Welcome to:

Dewatering Technologies for Wet Biomass

Agenda

1. Welcome
2. Instructions
3. AURI staff introductions
4. Presentation
5. Questions/Discussion
6. Conclusion

Collaborators

auri
Agricultural Utilization Research Institute

Northwest Minnesota Foundation

Northwest Minnesota Foundation
Developing Community Assets

PulverDryer USA

PULVERDRYER™
Pulverizing and Drying Systems

American Crystal Sugar

American Crystal Sugar Company

Purpose

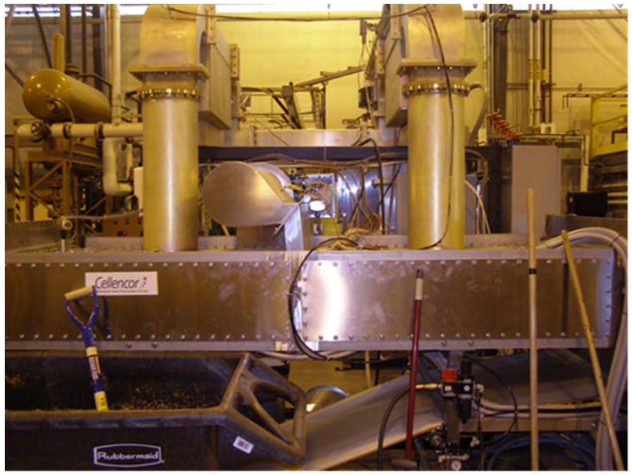
- Develop new uses for agricultural products and coproducts.
- AURI's focus on technology transfer opportunities.
- Identify technologies capable of economical and efficient drying of wet biomass materials.

Purpose

- 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**

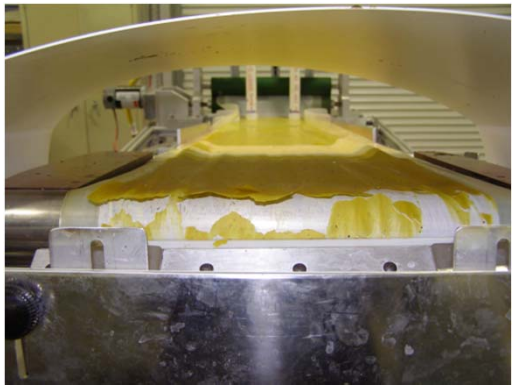


Cellencor, Inc.; Ames, IA

Initiative History

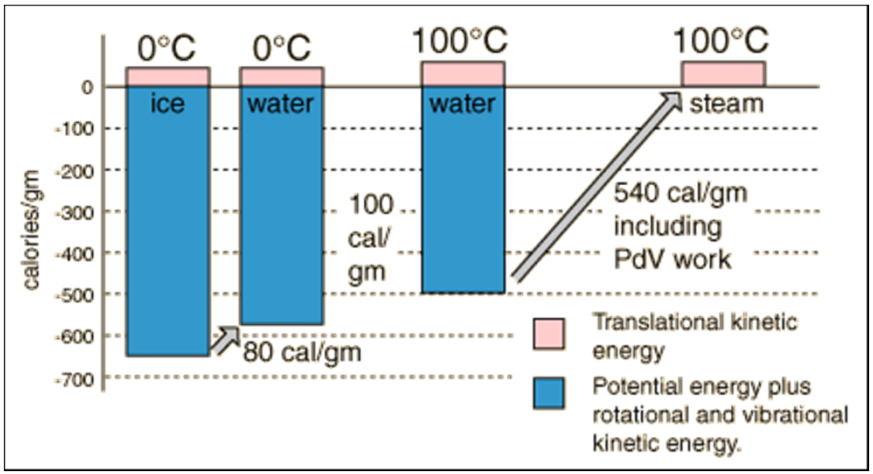
- **AURI Drying Initiative; 2009-2010**
  - **Dryer technologies presentation and demonstration forums in Benson and Willmar, Minnesota**

***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

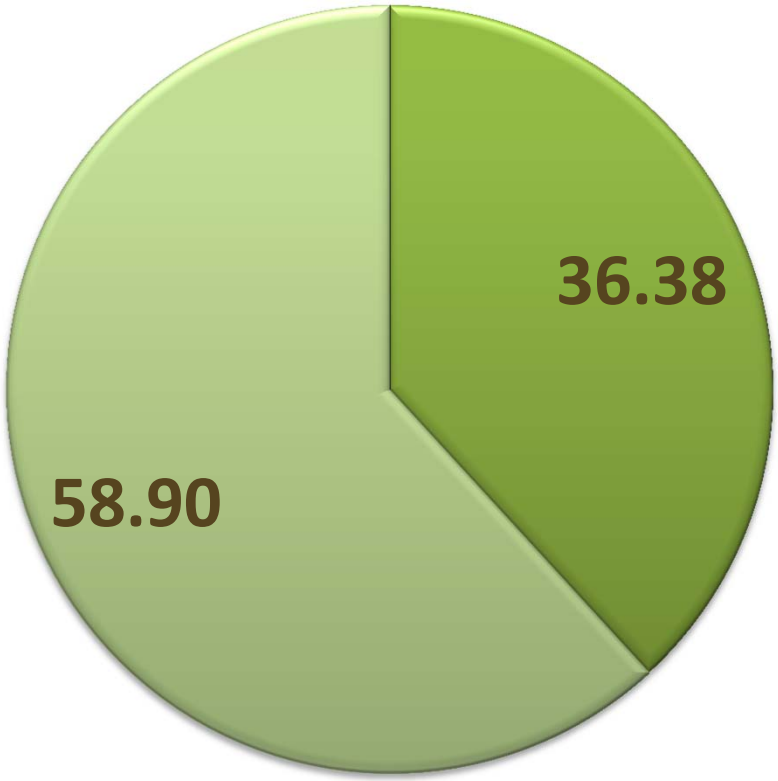
  HydroPress

Dewatering Results – Wet Sugar Beet Tailings

Initial Tailing Wt. (lbs.)	Post HydroPress Tailing Wt. (lbs.)	Extracted Liquid Wt. (lbs.)	Tailing Loss (lbs.)	(%) Product Recovered	(%) Liquid Extracted
27.6	9.8	13.2	-4.6	35.51	47.83
103.9	37.8	61.2	-4.9	36.38	58.90

Sugar Beet Tailing post HydroPress

Dewatering Results – Wet Sugar Beet Tailings



% Solids recovered + moisture

% Liquid extracted

"Check your work"

- **Raw Sugar Beet Tailings:**
  - **99 lbs. at start X 79.78% moisture = 78.98 lbs. H2O**
- **Tailings from HydroPress:**
  - **37.8 lbs. recovered solids X 69.82% H2O= 26.39 lbs. H2O**
  - **61.2 lbs. recovered liquid & solids X 87.48% H2O = 53.54 lbs. H2O**
- **26.39 lbs. + 53.54 lbs. = 79.93 lbs. (+0.95 lb. error)**

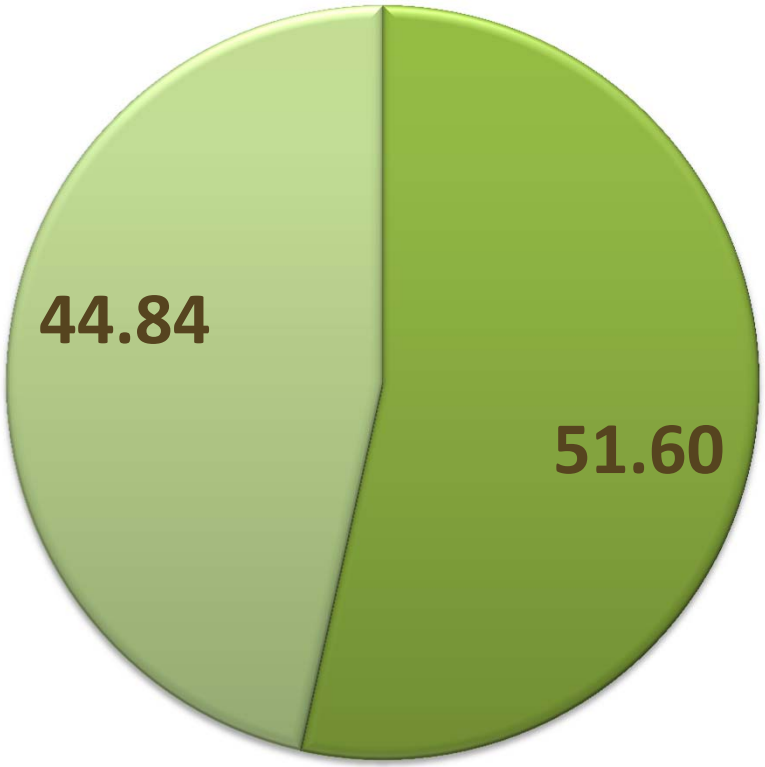
Dewatering Results – Wet Sugar Beet Pulp

Initial Pulp Wt. (lbs.)	Post HydroPress Pulp Wt. (lbs.)	Extracted Liquid Wt. (lbs.)	Pulp Loss (lbs.)	(%) Product Recovered	(%) Liquid Extracted
81.4	42	36.5	-2.9	51.60	44.84

Sugar Beet Pulp

Sugar Beet Pulp post HydroPress

Dewatering Results – Wet Sugar Beet Pulp



% Solids recovered + moisture

% Liquid extracted

Liquid Extract Characterization from Sugar Beet Pulp

- **Extracted liquid fraction contained 19.3% solids and 80.7% moisture.**
- **Liquid extract recovered contained:**
  - **1.2% fructose**
  - **0.74% glucose**
  - **< 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.

Conclusion

- **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.**

Disclaimer

- Reference herein to any specific commercial products, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by AURI.
- 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