Welcome to:

Dewatering Technologies for Wet Biomass
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Purpose

• Develop new uses for agricultural products and coproducts.

• AURI’s focus on technology transfer opportunities.

• Identify technologies capable of economical and efficient drying of wet biomass materials.
• Many wet biomass feedstocks generally have low value due to the high cost of thermally removing water.
• Dryer feedstocks would open markets for combustion, pelleting material, feed, slow release fertilizer or ground covers.
• At a minimum, producers or processors would be trucking more material and less water.
Initiative History

• **Dewatering Technologies for Wet Biomass Initiative** supports previous AURI drying initiatives.

• **Microwave Drying Initiative; 2008**

Cellencor, Inc.; Ames, IA
Initiative History

• AURI Drying Initiative; 2009-2010
  o Dryer technologies presentation and demonstration forums in Benson and Willmar, Minnesota

*Kinetic Disintegration System
*Heat pump assisted drying
*Single & triple pass rotary drum

*High Speed Air Cyclonic Dryer
*Belt drying systems
*Industrial microwave
Goal

• Identify drying and dewatering technologies that efficiently remove water.
• Focus on performances close to theoretical energy minimum of 970 Btu per pound of moisture removed.
• Common energy required by industry to remove one pound of moisture = >2,800 Btu/lb. moisture.
Thermal Drying vs. Mechanical Dewatering

- Theoretical minimum energy required for liquid to gas transition = 540 cal./g = 970 Btu/lb. at 1 atm.

VS.

- Mechanical dewatering is not restricted by thermodynamic energy minimum and may present more efficient solutions.
Dewatering Research

• Test Material:
  Wet sugar beet tailings &
  Wet sugar beet pulp

• Technology evaluated:
  PulverDryer USA
  HydroPress
## Dewatering Results – Wet Sugar Beet Tailings

<table>
<thead>
<tr>
<th>Initial Tailing Wt. (lbs.)</th>
<th>Post HydroPress Tailing Wt. (lbs.)</th>
<th>Extracted Liquid Wt. (lbs.)</th>
<th>Tailing Loss (lbs.)</th>
<th>(%) Product Recovered</th>
<th>(%) Liquid Extracted</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.6</td>
<td>9.8</td>
<td>13.2</td>
<td>-4.6</td>
<td>35.51</td>
<td>47.83</td>
</tr>
<tr>
<td>103.9</td>
<td>37.8</td>
<td>61.2</td>
<td>-4.9</td>
<td>36.38</td>
<td>58.90</td>
</tr>
</tbody>
</table>

Sugar Beet Tailing post HydroPress
Dewatering Results – Wet Sugar Beet Tailings

- % Solids recovered + moisture
- % Liquid extracted

36.38

58.90
“Check your work”

- **Raw Sugar Beet Tailings:**
  - 99 lbs. at start × 79.78% moisture = 78.98 lbs. H2O

- **Tailings from HydroPress:**
  - 37.8 lbs. recovered solids × 69.82% H2O = 26.39 lbs. H2O
  - 61.2 lbs. recovered liquid & solids × 87.48% H2O = 53.54 lbs. H2O

- 26.39 lbs. + 53.54 lbs. = 79.93 lbs. (+0.95 lb. error)
## Dewatering Results – Wet Sugar Beet Pulp

<table>
<thead>
<tr>
<th></th>
<th>Initial Pulp Wt. (lbs.)</th>
<th>Post HydroPress Pulp Wt. (lbs.)</th>
<th>Extracted Liquid Wt. (lbs.)</th>
<th>Pulp Loss (lbs.)</th>
<th>(%) Product Recovered</th>
<th>(%) Liquid Extracted</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sugar Beet Pulp</strong></td>
<td>81.4</td>
<td>42</td>
<td>36.5</td>
<td>-2.9</td>
<td>51.60</td>
<td>44.84</td>
</tr>
</tbody>
</table>

Sugar Beet Pulp

Sugar Beet Pulp post HydroPress
Dewatering Results – Wet Sugar Beet Pulp

- % Solids recovered + moisture
- % Liquid extracted

44.84
51.60
Liquid Extract Characterization from Sugar Beet Pulp

• Extracted liquid fraction contained 19.3% solids and 80.7% moisture.

• Liquid extract recovered contained:
  o 1.2% fructose
  o 0.74% glucose
  o < 0.10% sucrose
Additional Research Needed

• Most dewatered materials still require additional drying due to remaining moisture content around 70% to 80%
• Evaluate technology utilizing larger quantities of material
• Focus on technology scale-up
• Process feasibility on a larger scale
• Economic analysis
Conclusion

• Initial trials conducted using the HydroPress technology provided by PulverDryer USA, Inc. appear to be a method of feasibly dewatering sugar beet tailings and sugar beet pulp.

• Assumption is due to the 58.9% liquid extraction observed in the wet sugar beet tailings and the 44.8% liquid extraction observed in the wet sugar beet pulp.
The majority of the moisture was removed utilizing mechanical methods.

PulverDryer USA, Inc. claims an operational cost of $6 per wet ton; this is comprised of a $1.50 to $2.25 per wet ton processing cost.

Dewatering technologies may offer an efficient companion technology to thermal drying thus increasing the market opportunities for wet biomass feedstocks.
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• The views and opinions of authors shall not be used for advertising or product endorsement purposes.
Questions?

- What is your reaction to the findings?
- Do you see value in this information?
- What additional research would you like to see done in this area?
Questions?

Al Doering
Senior Associate Scientist - Coproducts
507.835.8990
adoering@auri.org

Nan Larson
Rural Innovation Director
507.537.6020
nlarson@auri.org

www.auri.org