# THE EFFECT OF SODIUM HYDROSULPHITE ON FINAL MASSECUITE VISCOSITY

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## Abstract

The effect of sodium hydrosulphite on C-massecuite viscosity has been investigated on a factory scale. The results indicate that the addition of sodium hydrosulphite has a significant influence in reducing massecuite viscosity.

## Introduction

Earlier tests carried out in Felixton investigated the effect of sodium hydrosulphite on low grade massecuites, included C-massecuite brix, boiling times and final molasses target purity differences.

One factor not considered was massecuite viscosity. In the present trials the effect of this chemical on viscosity was investigated at Umzimkulu Sugar Mill over a period of four months.

## Experimental

1. *Period.*

   The data used cover the period 21 August 1979 to 7 December 1979. Addition of sodium hydrosulphite (SHS) alternated on a one week with, one week without, basis.

2. *Instrument*

   The instrument used was a Brookfield type HB synchro-electric viscometer with spindle No. 7. Speed rotation varied from 2,5 to 10 rpm depending on massecuite viscosity.

3. *Method of sampling and analysis.*

   Samples were taken direct from the pan at strike. They were collected in a 3 litre enamel billy-can and the surface was immediately covered with filter paper to insulate and prevent surface cooling and evaporation. Any condensate formed was also absorbed by the filter paper enabling a more consistent viscosity reading to be obtained. Viscosity measurements were taken by punching a hole through the filterpaper and inserting the spindle to the required level. At the same time the temperature was recorded. Measurements were taken at different points and different temperatures and the average value recorded. All viscosities were measured at a temperature of 49 to 51°C.

4. *Dosage.*

   The dosage was 4 kg per 55 m$^3$. Half was added before graining and the balance after cutting into the strike pan. At the present price of R1,30 per kg this works out at 9,5 cents per m$^3$ of treated massecuite.

## Results

Massecuite brix, apparent purities and viscosities were plotted against time, to check for time trends as the season progressed. No trends were apparent over the period in question and it is therefore assumed that any relationships to be found are not due to outside effects connected somehow with seasonal factors.

Massecuite brix, purity and temperature are known to have marked effects on massecuite viscosity. These three factors should therefore be kept at fixed levels if the effect of a fourth factor, namely SHS, on vicosity is to be investigated. Since this work was done on a factory scale, massecuite brix, purity and temperature were not exactly the same for the runs with SHS and the runs without SHS.

The number of massecuites involved in the test, the average values of massecuite brix, purity and viscosity and the average temperatures at which the viscosities were measured are shown in Table 1.

**TABLE 1: Data for the massecuites with and without SHS.**

| | With SHS | Without SHS |
|---|---|---|
| Number of massecuites | 29 | 39 |
| Average brix | 96,7 | 96,9 |
| Average purity | 52,9 | 52,2 |
| Average temperature | 50,2 | 49,9 |
| Average viscosity | 6231 | 10524 |

T-tests were carried out to check for statistically significant differences between the means of the four factors involved, namely massecuite brix, purity and viscosity, and temperature of viscosity measurement.

The results of these t-tests are given in Table 2.

**TABLE 2: T-tests for means.**

| Testing for: | t calc. | t 0,05;66 |
|---|---|---|
| Massecuite brix | 1,09 | 2,00 |
| Massecuite purity | 1,80 | 2,00 |
| Temperature at which viscosities were measured | 2,16 | 2,00 |
| Massecuite viscosity | 4,95 | 2,00 |

## Discussion

The results in Table 2 indicate that there is no statistically significant difference between the means for massecuite brix and purity. It can therefore be assumed that the means for these two factors, for massecuites with and without SHS, are equal.

The same conclusions cannot however be made in the case of the temperatures at which the viscosities were measured. Here the means are statistically different at the 5% level.

Finally, the t-test for viscosity shows a highly significant (>1%) difference between the mean viscosity for massecuites with and without SHS.

It cannot however be concluded that the difference in massecuite viscosity is due entirely to the effect of SHS since temperature of measurement was significantly different.

The effect of temperatures on massecuite viscosity has been estimated[2, 3] to be an increase of approximately 10% for a 1°C drop. Since the average difference in the mean temperatures of measurement shows a drop of 0,3°C, it is estimated that the mean viscosity of massecuites without SHS would only be reduced by 3% to 10208. This value is still much higher than the viscosity with SHS and hence it is concluded that the addition of SHS does reduce massecuite viscosity.

## Conclusion

1. *Statistical results from previous work.*

   Previous work[1] has indicated that the addition of SHS increased brix by 0,3 units and reduced boiling times by 0,5 hours.

   This work does not reveal a significant effect on massecuite brix. This is probably due to the much smaller number of observations in the present exercise, namely 68 as opposed to 344 previously.

2. *Statistical results from present work.*

   This test completes the investigation by showing that sodium hydrosulphite has an effect on C-massecuite viscosity, which is a very important factor in back-end processing. This reduction in viscosity is achieved at a low cost. Viscosity is reduced by approximately 40 percent at a cost of 9,5 cents per $m^3$ massecuite.

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