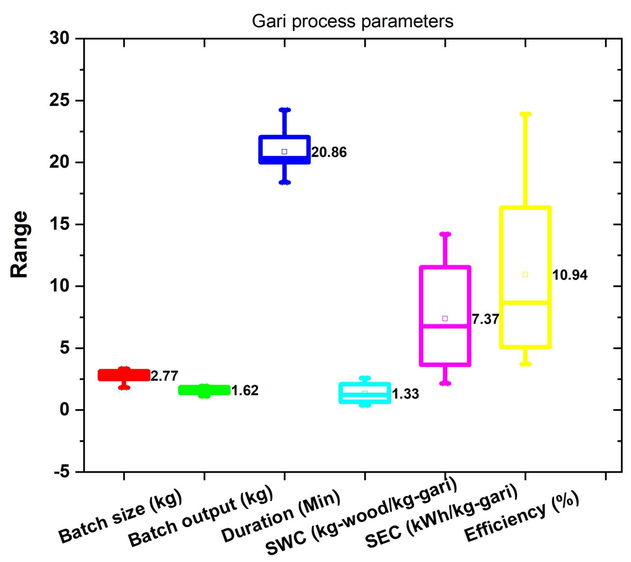
Methods

- Semi-controlled cooking tests method (SCCT) through Data logging for multi-sensor temperature and relative humidity.
- Observe, weighing and recording.

Results

- The combustion chamber, roasting pan surface, gari, and ambient temperatures of 494 °C, 142 °C, 110 °C and 33 °C, respectively.
- The specific energy consumption found to produce a kg of gari from dewatered cassava mash (48 % moisture content (MC)) to gari (6.7 % MC) from the nine cookstoves evaluated was 7.37 kWh kg-1.
- The roasting process alone accounted for 96.74 % of the energy consumed.
- Out of the 114 batches examined, the average batch size was 2.7 kg dewatered cassava mash and 1.6 kg output gari.
- The average energy efficiency was 10.94 %.
- The average roasting duration was 20.86 min minutes.
- A strong correlation (R^2) of 0.88 between the data of the specific energy consumption and the gari produced.





Conclusions

- The semi-controlled cooking tests (SCCT) methods used in this study could be used to analyse the processing parameters such as temperatures, moisture contents, energy and quantification of the yield of the cassava processing into gari.
- The SCCT proved to be a capable method for assessing baseline gari processing energy trends in the Togo research area.
- In addition to valuable observations of stove type and operation, the technique caught essential user behavior in terms of fuel usage, which had a significant impact on reported performance outcomes.
- Gari roasting is an energy-intensive process, and the cookstoves used in the research area, predominantly U-shaped traditional ones, are inefficient.
- The energy consumption rate varies greatly from operator to operator, as seen by greater coefficients of variation of more than 50%.
- More energy tests on additional types of cookstoves are required to further develop the SCCT techniques.
- Roasting the gari to the desired moisture and temperature could save energy.
- The studied facilities spent 85 % more energy than is required as compared to the optimized energy consumption of about 0.2 kg-wood/kg-gari.
- About 85 % wood fuel could be saved if efficient energy utilization is promoted.
- Because renewable energy only accounts for around 5 % of the energy requirement in gari processing, the roasting process has a high GhG energy footprint.
- This study highlighted the need to invest more time and resources in finding innovations on alternative energy resources such as solar thermal/PV for gari processing.

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