RECENT EXPERIENCES WITH CONTINUOUS CRYSTALLIZATION FOR 'A' STRIKE MASSECUITES IN PLANTATION WHITE SUGAR FACTORIES

T. Ananta, A. Bachtiar and E. Purnomo

Indonesian Sugar Research Institute
Pasuruan 67126, Indonesia

ABSTRACT

Based on the workshop on the application of subjects discussed in the XIX ISSCT Congress in 1986, experiments were carried out on the use of continuous crystallization under vacuum for A-massecuites during the 1990 milling season in Krebet Baru I and II Sugar Factories. The crystal gain % original A-massecuite which depends on the recirculated of A-molasses is discussed. The limits of recirculation of A-molasses for a target of 43% crystal content in A-massecuite are determined.

Key words: Vacuum cooling crystallization, molasses recirculating, crystal gain.

INTRODUCTION

In 1978 continuous crystallization under vacuum was tried successfully in a cane sugar refinery at Nantes. The increase in crystal weight in the refinery first strike was 45%. In 1986 Gorce et al reported the results of continuous crystallization under vacuum applied in raw cane sugar factories Bois Rouge and Gol in Réunion Island. The increase in crystal weight was 10-17% and it was possible after two weeks of trials to change the boiling system from three to two boilings. Application of the continuous crystallization under vacuum for plantation white sugar now seems logical. This paper deals with the results of the application of continuous vacuum crystallization in sugar factories, Krebet Baru I and II, which produce plantation white sugar by means of a double sulfiation process.

MATERIALS AND METHODS

The application of the continuous crystallization under vacuum (Figure 1) was as follows:

A strike massecuite flowed from the vacuum pan into a receiver. The massecuite was then pumped into a continuous crystallizer, which was maintained under
FIGURE 1. Continuous crystallization of A massecuite in Krebet Baru I and II Sugar Factories.

Vacuum at 29-22 kPa absolute pressure. The retention time of the massecuite in the vacuum crystallizer was at least 55 minutes. After leaving the crystallizer the first strike massecuite was purged and part of the molasses derived from it was heated to 75-80°C and returned to the vacuum crystallizer at a rate 9-30% of the massecuite flow. The rest of the A-strike molasses was sent back to the boiling house.

The difference between the continuous crystallizers in Krebet Baru Sugar Factories I and II and that used in Nantes refinery according to Cuel and Epee was that the continuous vacuum crystallizers in Krebet Baru Sugar Factories I and II had only one compartment maintained at 26±3 kPa absolute instead of two vacuum compartments at 21 kPa absolute and 13 kPa absolute. A complete control system was not used in Krebet Baru; the control instruments consisted only of a conventional thermometer, manometer and level indicators.

Sampling and analyses

One A-strike massecuite was divided into two parts, one part was purged without using the vacuum crystallizer and without the addition of A-molasses. The other part flowed into the vacuum crystallizer diluted with 9-30% heated A-molasses.
at 75-80°C. Samples of undiluted and diluted massecuites were taken at the same time when entering the centrifugals. The A-molasses samples were obtained by filtration of the massecuite under vacuum (nutsch).

Samples of recycled A-molasses were also taken. The dry matter content (Brix) and apparent purities of the massecuites and A-molasses samples were determined.

RESULTS AND DISCUSSION

From the determinations of dry matter content (Brix) and pol of massecuite, A-molasses derived from it and recycled A-molasses, calculations were done according to Appendix I. The results of the calculations are shown in Figures 2, 3, 4 and 5.
Recycled A molasses %

\[ Y = 0.336X + 0.387 \]
\[ r = 0.70 \]

**FIGURE 3. Effect of A-molasses recycle rate on change in crystal content (Krebet Baru I Sugar Factory).**

Figures 2 and 4 show dilution with recycled A-molasses (%) vs. crystal gain % original massecuite of respectively Krebet Baru I Sugar Factory and Krebet Baru II Sugar Factory. Figures 3 and 5 show dilution with recycled A-molasses (%) vs. the difference between the original crystal content \( (C_{cr1}) \) of the massecuite and the crystal content \( (C_{cr2}) \) of the massecuite from the vacuum crystallizer, i.e. recycled A-molasses (%) VS \( C_{cr1} - C_{cr2} \) (%).

From the regression curve \( Y = 0.353X - 0.492 \) in Figure 2 it can be calculated that 20% and 30% dilutions with recycled A-molasses give crystal gains of 6.6 and 10.2% respectively.

Krebet Baru I Sugar Factory produced A-massecuites with an average crystal content of 54%. For ease and efficient operation a crystal content of 43% was
Recycled A molasses %

Regression line

Crystal gain %

54 - 43 = 0.336 X + 0.387 → X = 31.6%

From the regression curve $Y = 0.260X + 1.380$ in Figure 4 it can be calculated that dilution of 20% and 30% give crystal gains of 6.6% and 9.2% respectively in Krebet Baru II Sugar Factory. This factory produced A-massecuites with an average crystal content of 55%. As in Krebet Baru I Sugar Factory a crystal content of 43% was taken as the limit. The amount of recycled A-molasses can therefore be calculated:
FIGURE 5. Effect of A-molasses recycle rate on change in crystal content (Krebet Baru II Sugar Factory).

\[ Y = 0.456 X - 1.952 \]
\[ r = 0.78 \]

Based on the above results the recycled A-molasses was maintained at 20-30%.

The results in Krebet Baru Sugar Factory I and II compared with Bois Rouge and Gol are shown in Table 1.

The reasons for the higher crystal gains in Bois Rouge and Gol were:

- The continuous vacuum crystallizer in Krebet Baru Sugar Factory consisted of only one vacuum compartment maintained at 26±3 kPa absolute instead of two compartments at 21 and 13 kPa absolute.
TABLE 1. Results of continuous vacuum crystallizer for A-masse cuite in Bois Rouge, Gol in Reunion Island and Krebet Baru I and II Sugar Factories.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A-Massecuite original</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brix</td>
<td>91.5</td>
<td>92.7</td>
<td>96.4</td>
<td>95.8</td>
</tr>
<tr>
<td>Apparent purity</td>
<td>86.9</td>
<td>84.3</td>
<td>81.4</td>
<td>83.5</td>
</tr>
<tr>
<td>Crystal content (%)</td>
<td>51</td>
<td>54.7</td>
<td>54</td>
<td>55</td>
</tr>
<tr>
<td>Recycled A-molasses (%)</td>
<td>30</td>
<td>42</td>
<td>20-30</td>
<td>20-30</td>
</tr>
<tr>
<td>A-Massecuite CVC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brix</td>
<td>89</td>
<td>90.2</td>
<td>93.6</td>
<td>93.7</td>
</tr>
<tr>
<td>Apparent purity</td>
<td>–</td>
<td>78.2</td>
<td>76.3</td>
<td>77.3</td>
</tr>
<tr>
<td>Crystal gain CVC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Original massecuite</td>
<td>10-15</td>
<td>17</td>
<td>6.6-10.2</td>
<td>6.6-9.2</td>
</tr>
<tr>
<td>Pol of sugar</td>
<td>98.8</td>
<td>99</td>
<td>99.8</td>
<td>99.7</td>
</tr>
</tbody>
</table>

Gol used a computer controlled system while conventional instruments were used in Krebet Baru I and II.

CONCLUSION

Recycling of A-molasses at the rates of 20 and 30% on massecuite gave crystal gains (% original massecuite) of 6.6 and 10.2% respectively in Krebet Baru I Sugar Factory whilst in Krebet Baru II the comparable gains were 6.6 and 9.2%. For these factories, molasses recycle rates of 31.6 and 30.6% respectively gave a crystal content of 43% for the massecuite entering the centrifugals. Based on these results, 30% recycling of A-molasses is taken as the maximum limit.

ACKNOWLEDGMENTS

The authors wish to express their sincere thanks to the management of PT. IMACO, Mr. Suwono, Mr Slamet Darsosuprapto, Mr Darmadi and other staff members of sugar factory Krebet Baru I and II for their cooperation in this work.
REFERENCES


APPENDIX I

From the experiments the following data are available

- Original massecuites (Ma)     Pol;  Brix;  App. Purity
- Original A-molasses from nutsch (Mo)     "  "  "
- Massecuite ex. continuous     "  "  "
- Vacuum crystallizer (Ma CVC)     "  "  "
- A-molasses ex. CVC from nutsch (Mo CVC)     "  "  "
- Recycled A-molasses (Mo R)     "  "  "

The following calculations were made

- Dilution

\[ X = \frac{\text{Purity Ma CVC} - \text{Purity Mo R}}{\text{Purity Ma} - \text{Purity Mo R}} \times 100\% \]

Dilution = (100 - X)

- Ton massecuite

\[ \text{Ton Ma} = \frac{\text{Ton Brix}}{\text{Brix Ma}} \times 100\% \]

- Crystal % massecuite \( c_r \)

Crystal content of original massecuite as well as crystal content of massecuite ex. CVC were calculated as follows:

\[ c_r = \frac{\text{Purity Ma} - \text{Purity Mo}}{100 - \text{Purity Mo}} \times \text{Brix Ma} \]

- Ton crystals massecuite

\[ \text{Ton crystals Ma} = c_r \times \text{ton Ma} \]
- Crystal gain % massecuite ex. CVC

\[
\frac{\text{Ton crystals } Ma \text{ CVC} - \text{Ton crystals } Ma}{\text{Ton Ma CVC}} \times 100\%
\]

- Crystal gain % original massecuite

\[
\frac{\text{Ton crystals } Ma \text{ CVC} - \text{Ton crystals } Ma}{\text{Ton Ma}} \times 100\%
\]

Plotting dilution (%) with recycled A-molasses vs. crystal gain % Ma gave Figures 2 and 4.

Plotting dilution (%) with recycled A-molasses vs. difference between the original crystal content \(C_{\text{w}}\) Ma and the crystal content \(C_{\text{w}}\) Ma CVC gave Figures 3 and 5.

The number of experiments \(n\) done in Krebet Baru II Sugar Factory was 43 (date: 1-8-1990 up to 16-8-1990).

The amount of experiments \(n\) done in Krebet Baru I Sugar Factory was 26 (date: 29-8-1990 up to 10-9-1990).
T. ANANTA, A. BACHTIAR AND E. PURNOMO

DES EXPERIENCES AVEC LA CRYSTALLISATION CONTINUE DES MASSECUITE A DURANT LA PRODUCTION DE SUCRE BLANC, "PLANTATION"

T. Ananta, A. Bachtiar et E. Purnomo

Indonesian Sugar Research Institute
Pasuruan 67126, Indonesia

RESUME

On s'est basé sur des discussions pendant le congrès ISSCT 1986, pour faire des expériences concernant la crystallisation continue, sous vide, pour les massecuites A. Ces expériences ont été faites en 1990 à Krebet Baru I et II. On discute l'augmentation du paramètre crystal % massecuite A, qui dépend de la quantité de melasse A en recirculation. Les limites pour cette recirculation, pour un taux de cristaux de 43% dans la massecuite A, sont données.

EXPERIENCIAS RECENTES CON CRYSTALIZACION CONTINUA PARA MASACOCIDA DE TEMPLAS "A" EN LOS INGENIOS AZUCAREROS EN "PLANTATION WHITE"

T. Ananta, A. Bachtiar y E. Purnomo

Indonesian Sugar Research Institute
Pasuruan 67126, Indonesia

RESUMEN

Basado en los seminarios sobre la aplicación de materia considerada en el Congreso 19 de ISSCT en 1986, experimentos se llevaron a cabo en el uso de cristalización continua bajo vacío para las masacocidas "A" durante la temporada de molida del 1990 en las factorias Krebet Baru I and II. El % de aumento de grano de la masacocida "A" original, que depende en la recirculación de las mieles "A" se considera. Los limites de la recirculación de las mieles "A" para obtener un 43% de contenido de grano en masacocida "A" es determinada.