

A Rapid Method for the Routine Factory Analysis of Lactic Acid

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Lactic acid determinations in sugar beet processing liquors have been utilized to measure the extent of sucrose degradation (2, 4, 5)². The majority of investigators use the colorimetric method, described by Barker and Summerson (1). This method is accurate and relatively simple, however it is limited in its ability to handle large numbers of samples. Stark, Goodban and Owens (3) pointed out that paper chromatography is a rapid, relatively accurate method by which organic acids can be identified. The purpose of this paper is to present a new paper chromatographic method for determining lactic acid. This method is being used at several factories with confidence that an accurate picture of lactic acid conditions is being recorded.

Materials and Methods

A chromatogram is obtained in the following manner:

- a. Whatman #4 paper— $18\frac{1}{4}'' \times 22\frac{1}{2}''$
- b. descending irrigation
- c. room temperature development
- d. calcium lactate pentahydrate as standard
- e. solvent

A parallel line is drawn 14 cm from one end of paper, each spot being separated by 3 cm on this line. The standards are located in the six middle positions and the unknowns are spotted on either side. The volume of sample spotted is contingent upon the lactic acid concentration. For high concentrations of lactic acid, 15 lambda are spotted and for low concentrations of lactic acid increments of 15 lambda are spotted.

Extensive work was done in selecting a suitable solvent. The solvent finally selected has the following make-up:

1. Stock Solution
 - 70 parts isopropyl alcohol
 - 25 parts benzene
 - 10 parts n-butyl alcohol
2. To 800 ml of stock solution add
 - 200 ml distilled water
 - 50 ml glacial acetic acid
 - .3 g bromcresol green
 - .1 g bromphenol blue

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² Numbers in parentheses refer to literature cited.

This yellow-orange, non-corrosive solvent has a pleasant odor and is easily prepared. It does not leave interfering residues upon evaporation. Lactic acid is readily separated from other constituents in beet sugar processing liquors.

After spotting, the papers are placed in the solvent troughs and allowed to remain for 1 to 1½ hours; they are then removed from the cabinets and allowed to dry. The solvent removal is facilitated when the chromatogram is exposed to water vapor. This can be accomplished by hanging the chromatogram between sheets of wet canvas in the drying oven or by constructing a canvas lined frame in which the chromatogram is placed. The chromatogram develops quite readily if the canvas frame is placed in a sink containing a small amount of hot water. It is noted that spraying or dipping of the chromatogram has been eliminated by the addition of the acid-base dyes to the solvent. The chromatogram will have a bluish-green background with lactic acid as a yellow spot. The sensitivity of the method is 1 gamma of lactic acid per 15 lambda of volume.

Results and Discussion

A comparative analysis was made between the colorimetric and chromatographic methods for the determination of lactic acid. The samples were obtained from The Great Western Sugar Company's Loveland factory. The results were:

Sample	Lactic Acid, ppm	
	G.W. Colorimetric	A.C.S. Chromatographic
Cossette Prses Juice	27	33
Diffusion Juice	64	58
Cell 3	72	66
Cell 5	85	83
Cell 7	75	100
Cell 9	89	108
Cell 11	93	95
Cell 13	77	116
Cell 15	79	71
Cell 17	88	71
Pulp Press Water	63	47

The time required for the development of chromatograms enables the worker to make evaluations throughout the entire day and the data will reflect a large number of samples. The simplicity of the paper chromatographic method has led to the introduction of the apparatus into routine factory analysis. Technicians are easily trained to spot and evaluate the chromatograms.

Certain precautions have to be taken in order to provide adequate chromatograms. The room in which the chromatograms are spotted and developed should be free of extraneous

odors, dust and traffic. Ammonia fumes and lime dust are extremely deleterious to the development of a chromatogram. An expenditure of \$100 or less will provide the complete apparatus necessary for the chromatography of lactic acid.

Summary

A chromatographic method has been described for the determination of lactic acid in sugar beet processing liquors. The method is rapid and adaptable to routine factory analysis.

Literature Cited

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