

FERMENTATION OF SUGAR CANE JUICE WITH DIFFERENT LEVELS OF FORMALIN/UREA

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The use of formalin as a preservative for sugar cane juice was investigated in the presence or absence of urea. Initially the degradation of urea to ammonia was studied at 0, 0.5, 0.8 and 2.5% urea with and without the addition of formalin. There was only a maximum 25.3 m mol of ammonia/litre of juice after 24 hours (in 2.5% urea treatment), most of the degradation to ammonia taking place in the first four hours.

Levels of formalin of 0, 0.75, 1.5, 2.25 and 3% were tested with or without urea. There was no difference in pH or Volatile Fatty Acids (VFA) between 0.75-3% formalin after 72 hours, which averaged 9.8 m eq/litre compared with 122 m eq. litre for the control. There was no effect of urea on fermentation.

Levels of formalin of 0, 0.01, 0.02, 0.03, 0.04 and 0.05% were then studied without the addition of urea.

It is concluded that 0.01% will store juice for 24 hours, 0.03 for 48 hours and 0.06 for 72 hours.

Key words: Sugar cane juice, formalin, preservation cane juice, urea levels, fermentation of sugar

Sugar cane fibre is only slightly digested in the rumen (Valdez and Leng 1976) and also reduces the nutritive value of other soluble components (Preston and Leng 1980). Therefore it would appear advantageous to separate the fibre from the soluble nutrients in order to feed the latter to animals and use the fibre to produce energy (Preston 1980). Liveweight gains of 0.8 kg/day have been obtained in cattle fed cane juice (Sanchez and Preston 1980), however due to the rapid fermentation of the cane juice, there is a need to find methods for preserving the juice before proposing practical feeding systems.

In diets based on molasses, urea is added with the objective of obtaining efficient microbial synthesis (Silvestre et al 1977) and in the same way cane juice/urea mixtures have been prepared. In order to judge the adequacy of this level it is necessary to know if the urea is degraded to ammonia before the animal drinks the juice.

Formalin is commercially sold as an aqueous solution of formaldehyde at 37% and is a preservative much used in the field of medicine, and in agriculture in the preservation of grass as silage. In this note, results of a trial at a laboratory level, to determine the level of formalin necessary to prevent or decrease fermentation of sugar cane juice will be presented.

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Materials and Methods

Treatments: Experiment 1 The level of urea (0.8%) to be added to juice was calculated from the ratio between urea and °Brix in molasses with 2.5% urea (the optimal level for cattle, Silvestre et al 1977). In order to see if urea was degraded to ammonia or not, three levels of urea were studied a control of 0% and levels of 0.5, 0.8 and 2.5%. Samples were taken at 1, 2, 3, 6, 12 and 24 hours.

Experiment 2: The first levels of formalin studied were 0, 0.75, 1.5, 2.25 and 3% with or without urea (0.8%). Samples were taken at 12, 24, 48 and 72 hours.

Experiment 3: Since there was no difference between these levels of formalin neither in the presence nor in the absence of urea, lower levels were studied (0, 0.01, 0.02, 0.03, 0.04 and 0.05% of formalin) without urea and the samples were taken at 12, 24, 48 and 72 hours.

Procedure: The juice was extracted in a 3 roller press (McKinnon, Aberdeen, Scotland) and the samples of juice were immediately taken to the laboratory where representative samples were taken. Measurement of pH and Brix were taken with the mean pH being 5.2 and °Brix 20.5 (understanding for Brix, the content of total soluble solids present in the samples).

The cane juice was divided between beakers of 100 ml volume with two replicates per treatment. At the set hours, samples (15 ml) were taken and pH measured, afterwards preserving the samples for laboratory analysis with 2 drops of sulphuric acid. The concentration of total volatile fatty acids (VFA) and ammonia (NH_3) were determined by steam distillation and titration with alkali and acid respectively.

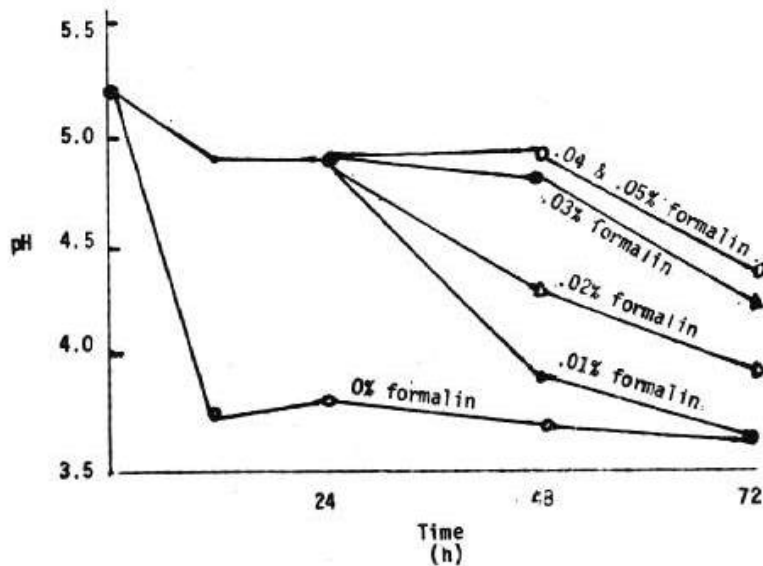
Results and Discussion

Experiment 1: There was very little fermentation of urea to ammonia with a maximal concentration of 25.3 mmol of ammonia/litre of juice at the 2.5% urea level with a major part of the fermentation taking place within the first 4 hours. In contrast changes in pH and VFA concentration did not take place until 6-12 hours. The concentration of urea apparently had no effect on the degree of fermentation of cane juice.

Experiment 2: There was no difference between the levels of .75 - 3% formalin on the fermentation of juice as measured by pH and VFA concentration. On the control (without formalin) the concentration was 122 m eq of VFA/litre of juice after 72 hours but in the other treatments there was an average of 9.8m eq/litre.

Experiment 3: The results (pH) of the lower (<0.05%) levels of formalin are shown in Figure 1. The concentration of VFA followed very closely the results of pH. They showed that within 24 hours there was no significant fermentation in juice with formalin added at 0.01%. Between 24 and 48 hours there was fermentation in the levels from .01% and .02. At 72 hours there was fermentation at all levels.

Figure 1 :
The efficiency of formalin the conservation of cane juice



Conclusions

It is concluded from these results that cane juice can be preserved with formalin. The required level depends on the desired time of storage. It is recommended that 0.1% is sufficient for 24 hours, .03 for 48 hours and at least .06 for 72 hours. These levels have been used in an experiment: with beef cattle drinking auger cane juice and there were no problems of fermentation nor of consumption of the juice.

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