MOLASSES LOSS IN THE MAURITIAN SUGAR INDUSTRY

By

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Abstract

Data from thirty-five years crushing seasons have been used to highlight the relationship between cane quality and impurities from mixed juice and sucrose loss in Mauritian molasses. Characteristics of Mauritian molasses are examined, notably the magnitude of sucrose loss, molasses exhaustion in terms of the target purity difference, and the effect of the boiling process on the removal of non-sucrose present in the raw material.

Introduction

The main source of sucrose loss is in molasses (7.7%), higher than losses in bagasse (2.8%), in filter cake (0.5%) and unidentified losses (0.8%), i.e. over 65% of total losses are in molasses.

There are two aspects of sucrose loss in molasses that need to be considered: the mass of molasses produced per tonne cane crushed (quantitative) and the sucrose content of the molasses or purity of the molasses (qualitative). The former is directly proportional to the impurities in the raw material, often expressed as (100—mixed juice purity), or non-sucrose in mixed juice. The latter aspect of sucrose loss in molasses has been the subject of numerous molasses exhaustion studies in countries all over the world, which predict that expected molasses purity is directly proportional to the impurities present in molasses, notably the reducing sugars to ash ratio or more precisely (fructose + glucose) to ash ratio in molasses. The numerator favours molasses exhaustion whereas the denominator does not. How much sucrose is actually left in molasses depends on a number of factors, most importantly the viscosity and efficiency of low-grade operation of the pans, crystaliser, massecuite reheating and centrifugal. The difference between the actual molasses purity and the expected purity gives an idea of molasses exhaustion.

It is possible to have a situation where the mass of molasses produced is high but the purity of molasses is low, e.g. when the cane is immature with a lot of impurities to increase the mass of molasses produced, and a high reducing sugars content to favour molasses exhaustion.

Relationship between impurities in cane and juice and sucrose loss in molasses

Data of industrial averages from 1965 to 2000 were examined for the following parameters:

(a) 1—sucrose/fibre ratio in cane;
(b) 100—ClOgeret purity of mixed juice;
(c) non-sucrose in mixed juice % cane;
(d) sucrose lost in molasses % sucrose in cane;
(e) weight of molasses @ 85 brix % cane; and
(f) Clerget purity of molasses.

Regression analyses on these parameters were carried out. Results of the correlation coefficients and regression equations are shown in Table 1. Good correlations were found between parameters a and d, b and d, and c as well as a and e, which are shown in Figures 1 to 4 respectively. These results agree with some of the relationships found previously between mixed juice impurities and molasses loss (Wong Sak Hoi, 1998). As expected, no meaningful relationship was found between the impurities in the raw material and actual molasses purity.

Table 1—Relationship between cane and juice quality with sucrose lost in Mauritain molasses (1965-2000).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>(r^2)</th>
<th>Regression equation</th>
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<tbody>
<tr>
<td>a and d</td>
<td>0.69</td>
<td>(d = 6.54a + 6.94)</td>
</tr>
<tr>
<td>a and e</td>
<td>0.19</td>
<td>(d = 0.66b - 1.09)</td>
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<tr>
<td>a and f</td>
<td>0.18</td>
<td>(c = 0.18b + 0.83)</td>
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<tr>
<td>b and d</td>
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<td>(c = 0.84b - 0.01)</td>
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<tr>
<td>b and e</td>
<td>0.68</td>
<td>(c = 1.71c - 0.16)</td>
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<tr>
<td>b and f</td>
<td>0.08</td>
<td>(c = 1.71c - 0.16)</td>
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<tr>
<td>c and d</td>
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<td>c and e</td>
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</tr>
<tr>
<td>c and f</td>
<td>0.16</td>
<td>(c = 1.71c - 0.16)</td>
</tr>
</tbody>
</table>

(a) 1—sucrose/fibre ratio in cane
(b) 100—Clerget purity of mixed juice
(c) non-sucrose in mixed juice % cane
(d) sucrose lost in molasses % sucrose in cane
(e) weight of molasses @ 85 brix % cane
(f) Clerget purity of molasses

Magnitude of sucrose loss in Mauritian molasses

In Mauritius, the industrial average sucrose lost in molasses over the last 10 years was 8.2% sucrose in cane (with average minimum and maximum values of 6.8 and 10.1% sucrose in cane). The mean industrial value of 8.2 is lower than the corresponding 10.1 reported in South Africa (Lionnet and Davis, 1999). It must be pointed out that South Africa endured four years’ drought from 1993-1996 entailing high sucrose loss in molasses while, in 1999, Mauritius had the most severe drought known in its history, with cane and sugar production representing only 67% and 59% of those in the previous year.
Fig. 1—Relationship between (1 - sucrose/fibre ratio in cane) and sucrose lost in molasses % sucrose in cane (1965-2000).

Fig. 2—Relationship between (100 - Clerget purity of mixed juice) and sucrose lost in molasses % sucrose in cane (1965-2000).
Fig. 3—Relationship between (100 - Clerget purity of mixed juice) and weight of molasses @ 85 brix % cane (1965–2000).

Fig. 4—Relationship between non-sucrose in mixed juice % cane and weight of molasses @ 85 brix % cane (1965–2000).
Molasses exhaustion

Target purity difference (TPD) is a good indicator of molasses exhaustion. Available monthly data produce the following average values for the last five years:

- Mixed juice Clerget purity 86.7%
- Molasses Clerget purity 39.0%
- Molasses ash 18.0%
- \((\text{Fructose} + \text{Glucose})/\text{Ash}\) 0.47
- Target purity 38.4%
- Target purity difference 2.4

The target purity (TP) equation used is that derived in South Africa: \(\text{TP} = 33.9 - 13.4 \log_{10} \left[\left(\frac{\text{fructose} + \text{glucose}}{\text{ash}}\right)\right]\).

The average of 2.4 TPD is quite low, which confirms the relatively good exhaustion of molasses in Mauritius reported by Sahadeo and Lionnet (1999) from analyses of molasses collected all over the world.

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Sucrose in molasses % non-sucrose in mixed juice

A low value of sucrose in molasses % non-sucrose in mixed juice (molasses factor \(\times 100\)) indicates good elimination of non-sucrose in the factory. Changes in this parameter over the last ten years are shown in Figure 5. Industrial mean, minimum and maximum values reported for the last ten years by Mauritian sugar factories are respectively: 54.8, 42.8–48.1 and 59.7–66.7. The average value of 54.8 is quite low and indicates good processing work.

Conclusions

Using data collected in Mauritius from 1965–2000, it was found that there is a high correlation between impurities in mixed juice and (i) the sucrose loss in molasses % sucrose in cane and (ii) the weight of molasses @ 85 brix % cane.

Past years’ data show low sucrose loss in Mauritian molasses with relatively low TPD indicating good exhaustion, and low molasses factor reflecting good removal of non-sucrose present in the raw material.

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**Fig. 5—Changes in sucrose in molasses % non-sucrose in mixed juice (1991–2000).**

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**REFERENCES**

