A NOTE ON THE UTILISATION OF AQUEOUS AMMONIA AS A PRESERVATIVE FOR SUGAR CANE JUICE IN RUMINANT DIETS[1]

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Ammonia (28% $_{NH3}$ w/v) at levels of 15 or 20 ml per litre of cane juice successfully preserved the juice and also supplied the necessary nitrogen for rumen fermentation of this energy source. Palatability of the treated juice was not apparently affected.

Key words: Sugar cane juice, preservation, ammonia, ruminants

Sugar cane juice has recently been used successfully as the principal source of dietary energy for troth monogastrics (Mena et al 1981) and ruminants (Sanchez & Preston 1980; Duarte et al 1981). However, the juice ferments rapidly at normal temperatures and as a consequence contains less sugar and is less palatable to livestock. It is important therefore in production systems based on juice utilization to have a reserve of this material in case of unforeseeable mechanical or electrical breakdown of the equipment.

Alvarez and Preston (1976) have demonstrated that aqueous ammonia could be used as an additive to prevent alcoholic fermentation in sugar cane silages. Aqueous ammonia has also been used to prevent the loss of soluble sugars during the ensiling of henequen pulp and bagasse (Godoy et al 1979). It was therefore decided to evaluate the use of aqueous ammonia to prevent fermentation in sugar cane juice.

Materials and Methods

Aqueous ammonia (28% $_{NH3}$ w/v) was mixed with 500 ml batches of freshly extracted sugar cane juice at levels of 0, 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0% (w/v). The mixtures were left at room temperature in sealed glass containers for a 7 day period to measure changes in pH and °Brix of the juice.

Results and Discussion

Results for pH and °Brix during the 7 days after treatment are shown in Table 1. Figures 1 and 2 give the trends in these measurements for aqueous ammonia levels of 0, 0.5, 1.0, 1.5 and 2%. Results for higher concentrations were identical to those for 2% aqueous ammonia.

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It is obvious that ammonia works well as a preservative, especially if fairly high levels are used.

At levels above 2.0% w/v, the juice becomes less palatable for cattle and in such situations it should bereft to stand until the excess ammonia dissipates.

It has been suggested by Leng and Preston (1976) that the optimum level of available nitrogen in the rumen to ensure optimum synthesis of microbial protein is 3 g N/100 g of fermentable organic matter. Taking the case of cane juice at 14°Brix, then this would require about 1.5% (w/v) of aqueous ammonia (28 % $_{NH3}$ w/v) in order to provide the required amount of available nitrogen for microbial protein synthesis. Cane juice of higher Brix content would need proportionally more ammonia - N.

In the experiment reported here, the inclusion of from 1.5 to 2.0% aqueous ammonia in the sugar cane juice, thus provided the necessary amount of N for rumen synthesis of protein and also preserved the juice for over 6 days.

Table 1:

The effect of different concentrations of aqueous ammonia on pH and °Brix (in parentheses) in sugar cane juice in anaerobic conditions.

Time (days)	Level of aqueous ammonia (% v/v)						
	0	0.5	1.0	1.5	2.0	2.5	5.0
0	5.3	9.3	9.5	9.8	9.9	10.0	10.1
	(12.8)	(12.6)	(12.4)	(12.2)	(11.8)	(12.0)	(12.0)
1	4.1	6.9	9.5	9.9	10.0	10.1	10.5
	(11.6)	(12.5)	(12.0)	(12.2)	(11.6)	(12.9)	(12.0)
2	4.1	5.0	9.5	9.8	10.0	10.1	10.5
	(9.0)	(12.4)	(12.5)	(12.9)	(12.7)	(12.9)	(12.5)
3	3.9	4.4	6.1	9.5	10.0	10.1	10.3
	(7.0)	(13.0)	(12.9)	(12.5)	(12.5)	(12.8)	(12.5)
4	3.9	4.5	5.5	9.9	10.1	10.0	10.4
	(5.4)	(11.8)	(12.4)	(12.4)	(12.2)	(12.2)	(12.2)
5	3.9	4.2	4.8	9.7	10.0	10.1	10.1
	(5.4)	(7.8)	(12.0)	(12.4)	(12.4)	(12.4)	(12.4)
6	3.9	4.2	4.7	9.6	10.0	10.2	10.2
	(5.4)	(6.2)	(11.2)	(12.2)	(12.0)	(11.8)	(12.0)

Experience in the use of preserved sugar cane juice has shown that great variation exists in the concentration of ammonia N in commercial aqueous ammonia. It is recommended therefore that the level of ammonia solution be adjusted depending on source of supply to give 0.6% ammonia (w/v) in the sugar cane juice and thus achieve an adequate period of preservation.

Cane juice treated with an aqueous ammonia solution has been used as the basal diet for cattle in a large feeding trial (Duarte et al 1981) and results will be presented in a future communication.

Figure 1:
pH of cane juice during a six day period after treatment with different concentrations of aqueous ammonia (28% NH_3 w/v)

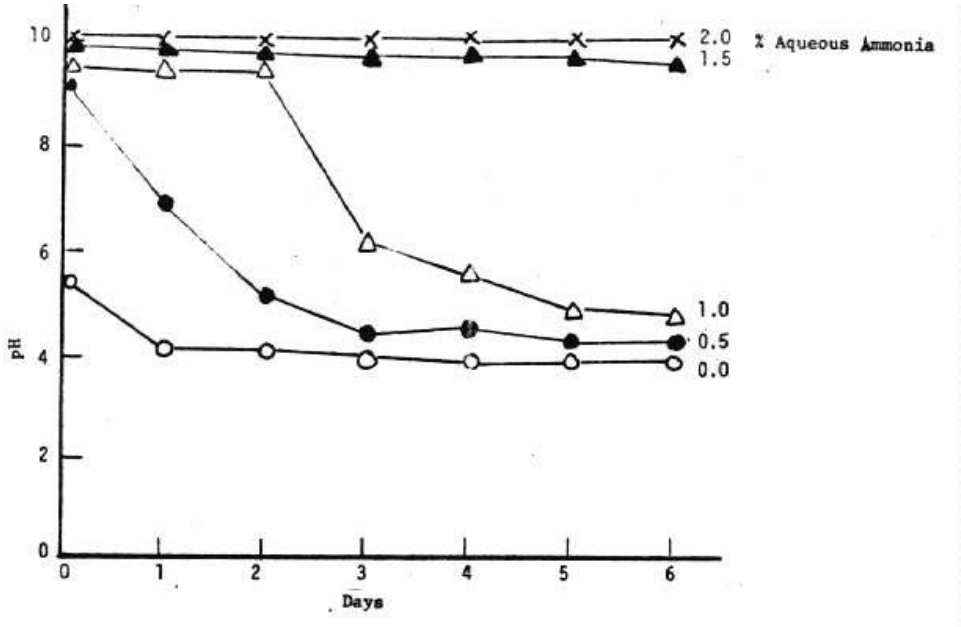
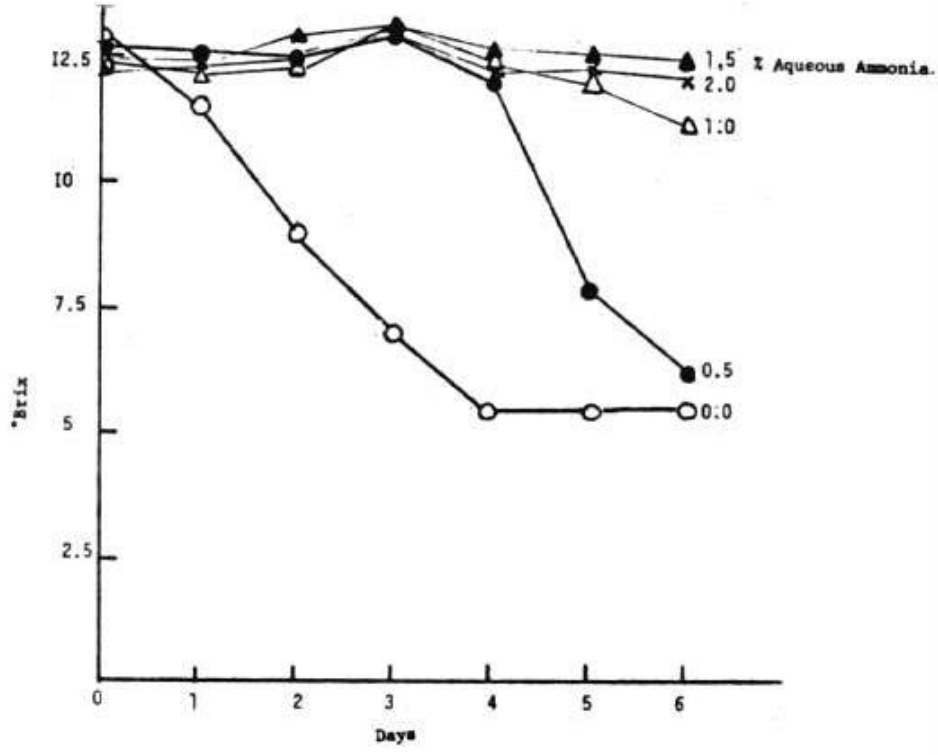


Figure 2:
°Brix fin cane juice during a six day period after treatment with different concentrations of aqueous ammonia (28% NH_3, w/v)



References

Alvarez F J, Preston T R 1976 Ammonia/molasses and urea/molasses as additives for ensiled sugar cane Tropical Animal Production 1:98-104

Duarte F, Mena A, Elliott R & Preston T R 1981 Unpublished data

Godoy R, Herrera F, Carcano R, Elliott R 6 Preston T R 1979 Preliminary observations on the use of anhydrous ammonia with and without molasses for the preservation and utilization of ensiled sisal pulp Tropical Animal Production 4:268-275

Leng R A & Preston T R 1976 Sugar cane for cattle production: present constraints, perspectives and research priorities Tropical Animal Production 1:1-22

Mena A, Duarte F, Elliott R & Preston T R 1981 The use of sugar cane juice as an energy source for fattening pigs Tropical Animal Production 6: in press

Sanchez M & Preston T R 1980 Sugar cane juice as cattle feed: comparison with molasses in the absence or presence of protein supplement Tropical Animal Production 5:117-124

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