

THE USE OF SUGAR IN THE BANTU BEER INDUSTRY

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Introduction

At the request of the South African Sugar Association an investigation was undertaken into the feasibility of offering sugar, or a sugar product, to the Bantu Beer Breweries as a brewing adjunct.

Currently the alcohol content of Bantu beer is derived from maize grits, the starch content of which is enzymatically hydrolysed to form sugars which are then fermented to alcohol. It was reasoned that it should be possible to replace that portion of maize grits which eventually becomes alcohol with its stoichiometric equivalent of sugar to produce a similar result. The aims of the investigation were to establish whether a beer brewed with sugar could be made to taste as good as the conventional one and whether the nutritional value of the product would be affected by such substitution.

Brewing Schemes

In a typical brewing scheme there are the following stages:—

1. *Souring*—the production of lactic acid by the fermentation of kaffircorn malt and water at 48 to 50°C for 8 to 16 hours.
2. *Addition of the Adjunct and Boiling*—when the acidity of the ferment from (1) has risen to the required level, grain, usually brewer's grits, is added. The mixture is diluted and boiled for two hours, causing gelatinisation of the starch. At the same time the acid-forming lactobacilli are killed off.
3. *Mashing at 60°C*—further kaffircorn malt is added and conversion of the starch to sugar takes place by α and β amylase, initially present in the malt.
4. *Pitching and Straining*—after two hours at 60°C the mash is cooled to 30°C, pitched with a commercial dried yeast preparation and strained.
5. *Fermentation*—the wort undergoes a short, high temperature fermentation, usually 8 to 24 hours at 30°C.

Assistance was provided by the Chemical Engineering Department of the University of Natal, who made available plant for small-scale brewing.

This consisted of a small vessel for souring and a large one for boiling and fermenting. Both were constructed from stainless steel and were provided with stirrers, heating elements and cooling coils. Temperatures were controlled by contact thermometers.

With the use of this plant and the substitution of sugar as the alcohol source, a simplified brewing cycle was evolved, as follows:—

1. *Souring*—the production of lactic acid is important for the distinctive flavour of Bantu beer and was left unchanged in principle except that the malt from step (3) was included in this stage. It was possible to establish the time required for souring to the required degree and step (2) (boiling) was timed so that water was boiling in the large reactor by the end of the souring period. The lactic ferment was added to the boiling water along with the residual maize grits. This, together with the kaffircorn, gives body to the beer as well as being a source of protein and vitamins.
 3. After boiling for two hours, sugar was added and the mixture cooled to 30°C.
 - 4 & 5. The wort was then pitched with a commercial dried yeast preparation, strained and left to ferment at 30°C for 24 hours.
- By omitting step (3) (mashing) from the brewing cycle, a calculated quantity of sugar can be substituted, ensuring that the legal limit of 3% alcohol is not exceeded. A saving in time is also achieved.

Experimental Work

With little available literature, the initial research required the development of a suitable brewing technique. A brew was soon developed which was considered by the Bantu staff of the University to be comparable with that produced by the local municipal brewery. A typical sample was submitted to the Bantu Beer Research Unit of the C.S.I.R. for analysis and comment and was found to be deficient in protein and vitamin B₂ by comparison with their standards.

While awaiting the results of these analyses, the Tongaat Municipality was approached with regard to using the sugar brew on a trial run to assess customer reaction at the Hambanati Township beerhall. It was originally intended to brew three successive batches of beer, each of approximately 200 gallons, together with the regular brew in case of complaints. The modified brew was well received and sold well. As a result, it was requested that a further two batches be brewed concurrently so that the entire sales for one day could be of the new beer. The total quantity produced was therefore in the region of 1,000 gallons and no complaints were received from customers; some considered it superior

to the normal brew. When it is appreciated that the recipe and method of brewing differed quite considerably from that of the beer brewed at the University, as did the final product, it would appear reasonable to assume that any brewery adapting its brewing scheme for the inclusion of sugar should be able to produce a brew very similar to, and just as acceptable as, the conventional one.

As a result of the C.S.I.R. report, the maize and malt content of the experimental brew was increased and a further sample submitted along with one of iJuba, the Durban Municipal beer. Although the protein content was scarcely improved it is significant to note that six out of seven Bantu tasters on their panel preferred the experimental brew to iJuba.

Conclusion

The S.A. Bureau of Standards is compiling a specification for Bantu beer. If the protein content obtainable in the modified brew is insufficient, it should be possible to supplement it relatively inexpensively.

The project holds promise for the Sugar Industry as an additional market for raw sugar, and, if possible, the C.S.I.R. should be encouraged to pursue any further investigation should they deem it necessary.

Abstract

The feasibility of using sugar as an adjunct in the Bantu beer industry was investigated. Beer was brewed on a pilot plant as well as small plant scale. The successes and shortcomings of test runs are discussed.

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Discussion

Dr. Graham (in the chair): I understood that the use of sugar in bantu beer was prohibited by law.

Mr. Dawes: The Bureau of Standards specification did not list sugar as a recommended ingredient. However, we wrote and suggested that the wording be changed so that sugar could be incorporated in the recipe.

Bantu beer was originally made from malted kaffir corn. In order to make the process more economical maize was introduced so I do not see why sugar should not be used instead of maize because the end result from any of the three is alcohol.

Dr. Matic: Surely it is a matter of economics? Is it cheaper to use sugar rather than maize?

Mr. Dawes: It can be done economically provided the sugar used is priced competitively against maize grits.

Mr. Barnes: I am interested in the protein aspect of the problem. I was the first man to brew beer from malted barley in Kenya. One of the native drinks was 'tembo' and it was made from sugarcane juice. The fermentation was very rapid and the end product very potent.

The authors of this paper might investigate the incorporation of food yeast, *torulopsis utilis*, which is made in Merebank, as it is rich in protein. Although reputed to be not particularly digestible by humans the presence of the beer might overcome that difficulty.

Mr. Dawes: We investigated food yeast but of course we have very little economic room for movement as regards a protein supplement. Also, the fermentation would be speeded up even more and its keeping property would diminish.

Mr. Jullienne: Scums could also be added.

Mr. Lenferna: Has sugarcane molasses ever been used as a base for maturing yeast in the beer industry?

Mr. Dawes: I do not know. We thought at first we would have to use invert sugar because a special strain of yeast is used for bantu beer. When high test molasses was used it gave the beer an unusual smell and taste.

Mr. Alexander: The prescribed .8% of protein has never been shown to be usable by humans. We expect little more than half of the protein present in maize to be digestible.

Therefore, if we can produce beer with a higher digestible protein content it should be a better product.

I think the law preventing the use of sugar was to prevent the brewing of shimiyané, or any other form of alcohol.

Dr. Matic: I do not think the total protein content is important. I think it is the presence of essential amino acids. One would expect protein of a certain composition to be specified.

Mr. Jennings: I have recently written to the Bureau of Standards suggesting that the protein specification should be altered from a figure based on "total protein" to one based on Net Dietary Protein Value. They will probably not accept this suggested change because the determination of N.D.P.V. is extremely tedious.

Mr. MacGillivray: Sugar refiners and glucose producers in Britain are trying to find wort substitute syrups but British brewers are wary of accepting molasses as they want exactly the same amino acid analysis as they are getting at present. This has been possible with wheat syrups but not with molasses.