Using Sugars™ for mill optimization projects

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- Lafayette LA, February 9, 2011
Objectives

1. Present modeling of a sugar cane factory utilizing Sugars™ based on LASUCA sugar mill.
2. Discuss factory modification to reduce steam usage.
3. Compare the different boiling schemes for improvement of raw sugar color.
Sugars™ is 2 programs

1. MS Visio for the graphical interface.
2. Sugars for calculations.

Visio communicates with Sugars using ActiveX Technology.
Other Software Programs

- ASPEN
- CHEMCAD
- HYSIM
- HYSYS
- PROISM
- SUPERPRO DESIGNER®(1)
- All these programs are capable of material and energy balances, but they are not specific for sugar mills and refineries.
Sugars™ for Windows®

- is used to model sugar factories and refineries.
- has successfully modeled thousands of sugar processes since it was introduced in 1986.
- is a reliable program that is used by sugar companies and engineering firms to improve existing factories, or to design new ones.
- is the most widely used program in the world for modeling and simulating sugar processes.
What Information Do You Need?

1. Daily manufacturing and quality report.
2. All turbine steam rates & installed hp.
3. Equipment performance data, heaters, evaporators, etc.
4. boilers, pans, and injection water pumps data, thermal parameters, pressures, temperatures and vacuum and types of equipment or unit operations.
HOT SIDE INJECTION WATER PUMP

STEAM TURBINES

Water rate
36 Lb/hp-hr

Power required
253 hp

ISentropic efficiency
45%

TO SPRAY PONDS/ COOLING TOWER PUMPS

15,333,210.0 lb/h

148,334.9 lb/h
1.3 psia
43.3 °C

VENT TO ATMOSPHERE

15,333,216.0 lb/h

247,032.23 lb/h
7,666.61 ton/h
79.0 psia
46.9 °C
150.5 °C (Sat.)
87.9 BTU/lb

40.6 °C

15,184,881.0 lb/h

15,184,881.0 lb/h

13,033,234.0 lb/h

13,033,234.0 lb/h

7,049.0 lb/h
40.6 °C
73.0 BTU/lb
For other uses

7,002.84 ton/h
14.7 psia
49.9 °C
100.0 °C (Sat.)
87.9 BTU/lb

30.0 psia
40.6 °C

9,199.9 lb/h

9,199.9 lb/h

6001

6002

6003

6004

6005

3901-0

294-0

1300-0

2300-0

3900-0

To mud filter condenser
244,064.9 lb/h
2300-1

R

294-1

R

294-1

5,220,952.5 lb/h
84.29737 fl/h
2,614.98 ton/h
30.0 psia
40.6 °C

15,184,881.0 lb/h

5,220,952.5 lb/h

TO PANS
CONDENSER

R

3901-1

TO EVAPORATORS
CONDENSER

R

3900-1

INJECTION WATER PUMPS

INJECTION WATER PUMPS

INJECTION WATER SYSTEM

BALANCED

FIKADI IM REYNE

C:\Users\Fikadu\Desktop\evap project\CASExLASUCAcomparison between dp, dm, atap & threeBcompar dp with dmTHREE BOIL 0% top off 85

16/12/2010 13:41:13 PURITY.vsd 9
Example LASUCA Sugar Mill

• Crop year 2009/2010 Base Model
  “No Excess Bagasse @ 10,500TCD “

Causes:

1. Syrup Brix was 59 – 61.
2. Pan steam demand was high.
3. Unsteady crushing for different causes.
4. Inconsistent bagasse feeding to boilers.
5. Low boiler efficiencies.
6. Mother nature.

❖ B/C, brought bagasse from another mill.
Questions

• Most of the time we considered the boiler couldn’t generate enough steam to the process or looks like shortage of capacity if we ground extra X amount of cane or changing the boiling scheme. The problem is overlooked other causes like:
  • Why the boiler forced to generate extra steam? Is it the process balanced?
  • How do we use the steam or vapors?
  • What is the syrup brix? What are the causes for frequent down time?
  • How do we control imbibition, molasses conditioning & mud filters water?
  • How do we feed the bagasse to boilers?
  • How do we control/or reduce the flue gas temperature?
  • What is the bagasse/steam quality?
  • For these reasons, simulation results from Sugars™ can be used as a guide to compare against the actual performance of the factory. In addition, it is used to train process engineers, design new factories, evaluate the feasibility of R&D projects, reconcile process data and provide information about the process that cannot be measured.
## COMPARISON B/N 2009 & 2010 CROP
RESULTS BASED ON SUGARS™ ON LASUCA MILL

<table>
<thead>
<tr>
<th></th>
<th>TCD 10500 @ 60 BRIX 2009 /2010 CROP year BOILER EFF≈ 52%</th>
<th>TCD 10500 @ 65 BRIX 2010 crop year BOILER EFF≈ 55%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injection water temp.</td>
<td>105 °F</td>
<td>100 °F</td>
</tr>
<tr>
<td>Exhaust usage at Pan Station</td>
<td>A,B, C &amp; Grain Pans</td>
<td>C &amp; Grain Pans</td>
</tr>
<tr>
<td>V1 Usage</td>
<td>50% A Pans only</td>
<td>All A &amp; B Pans</td>
</tr>
<tr>
<td>V2 Usage</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Lb/hr HP STEAM</td>
<td>464,796</td>
<td>441,704</td>
</tr>
<tr>
<td>Required Make-up to Exhaust steam , Lb/hr</td>
<td>62,000</td>
<td>45,500</td>
</tr>
<tr>
<td>Excess Bagasse, Lb/hr</td>
<td>0</td>
<td>23,092</td>
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</tbody>
</table>
Lasuca Crop Year 2010

• The base model is changed. Most of the problem areas are addressed and the plant became more efficient and produced more excess bagasse as a result of less steam demand. Also, sugar Pol increased with low color due to good quality cane.

• The excess bagasse created a different (storage or disposal) problem but it is more than offset by a better balanced factory.

• NB: The “Base Model” is interchangeable.
Raw Sugar Color Improvement Methods Using Sugar™
Types of Boiling Scheme Over 80 Syrup Purity

1. Conventional Three Boiling Scheme.
2. Double Magma with Three Boiling.
3. Modified Double Magma with:
   - 4 Boiling.
   - All “B” magma to remelt.
   - All “C” magma to remelt.
4. Double curing (purging) at “C” sugar.
## Comparison Based On Sugars™

With 15,000CU ph 7 cane juice & 10500 TCD cane juice &

<table>
<thead>
<tr>
<th>BOILING System</th>
<th>Steam On cane</th>
<th>A &amp; B MAS. Volume LB/HR</th>
<th>“C” MAS. Vol. LB/HR</th>
<th>COLOR @ 7 PH</th>
<th>COLOR @ 8.5 PH</th>
<th>SUGAR %POL</th>
<th>SUGAR LB/hr</th>
<th>F.M True PTY</th>
<th>F.M Apt PTY ≈</th>
<th>F.M Lb/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three boiling</td>
<td>49.3</td>
<td>196,384</td>
<td>55380</td>
<td>1459</td>
<td>2918</td>
<td>98.8</td>
<td>90400</td>
<td>41.3</td>
<td>33.3</td>
<td>35718</td>
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<tr>
<td>Double Magma</td>
<td>50.9</td>
<td>270,425</td>
<td>57855</td>
<td>503</td>
<td>1006</td>
<td>99.3</td>
<td>89749</td>
<td>42.8</td>
<td>34.8</td>
<td>36518</td>
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<tr>
<td>Double Purging @ C sugar</td>
<td>49.4</td>
<td>189,761</td>
<td>57031</td>
<td>716</td>
<td>1431</td>
<td>99.2</td>
<td>89848</td>
<td>42.7</td>
<td>34.7</td>
<td>33149</td>
</tr>
</tbody>
</table>
# Comparison On Boiling Schemes

<table>
<thead>
<tr>
<th>BOILING SYSTEM</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>THREE BOILING</td>
<td>1. Handling high syrup purities without back boiling.</td>
<td>1. Not uniform sugar quality.</td>
</tr>
<tr>
<td></td>
<td>2. Relatively less steam demands.</td>
<td>2. It is conditional.</td>
</tr>
<tr>
<td>Double Magma</td>
<td>1. Uniform sugar quality.</td>
<td>1. Requires high pan &amp; centrifugal capacity plus relatively high steam demands. (Due to 30 – 35% more massecuite volume).</td>
</tr>
<tr>
<td></td>
<td>2. Higher sugar pol and less color</td>
<td>2. Cannot handle high syrup purities without back boiling.</td>
</tr>
<tr>
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<td>3. B strikes easier to boil due to high crystal content.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Less time for boiling due to high purity material.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Less pan capacity &amp; more energy efficient.</td>
<td>2. Can not handle high syrup purities without back boiling.</td>
</tr>
<tr>
<td></td>
<td>3. Slightly less molasses production due to less water usage at fore workers machine.</td>
<td>3. It requires maximum attention on magma and wash purities to get lower sugar color &amp; final molasses purities.(i.e., 93 Purity magma &amp; “C” wash around B molasses purity).</td>
</tr>
</tbody>
</table>
Conclusions

• The Sugars™ program is a valuable tool for operating and planning decisions.

• Both Double magma and Double purge at “C” magma schemes can provide improved quality raw sugar. The final selection depends on the plant set up, available equipment and management strategies.

• We will be happy to work with interested parties to compare various scenarios.
Acknowledgements

• Mr. Mike Comb, general manager, and LASUCA management team, for their encouragement and permission to use the factory name as model example.

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• Mr. Warner Weiss, Manager of Sugars International LLC for his full support and guidance to help with understanding the software.

• Mr. Mark Suhr from MS processes Intl for training.
References


4. Sugars International LLC web site: http://www.sugarsonline.com


THANK YOU