FURTHER IMPROVEMENTS IN RAW SUGAR QUALITY

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Introduction

The improvement in the quality of raw sugars sent to Hulett's Refinery during the three seasons, 1963/64 to 1965/66, was the subject of a paper presented to this association last year. (1) These improvements have been maintained and even accelerated during the 1966/67 season.

Criteria used for assessing quality of raw sugar

The factors which have been used in assessing changes in the quality of raw sugars are those which most affect the refining characteristics of that sugar, namely grain size, filterability, and the concentration in the crystal of ash, starch and total gums.

While polarisation and moisture are of considerable significance to the refiner, especially as far as storage and affination techniques are concerned, Hulsar's demands regarding these factors are less strict than is the case with overseas refineries. For this reason, the criteria used for the comparisons have been restricted to those concerned with the washed sugar.

The list includes filterability, although the use of current laboratory filterability tests for predicting the filter performance of sugars at Hulsar is now open to serious doubt (2, 3).

The Improvement in Quality

Table one summarises the average analyses of all Natal raw sugars received at the refinery during the past few seasons. Figures for the 1966/67 season represent sugars received up to the end of January, 1967.

Table I

Season	1963 /64	1964 /65	1965 /66	1966 /67
Specific Grain size (mm) . .	0.59	0.58	0.60	0.69
% 'Fine Grain' (-Tyler 28) . .	37.9	36.9	35.0	22.7
Filterability % (CSR 20°C) .	30	36	36	43
Starch in crystal (ppm) . . .	730	520	470	380
Sulphated Ash in crystal (%)	0.15	0.11	0.11	0.08
Total Gums in crystal (%) . .	—	0.20*	0.17	0.14

*Note:
Gum in crystal for 1964/65 season refers only to the period December to February.

In table two, the sugars sent to the refinery have been grouped according to filterability, and the distribution per season of sugars in each filterability group expressed as a percentage of the total raws received.

Table II

Season	Filterability % (CSR 20°C) >40%	40–30%	30–20%	<20%
1963/64 . . .	20.0	32.6	28.4	19.0
1964/65 . . .	36.1	35.1	21.9	6.9
1965/66 . . .	39.8	32.2	17.2	10.8
1966/67 . . .	64.1	23.0	11.7	1.2

Table three compares the quality of sugars produced during the seasons 1965/66 and 1966/67 by the Refinery's main contributors. Only those mills which have contributed more than 5,000 tons of sugar in both seasons have been used for these comparisons.

Discussions

The overall improvement in the quality of sugars sent to Hulsar during the past few seasons is obvious from a study of the tables. In particular the very rapid improvement in quality recorded last season should be noted. Crystal impurities have been reduced, filterability increased and grain size improved to a figure which would obtain substantial bonuses for the sugar in question if assessed according to the specifications of at least one overseas refinery.

While the quantity of impurity in the crystal has been reduced considerably, it is interesting to note that sugar sent to the refinery this season by Umzimkulu contained 20 ppm starch, 0.02% ash and 0.07% gums in the crystal. The effect of the new clarification techniques on the crystal purity of sugars from other mills will be watched with great interest.

Also interesting is the analysis of the small parcel of sugar received at the refinery from Union Bark Co-operative, where a B.M.A. diffuser is used. This sugar, with a filterability of 67%, contained 60 ppm starch, 0.04% ash and 0.06% gums in the crystal. While the good quality of this sugar must be due in part to the nature of the cane at Dalton, it will be interesting to see the changes in quality of Empangeni sugar following the introduction of diffusion.

Summary

The greatly improved refining quality of raw sugars sent to Hulett's Refinery during the 1966/67 season compared with previous seasons, is assessed in terms of filterability, grain size and crystal purity.

References

1. Jennings, R. P. Improvements in Raw Sugar Quality. Proc. S.A.S.T.A. Vol. 40, 1966, page 192.
2. Jennings, R. P. A Modified Method for Determining Filterability. Proc. S.A.S.T.A. Vol. 40, 1966, page 199.
3. Jennings, R. P., and Alexander, J. B. A Comparison between Laboratory Filterability Tests on Affined Raws and the Filterability of Factory Carbonated Liquors. 2nd Technical Session, Cane Sugar Refining Research Project, 1966, in press.

TABLE III

Mill	Empangeni		Felixton		Amatikulu		Darnall		Glendale		Tongaat		Mt. Edgecombe		Sezela	
Season	65/66	66/67	65/66	66/67	65/66	66/67	65/66	66/67	65/66	66/67	65/66	66/67	65/66	66/67	65/66	66/67
Specific grain size	0.61	0.75	0.66	0.70	0.62	0.77	0.62	0.66	0.41	0.56	0.56	0.69	0.65	0.74	0.51	0.55
% Fine Grain	30.3	14.9	26.3	20.1	32.4	13.2	29.5	24.3	75.4	38.7	41.9	21.5	24.9	17.6	49.7	41.6
% Filterability	32	40	42	43	47	57	36	40	34	36	26	52	47	37	48	38
ppm crystal starch	590	560	500	470	410	370	460	370	390	420	530	270	370	400	260	290
% crystal ash	0.09	0.09	0.08	0.08	0.10	0.06	0.09	0.05	0.15	0.14	0.14	0.08	0.05	0.08	0.13	0.13
% crystal gums	0.17	0.16	0.16	0.14	0.15	0.13	0.16	0.14	0.18	0.16	0.22	0.13	0.14	0.15	0.12	0.14

Notes: 1. Amatikulu results for 1965/66 refer to sugars produced at both old and new mills, whereas 1966/67 results refer to new mill sugars only.
2. During 1966/67 season, Mount Edgecombe changed from sulphitation to defecation clarification.

Discussion

Mr. Bentley (in the chair): The figures in Table III show that Mount Edgecombe, after changing from sulphitation to simple defecation now shows a higher starch figure in its sugar, whereas starch has declined in most other factories' sugar.

I am interested to know why starch is always shown as ppm whereas gums are shown as a percentage.

Mr. Alexander: I am from the refinery and I must congratulate the mills on the better sugar we received this season. However, this may not be entirely due to the efforts of the mills because at the end of the season we received some sugars with over 1,000 ppm starch, so possibly the mills received the best cane early in the season.

Mr. Ashe: At the end of the paper the low starch content of Union Co-op. Bark sugar is mentioned, so we await with interest Empangeni's figures next year when their diffuser is installed.

Are there any figures for starch in Entumeni's sugar?

Dr. Graham: The S.M.R.I. has been working at Entumeni since December.

As long as the diffuser operates below 70°C the starch content in the juice is small. At higher temperatures the starch concentration is about the same as in the mill juice. As the diffuser operated most of the season above 70°C starch was fairly high. A reservation about operating at 70° is a possible drop in extraction but we are not yet sure of this. Dalton had cane of very low starch content, and this probably contributed largely to the low starch content of their sugar.

Mr. Fourmond: I believe that Mr. Bruijn has found that frosted canes have a very low starch content, and Dalton cane was affected by frost.

Mr. Bruijn: That is true but I do not have figures to show how much of the cane at Dalton was frostbitten.

Mr. Box: In connection with what Dr. Graham said, the starch in diffuser juice, even when it is operating at 75°C, is still lower than in the juice from a 2nd, 3rd or 4th mill.

Dr. Graham: In the S.M.R.I. Annual Report a few years ago we gave figures for starch in different mill juices and our conclusions were that primary juice contains only about a quarter of the starch contained in secondary juice. However, these figures were unreliable as the juice samples analysed, which were from Mount Edgecombe, were taken at periods as much as a month apart. Recent analyses have shown the starch content of primary and secondary juice to be of the same order of magnitude.

For high temperature operation Entumeni juices showed similar starch contents for primary and diffuser juices. While some aspects of sugar quality cannot be easily controlled, others are, and the mills are to be congratulated on the improvement in grain size during the past season.

Mr. Fourmond: Seeing what is being done to solve the starch problem, I hope the engineers will not spoil the effect by applying hot imbibition.

Mr. Buchanan: When a solution of starch is studied under a microscope it is apparent that even if the temperature is raised to boiling point the granules take some time to swell, burst and release the soluble portion into solution, and it takes even longer for the husk of the starch granule to dissolve. A milling tandem has a very short imbibition time so hot imbibition should have very little effect unless it is very hot and the normal retention time is extended.