DOE Informational Questionnaire

Sweetwater Energy, Inc.
Jonathan Sherwood
300 Trolley Blvd.
Rochester, NY 14606
585-647-5765
Jonathan.Sherwood@Sweetwater.us

Category 1: Lignocellulosic Sugars

Question 1: To which types of research entities are you willing and able to sell your lignocellulosic sugar (e.g., university researchers, national laboratories, industry/private sector)? Are there any types of research entities to whom you are not willing and able to sell your lignocellulosic sugar?
- Sweetwater will sell sugars to any research institution looking to create value-added products from cellulosic sugars.

Question 2: What are the maximum and minimum quantities of lignocellulosic sugar you are willing and able to sell (kg)?
- Sweetwater can sell as little as a liter of 11% sugar solution or as much as a 55-gallon drum at higher concentrations. Arrangements for larger volumes are possible.

Question 3: What is the sugar concentration in your product?
- Sweetwater’s sugar is sold in concentrations of between 11%-50%, depending on a customer’s requirements.

Question 4: What physical form do you sell your sugars (e.g., solid or liquid)?
- Sweetwater’s sugars are sold in liquid solution at the concentration required by the researcher.

Question 5: How do you package your lignocellulosic sugars for shipping? Do you ship in bulk?
- Sweetwater packages sugars in sealed containers from 1 liter to 55-gallon drums.

Question 6: What type(s) of biomass do you use to produce lignocellulosic sugar?
- Sweetwater has successfully processed dozens of feedstocks. We have processed several types of hardwoods, softwoods, grasses – including miscanthus and sorghum, and various wastes, such as palm fronds and banana peels. The full list includes:
  o Maple
  o Aspen
  o Oak
  o Beetle Pine
  o Slash
Red Oak
Basswood
Arundo Donax
Mixed Hard wood
NYS Waste Wood
Sorghum
Sorghum Stover
Miscanthus
Sweet Sorghum Bagasse
Willow
Almond Hulls
Almond Tree wood chips
Fruit Tree Wood/Softwood Chips
Ensiled Sorghum
Corn Stover
Sweetgrass
Energy Cane
Palm Press Fiber
Palm Decanter Cakes
Energy Cane
Beech Wood
Corn Fiber
Palm Empty Fruit Bunches
Cherry Saw Dust
Wet Distillers Grains
Douglas Fir Sawdust
Hemlock Sawdust
Cedar Sawdust
Washed DDGS
Apple Pomace
Redwood Sawdust
Spent Mushroom Substrate
Green Bananas
Wheat Straw
Tamarac
Poplar
Sugar Beet Pulp
Sugar Beets
Sugarcane Bagasse

Question 7: What process do you use to produce lignocellulosic sugar?

- Sweetwater uses a proprietary thermomechanical enzymatic hydrolysis to separate sugar and lignin. The process produces very few inhibitors, so the sugar and lignin are of very high quality.
Question 8: What details of the scale of your process are you willing to share (e.g. batch and/or continuous/ volumetric productivity)?

- *Basic block flow diagram:*
Question 9: What is the typical composition of your sugar stream (e.g., glucose, galactose, mannose, xylose, arabinose) and what is the purity?

**HPLC PLOTS**

*Hardwood-derived C5 Rich Stream (After pretreatment)*

<table>
<thead>
<tr>
<th>Detector A</th>
<th>Quantitative Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ID#</strong></td>
<td><strong>Name</strong></td>
</tr>
<tr>
<td>1</td>
<td>Glucose</td>
</tr>
<tr>
<td>2</td>
<td>Xylose</td>
</tr>
<tr>
<td>3</td>
<td>Arabinose</td>
</tr>
<tr>
<td>4</td>
<td>Formic Acid</td>
</tr>
<tr>
<td>5</td>
<td>Acetic Acid</td>
</tr>
<tr>
<td>6</td>
<td>Ethanol</td>
</tr>
<tr>
<td>7</td>
<td>HMF</td>
</tr>
<tr>
<td>8</td>
<td>Furfural</td>
</tr>
</tbody>
</table>

*Note: acetic acid levels in grasses are much lower than in hardwoods*
Hardwood-derived C6 Rich Stream (After pretreatment, C5 Separation and subsequent C6 rich hydrolysis; 72-hour hydrolysis time with industry standard enzyme dosing)

*Note: acetic acid levels in grasses are much lower than in hardwoods*
Hardwood-derived C5/C6 Blended Stream (After pretreatment, no C5 separation followed by 72 hours of enzymatic hydrolysis with industry standard enzyme dosing)

*Note: acetic acid levels in grasses are much lower than in hardwoods*
Question 10: Do you routinely test your cellulosic sugar for consistency within and between lots and between feedstocks (if applicable)?

- Yes, Sweetwater tests its sugars and lignin with every batch and every production run.

Question 11: What impurities are present in your lignocellulosic sugar process and what testing do you perform to determine the presence of impurities?

- Sweetwater’s Sunburst-derived sugar streams are extremely low in breakdown inhibitors, such as furfural, formic acid and HFM. We measure the presence of inhibitors via HPLC analysis throughout our process to make sure the production of these inhibitors is as low as possible. The Sunburst-derived sugars are high quality, high yielding, and extremely suitable for a broad range of chemical and biological processes to make many different end products from biochemicals to biofuels.

Question 12: Does your process include a purification step?

- Sweetwater does not normally purify its sugar, however, if required purification can be done at an incremental cost, depending on the research institution’s required specifications.

Question 13: What is the highest concentration in grams/Liter you can provide?

- Sweetwater has provided sugar solutions to customers at concentrations as high as 50%.

Question 14: Have you examined the impacts of transport and storage on sugar degradation? If so, can you please provide any relevant (non-proprietary) details of these impacts?

- Yes. Shipping times and conditions have very little impact on high-concentration sugar solutions. Low-concentration solutions require cooling and shortened shipping times.

Question 15: What additional information are you willing and able to provide to the research community about your lignocellulosic sugar? Please provide any nonproprietary cost information you are willing to share.

- Sweetwater is happy to provide a cost estimate to any research institution. Cost is based on specification requirements and feedstock utilized.