Measurement of Salt Content of Beet Juices by Total Acidity

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The amount of ionic materials in sugar beet juice is an important factor in its processing quality. This has been recognized by the emphasis on ash and conductivity determinations. With the advent of stable, easily regenerated resins of analytical grade quality, another measure of salt content becomes available. This paper reviews the method used at this Laboratory and some of the findings obtained with it.

Materials and Method

About 10 ml. of wet resin or about 5 grams of air-dried resin (Dowex 50 or similar resin, mesh size about 60-100) was washed into a 12 mm. diameter tube stoppered at the lower end with a one-hole rubber stopper covered with fine-mesh nylon cloth. The resin was regenerated with 5 percent H_2SO_4 and washed with ion-free water until the pH of the effluent was 6 or above. Ten ml. of beet processing juice adjusted to about 10 percent sucrose was added to the column at a flow rate of about 10 ml./min. The column was washed with about 20 ml. of ion-free water or until the pH was 6 or above. The washings and eluate were made up to a definite volume, say 50 ml. Ten ml. of this solution were titrated with standard 0.1N NaOH to a phenolphthalein endpoint. Results may be expressed in milliequivalents of base per 100 grams of sucrose or other accepted units.

Results and Discussion

When determining the composition of beet processing juices, total available anions was used as a measure of the completeness with which the anions were accounted for. Thus it was proved that nearly all the acids in beet juice were accounted for as Cl, PO_4, citrate, SO_4, and malate (1). In diffusion juice lactic acid is an important factor when fermentation occurs. Recently in some unpublished work acetic acid was also found presumably as

Table I.—Total Anionic Constituents in Beet Diffusion Juices as Affected by Storage.

Factory	Date of sample	Anionic const. ml./l.	Lactic acid ml./l.
	1953	10% sucrose basis	
Moorhead	Oct.	74	1.9
	Dec.	76	2.2
Brighton	Oct.	66	0.7
	Dec.	68	2.1
Toppenish	Oct.	42	1.1
	Dec.	45	1.5

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[2] Numbers in parentheses refer to literature cited.

one of the products of fermntation (2). In molasses lactic (3), glycolic (3), glyceric (3), acetic (2), and formic (2) acids were found to increase in quantity over that in the diffusion juice.

One of the simplest methods for following certain changes during storage of sugar beets is measurement of total acidity. Diffusion juices from portions of beets harvested in October were analyzed for total anionic constituents. Diffusion juices were obtained from the same factories and from similar beets in December and analyzed. The results are given in Table 1. It is apparent that there is an increase in acidic constituents. As much as half the increase was found to result from a lactic fermentation as shown in Table 1.

In the hope that salt content would show some relationship to sucrose percentage both were measured in a series of 50 beets by Dr. D. W. Greenwood, Utah State College, Logan, Utah. The total anions and sucrose showed a —0.15 correlation which is not significant. This is unexpected because sodium tends to show a marked negative correlation and potassium a negative correlation of lower significance. Anions should reflect any increase in cationic constituents so further examination of this apparent anomaly is suggested.

In recently reported work by J. Pomeranz and C. Lendner (4) an equation relating total anions to ash content of sugar products has been developed This equation is $y = 0.0570x - 0.00893$ where y = ash and x = ml. of N alkali used per 100 grams of sugar and offers a rapid test for the salt content of sugar.

Conclusion

Total anionic constituent determination is recommended as a reliable, precise and accurate method for following certain characteristics of progressing quality of beet juice and sugar products in the factory and should be examined as a tool to aid the plant breeder in eliminating low-sugar beets.

References

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