

DISSOLVED STARCH IN MIXED JUICE

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Abstract

The quantity of starch in solution in mixed juice appears to vary, possibly seasonally. The effect of dissolved starch on the efficiency of a vacuum flotation starch removal process is discussed.

Introduction

This investigation originated at Darnall in December, 1967, from the observation that the starch content of the clear juice from the vacuum clarifier was high (300 to 400 ppm on brix) even though the clarifier appeared to be operating efficiently as far as juice clarity was concerned. Operating conditions, such as heater temperatures, had been checked and found to be in order. It was then thought that more of the incoming starch might be in solution than was usual. Subsequent investigations showed that this was the case.

For the purposes of this paper dissolved starch is defined as that starch which will pass through a filter of pore diameter 0.65 μ .

Method

Starch analyses were carried out on catch samples of mixed juice taken from the tank above the juice scale and on catch samples of clear juice from the seal tank of the vacuum clarifier.

To determine the dissolved starch, the granular starch was first removed by filtering the juice through a filter of pore diameter 0.65 μ . It was found necessary to use a filter aid. Tests showed that varying amounts of filter aid had a negligible effect on the starch concentration.

The method for determining starch was basically that used by Alexander¹, with the modification that dissolved starch was precipitated with alcohol and the precipitate washed with alcohol only.

Results

Date	Starch Content ppm on Brix			
	Mixed Juice		Clear Juice	
	Total	Dissolved	Total	Dissolved
6.12.67	1810	190	320	210
8.12.67	1850	240	320	210
13.12.67	1910	310	400	200
14.12.67	1330	270	650	210
19.12.67	1250	310	440	300
21.12.67	2730	280	380	280
22.12.67	1570	310	330	300
27.12.67	1580	250	470	260
28.12.67	1190	220	510	240
31.12.67	1750	190	220	180
2. 1.68	1760	230	310	200
3. 1.68	1170	250	330	200
4. 1.68	1940	230	240	210
7. 1.68	2190	280	330	200
Average	1716	254	375	229
19. 1.68	1790	40	110	Trace
23. 1.68	1260	Trace	Trace	Trace
24. 1.68	1730	58	460	20
25. 1.68	1730	94	110	Trace
Average	1628	48	170	5

Results of the analyses carried out at Darnall are shown in the table below.

Discussion

It can be seen that over the period 6th December to 7th January, 14.8 per cent of the starch in mixed juice was in solution, while this value dropped to 2.95 per cent later in January.

The vacuum flotation process is designed for the removal of granular starch, though small quantities of dissolved starch may be removed by adsorption. Dissolved starch in the incoming juice will have an adverse effect on the efficiency of the overall removal. This can be seen from the figures for starch in clarified juice quoted in the table and from the following example.

Assume the efficiency of the vacuum flotation system to be such that 95 per cent of the granular starch is removed:

Case 1.—Where only 2.95% of the total starch in mixed juice is in solution

$$\begin{aligned} \text{Overall efficiency of removal} &= \frac{95 \times 97.05}{100} \\ &= 92.2\% \end{aligned}$$

Case 2.—Where 14.8% of the total starch in mixed juice is in solution

$$\begin{aligned} \text{Overall efficiency of removal} &= \frac{95 \times 85.20}{100} \\ &= 80.9\% \end{aligned}$$

It is of interest to note that dissolved starch will have no adverse effect on the efficiency of a system employing enzymes to destroy the starch.

The starch content of Darnall sugar for December, 1967, averaged 250 ppm, while the average during June, 1967, was 120 ppm. If the higher starch contents at year end can be attributed to an increase in the dissolved starch in mixed juice, the possibility of a seasonal effect cannot be ruled out. The investigation of this possibility by the accumulation of data throughout the coming season could confirm a problem of considerable importance to factories using vacuum clarification.

Acknowledgements

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Reference

- Alexander, J. B. (1954). Some Notes on Starch in the Sugar Industry. *Proc. S. Afr. Sug. Technol. Ass.* 28: (1954) 100-103.

Discussion

Mr. Alexander (in the chair): This type of paper is extremely valuable and more should be presented at our congresses to enable discussion to take place on work being done in our factories.

Mr. Buchanan: Referring to dissolved starch I have a microphotograph showing starch granules a little under 1μ in diameter. However some of the granules might have been ruptured in the preparation of the cane.

Dr. Roth: I have done some work to determine quickly the starch content of different cane varieties and to determine where the starch is present in the cane. Soluble starch can be identified microscopically to $.7\mu$. Below that it does not reflect the colour of the iodine but it is still available. Most granules are from 3 to 5μ but they can go up to 8.7μ . The Rabe

process probably removes starch granules that are larger than 1μ .

The enzymes, however, could attack the smaller starch granules.

Mr. Alexander: We are pleased to hear the Experiment Station is investigating the form of starch in cane. This is important to know when we are trying to remove it from juice. We would also like to know why soluble starch is sometimes higher at certain times.

Mr. Rabe: We have a lot of soluble starch in the cane at Umzimkulu.

When cane is burnt some very high temperatures can be achieved. We divided a field due to be cut, burnt half the cane, then harvested the whole field. There was less soluble starch in the unburned cane. But our method of extraction was suspect as we used a hydraulic press which allows for a filtering action in the fibre and starch would have been held back.