THE USE OF SODIUM BENZOATE AND AMMONIUM HYDROXIDE (AQUEOUS -NH_3) AS PRESERVATIVE FOR SUGAR CANE[1]

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Experiments were carried out with sodium benzoate and aqueous ammonia (28.2%NH_3),the objective being to stop spontaneous fermentation of suger cane juice. It was found that sod ium benzoate at a concentration of 0.05% was sufficient to stop fermentation for 2-3 days; 0.1% was necessary to conserve the juice for 6 days. The concentration of aqueous ammonia necessary for the same periods of preservation were 0.32 and 1.28% (0.08% and 0.32% NH_3.

Key words: sugar cane juice, preservatives, sodium benzoate, aqueous ammonia, cattle feeding

Trials in which sugar cane juice has been used as a source of energy for both monogastric animals (Mena et al 1981) and ruminants (Sanchez and Preston 1980; Duarte et al 1981), have given similar results to those observed with diets based on cereal grains. However, sugar cane juice presents a number of limitations, one of these being that at ambient temperatures in the tropics there is a rapid fermentation causing the degradation of the sugars, principally to alcohol. Consumption by the animals is affected directly by these changes as the palatability of the juice is reduced within a period of 24 hours.

For this reason it is important to study different additives which could allow conservation of the juice so that a feeding system based on sugar cane juice could be developed without having to mill cane every day. Sodium Benzoate (food grade) is a preservative commonly used in feed technology. Aqueous ammonia has been used before as a preservative for sugar cane in order to reduce alcoholic fermentation (Alvarez and Preston 19762; and has given good results in the conservation of other by-products rich in sugars such as bagasse and henequen pulp (Godoy et al 1979), Formalin has also been used (as an aqueous solution of formaldehyde at 37%) to reduce the fermentation of sugar cane juice (Bobadilla and Gill 1981).

Preliminary results of laboratory work are included in this paper, which was carried out with the purpose of finding those levels of sodium benzoate and aqueous ammonia necessary to stop or retard alcoholic fermentation in sugar cane juice.

Materials and Methods

Additives: Two experiments were carried out with sodium benzoate under aerobic and anaerobic conditions respectively. The levels of sodium benzoate used were 0, .01, .02, .03, .04 and .05% (v/v) in Experiment 1 and 0, .05, .075 and .10% in Experiment 2.

A third experiment was carried out with aqueous ammonia (28.2% NH_3) using levels of 0, .32, ,64, .96, 1,28 and 1.6% (w/v).

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Procedure: The sugar cane juice was extracted from freshly harvested sugar cane stalks using a 3-roller sugar cane press (McKinnon, Aberdeen, Scotland). The juice was immediately sampled and these samples taken to the laboratory and distributed among flasks of 100 ml. Two replicates per treatment were used and flasks were maintained sealed at an ambient temperature for 6 consecutive days. pH and °Brix were recorded every 24 hours (°Brix was taken as a measure of the concentration of total soluble solids in a sample).

Results and Discussion

The change in °Brix (as an index of sugar content) of the juice samples treated with sodium benzoate and aqueous ammonia are presented in Figures 1 and 2 respectively. Changes in pH for the same treatments are shown in Figures 3 and 4.

Figure 1:
Changes in the °Brix for juice treated with sodium benzoate at different concentrations under aerobic (-----) or anaerobic (- - -) conditions.

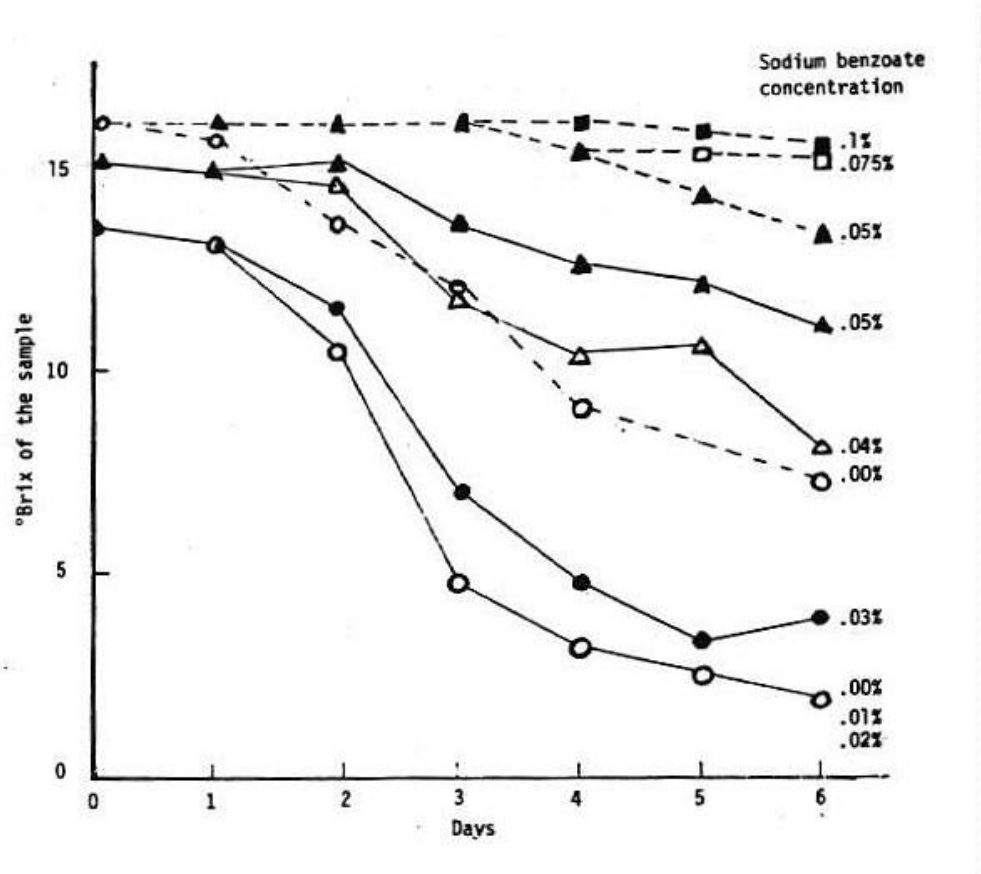


Figure 2:
Changes in °Brix of sugar cane juice treated with aqueous ammonia at different concentrations under anaerobic conditions

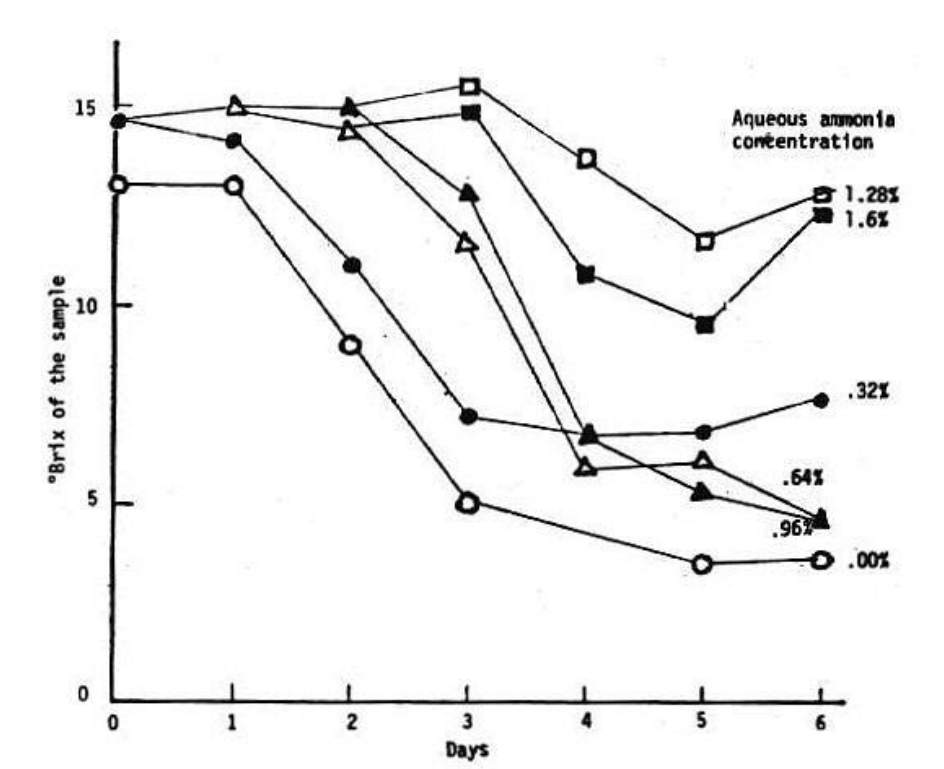


Figure 3:
Effect of different concentrations of sodium benzoate on the pH of sugar cane (◦ control; • 0.05%)

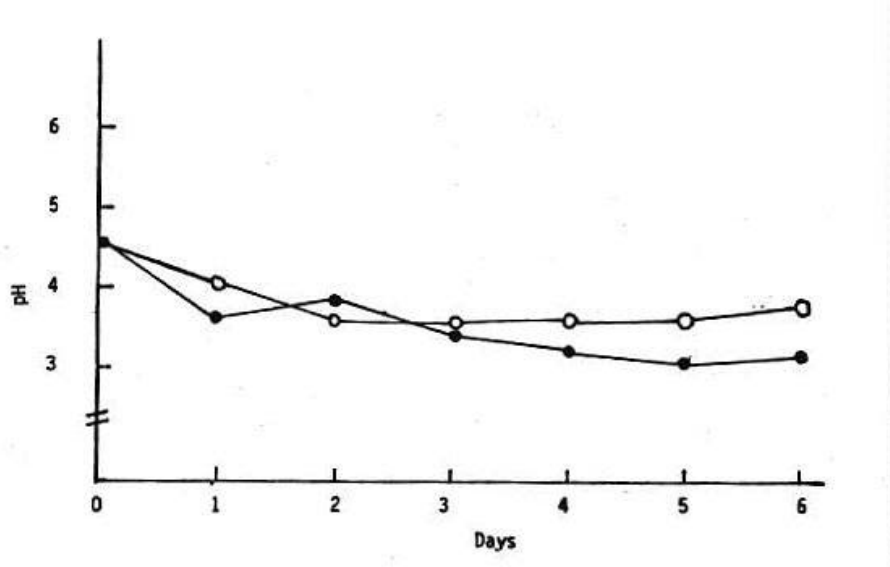
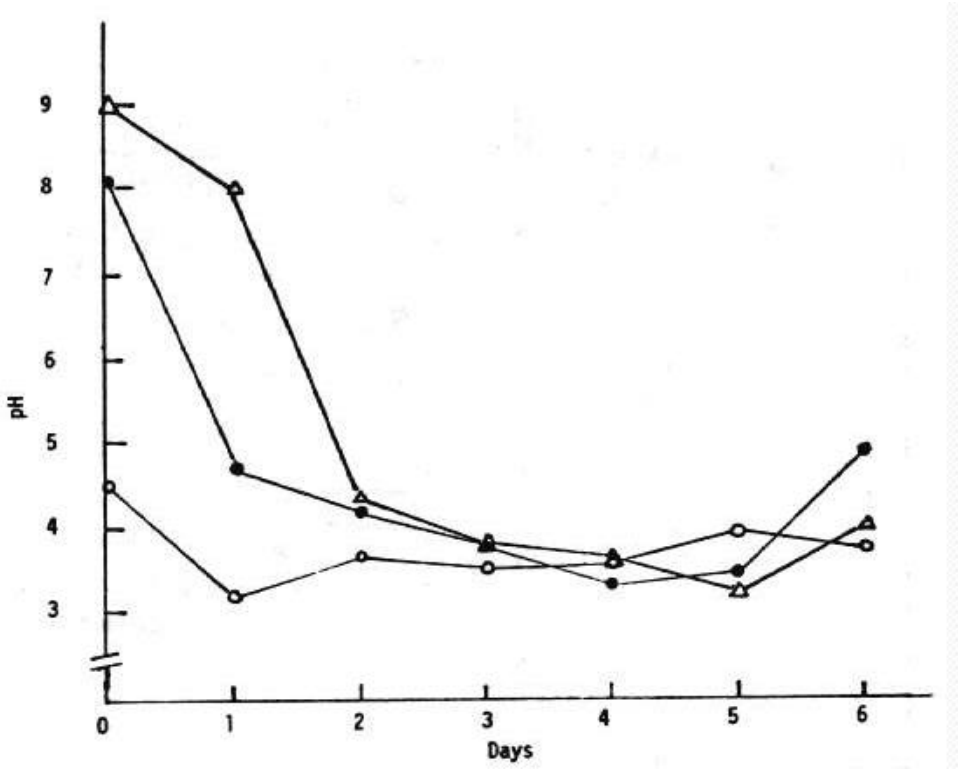


Figure 4:
Effect of different concentrations of aqueous ammonia on the pH on sugar cane juice (◦ control; • 0.64%; △ 1.28%)



It appears that a concentration of 0.05% sodium benzoate in the juice was sufficient to conserve the sugars in the juice for 2 or 3 days; however preservation for up to 6 days required a higher concentration of 0.1%.

The concentration of aqueous ammonia necessary to preserve the juice for up to 2 days was 0.32%(0.08% NH_3) and in order to preserve the juice for up to 6 days 1.28%(0.32% NH_3) was necessary. Even at the higher concentration there was some degradation of the sugars (approximately 10-15%).

The pH of the juice dropped slightly from 4.5 to 3.5 during the first 24 hr, independent of the concentration of sodium benzoate. The pattern was quite different when aqueous ammonia was used; in this case the pH rose to between 8 and 9 when the preservative was added, afterwards falling to around 3.5 after 3 days.

There was a slight indication that fermentation proceeded more slowly under anaerobic conditions.

Sodium benzoate was a more economic preservative than aqueous ammonia, the prices at present in Dominican Republic being US$ 4.4/kg and US$7.2/ litre respectively (equivalent to US$ 4.40 and US$ 112.00 per 1000 litres of juice preserved).

Conclusions

In the Dominican Republic it is recommended that sodium benzoate be used as a preservative for sugar cane juice. The concentration needed will depend on the storage time required, that is, 0.05% for 48 hr, 0.075% for 72 hr end 0.10% for a longer period.

It is suggested that containers used for juice storage should be sealed to stop the entrance of air.

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