AFTER

Dissecting biochemical changes is a prerequisite for improving traditional process: case study of Gowé, a malted and fermented sorghum based beverage from Benin

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Gowé is a Beninese traditional beverage made of cooked malted and fermented sorghum flour. It is appreciated for its acidic taste, its fermented aroma and its semi-liquid texture. The traditional process is very complex (***Figure 1***) and leads to a cooked dough with irregular sensory and sanitary quality and short shelf life. The beverage is prepared just before consumption by adding ice and sugar to the cooked dough. The aim of this work was to study the evolution of starch and related molecules (amylases, sugars, organic acids) throughout the process and to test simplification routes for processing Gowé.

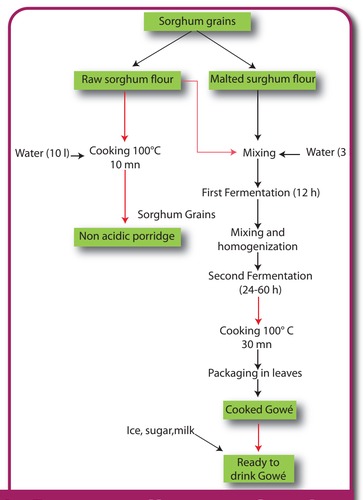

Figure 1. Process diagram for the production of traditional Gowé.

Experimental

The traditional process has been compared with four modified routes for producing Gowe; they all include inoculation with a selected strain of *Lactobacillus fermentum,* at 10^6 CFU/l, combined with one or two fermentation steps for 24 or 48h.

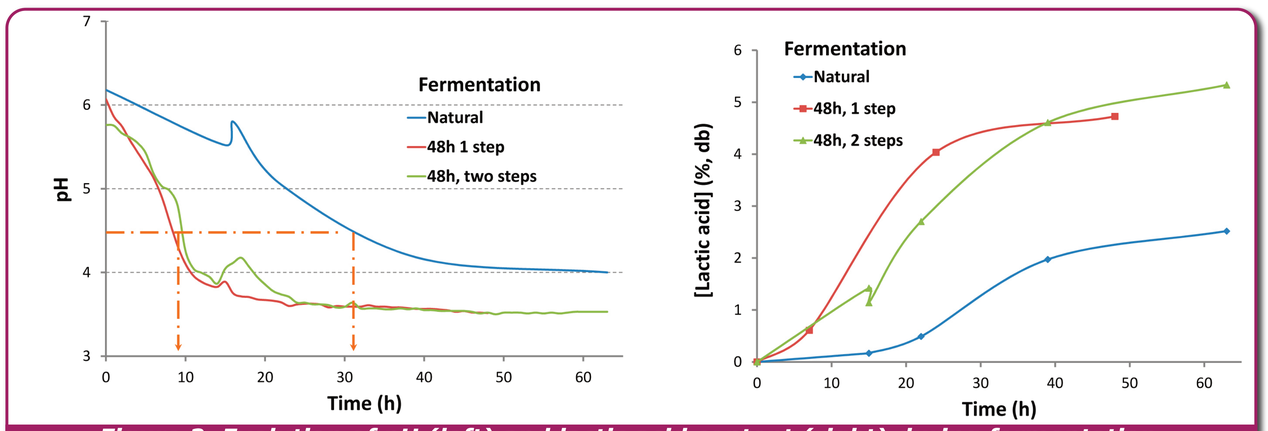

Figure 2. Evolution of pH (left) and lactic acid content (right) during fermentation.

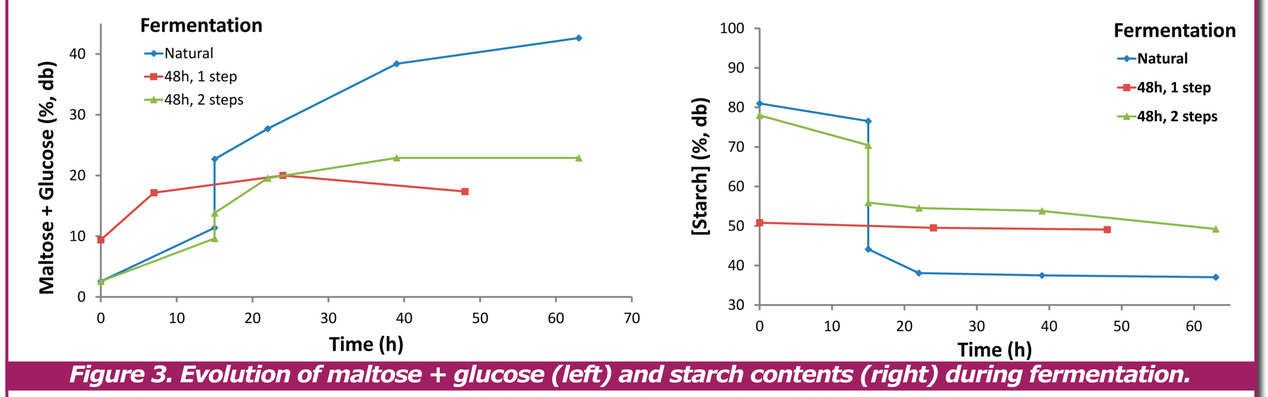

Figure 3. Evolution of maltose + glucose (left) and starch contents (right) during fermentation.

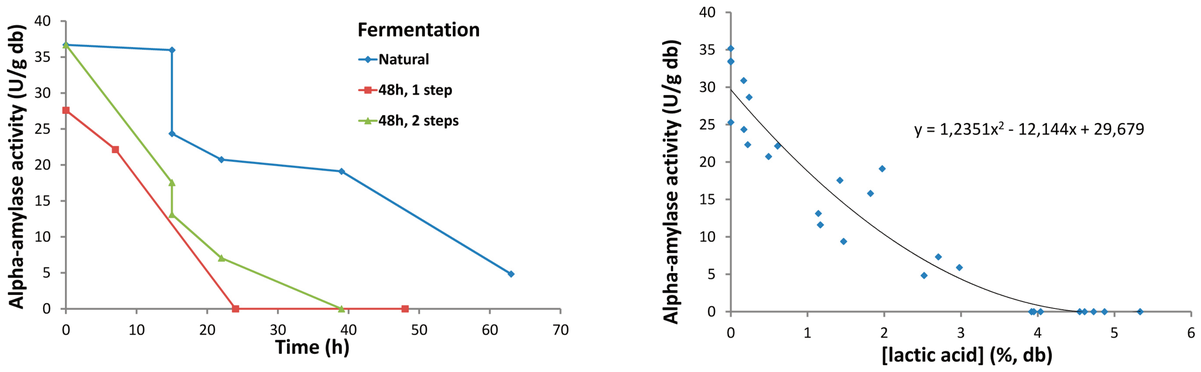

Figure 4. Evolution of α-amylase activity during fermentation (left) and with lactic acid content (right).

Acidification kinetic *Figure 2*

- The decrease of pH was more rapid with inoculation, whatever the process; safe level (4.5) was reached after 30 h with spontaneous fermentation but after 10 h in the case of fermentations with inoculation.
- Lactic acid was the only organic acid produced. At the end of the fermentation, lactic acid content reached 2.7% (dry basis, db) with spontaneous fermentation and 4.5-5.3% (db) with fermentations with inoculation.

Sugar and starch evolution *Figure 3*

- Maltose and glucose content increased to 37-48% (db) with the traditional process but was half this value with the modified processes.
- During processing, starch content decreased from 81.5% During processing, starch content decreased from 81.5% (db) to 40% with the traditional process but remained by 50% (db) with the modified processes leading to more viscous product.

Amylase activity *Figure 4*

Malt α-amylase appeared very sensitive to acidity. Its activity dramatically decreased during fermentation, particularly in the modified processes and was not detected when lactic acid content was over 4% (db), ie for a pH below 4. This explained why sugar level was lower and starch content higher, in the case of fermentations with inoculation.

Conclusion *Figure 5*

The inhibition of sorghum malt α-amylase activity in acidic conditions hence appeared the main constraint of Gowé processing. The improvement of lactic fermentation kinetic (in view of improving the sanitary status of Gowé,) induces the inhibition of α-amylase activity due to higher lactic acid production, thus leading to lower starch degradation, higher cooked dough viscosity and lower free sugar content. As a consequence, the sensory quality of cooked Gowé might be lower. Re-engineering of Gowé processing will thus focus on optimising fermentation kinetic for improving food safety level while maintaining amylase activity for improving sensory quality.

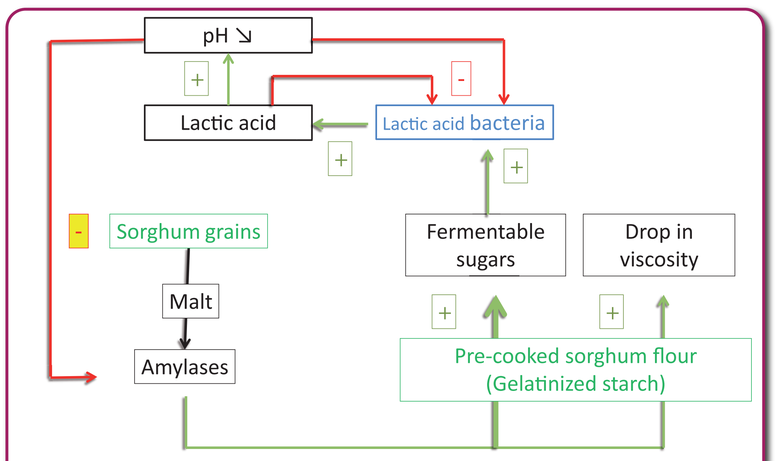

Figure 5. Outline of main reactions in Gowé processing.

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SEVENTH FRAMEWORK PROGRAMME