

DOE Informational Questionnaire

Sweetwater Energy, Inc.
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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:*
 - *Maple*
 - *Aspen*
 - *Oak*
 - *Beetle Pine*
 - *Slash*

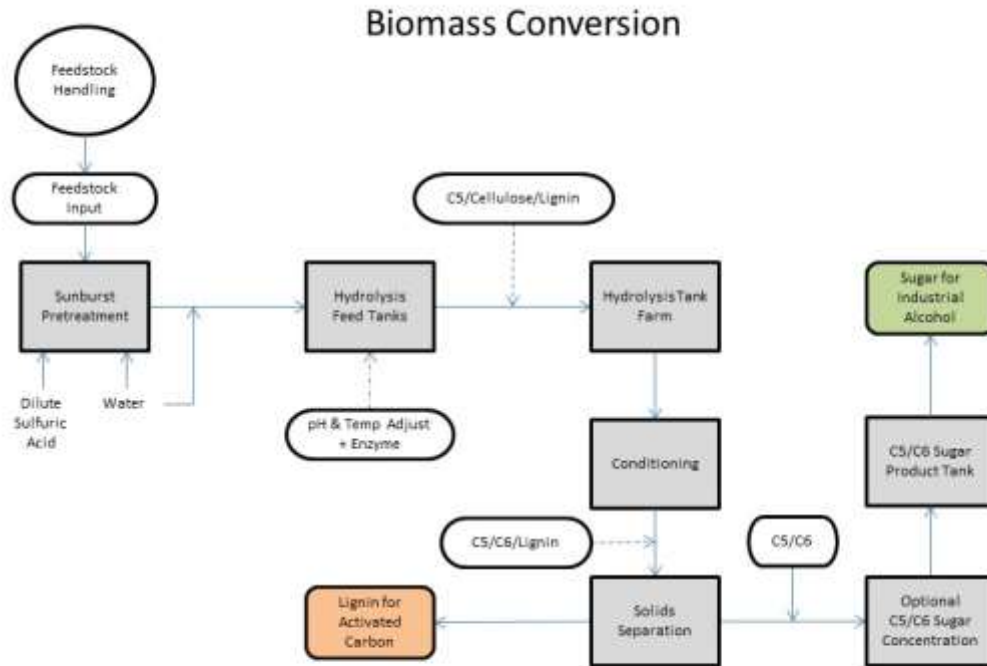
- *Red Oak*
- *Basswood*
- *Arundo Donax*
- *Mixed Hard wood*
- *NYS Waste Wood*
- *Sorghum*
- *Sorghum Stover*
- *Miscanthus*
- *Sweet Sorghum Bagasse*
- *Willow*
- *Almond Hulls*
- *Almond Tree wood chips*
- *Fruit Tree Wood/Softwood Chips*
- *Ensiled Sorghum*
- *Corn Stover*
- *Sweetgrass*
- *Energy 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)?

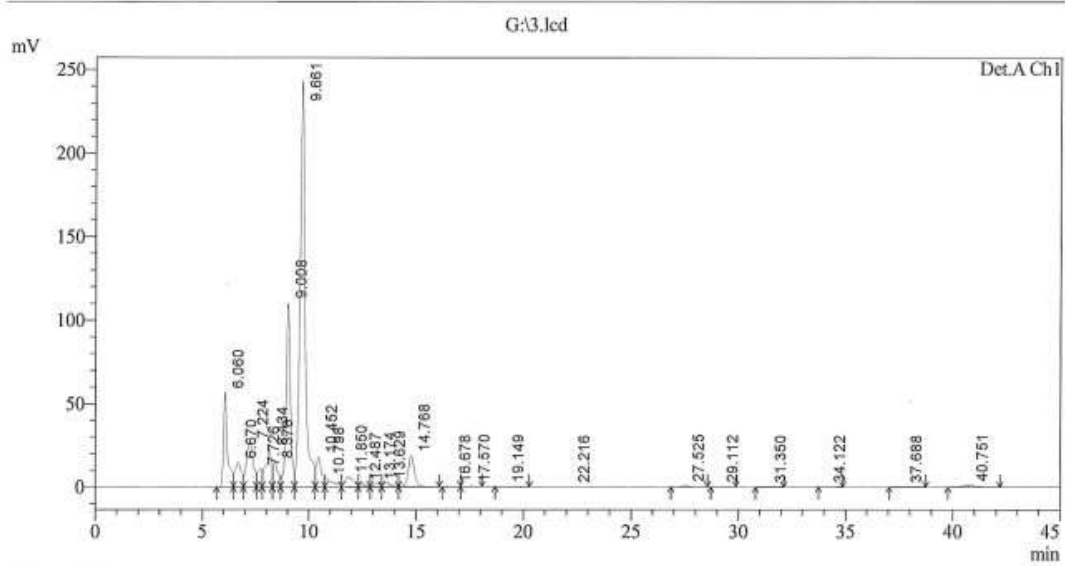
- *Basic block flow diagram:*



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)



1 Det.A Ch1/

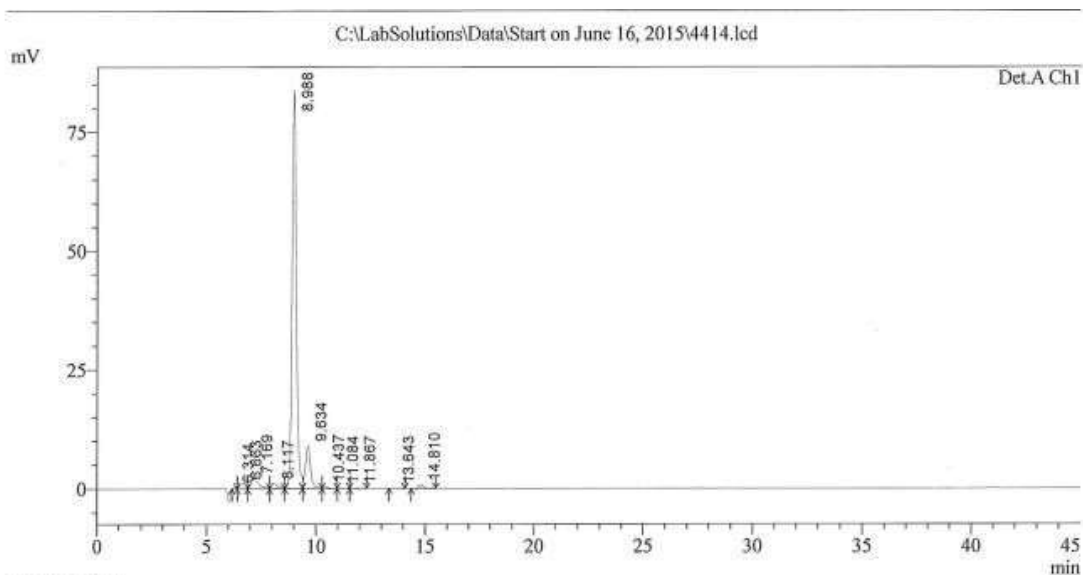
Quantitative Results

Detector A

ID#	Name	Ret. Time	Area	Height	Conc.(g/L)
1	Glucose	9.008	1579445	110445	21.318
2	Xylose	9.661	4187174	243558	58.326
3	Arabinose	10.452	311734	17922	4.254
4	Formic Acid	13.629	62324	2540	2.554
5	Acetic Acid	14.768	383986	18655	11.048
6	Ethanol	22.216	0	0	0.000
7	HMF	27.525	23249	673	0.271
8	Furfural	40.751	56985	1139	0.672

*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)



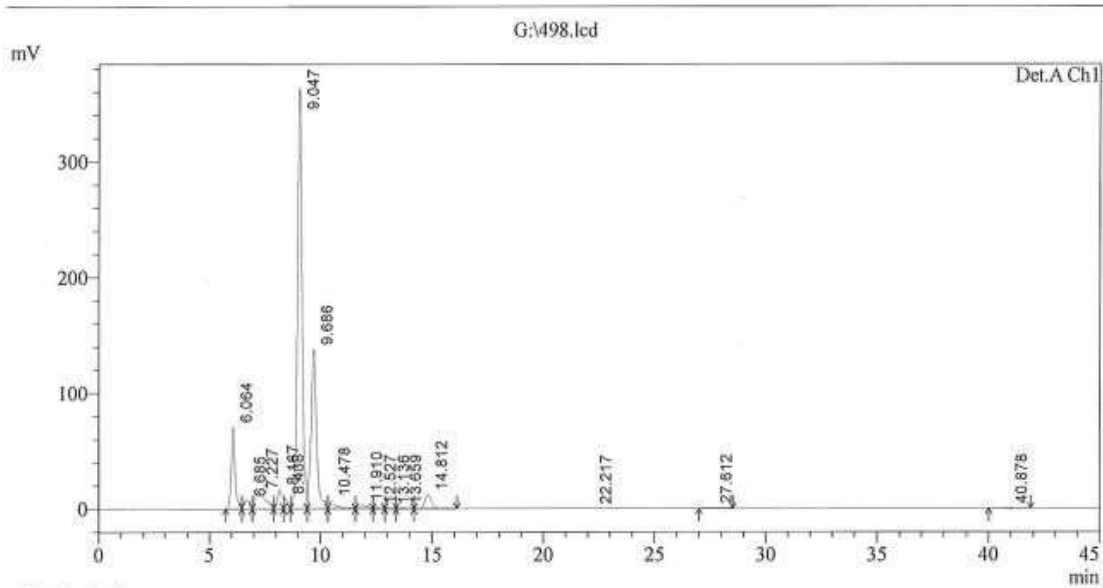
Quantitative Results

Detector A

ID#	Name	Ret. Time	Area	Height	Conc.(g/L)
1	Glucose	8.988	1160058	83766	67.118
2	Xylose	9.634	151048	9024	9.043
3	Arabinose	10.437	8423	439	0.500
4	Xylitol	11.084	1036	54	0.061
5	Formic Acid	13.643	1089	67	0.184
6	Acetic Acid	14.810	14950	791	2.118
7	Ethanol	0.000	0	0	0.000
8	HMF	0.000	0	0	0.000
9	Furfural	0.000	0	0	0.000

*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)



1 Det.A Ch1/

Quantitative Results

Detector A

ID#	Name	Ret. Time	Area	Height	Conc.(g/L)
1	Glucose	9.047	5337401	363797	71.976
2	Xylose	9.686	2415327	138184	33.574
3	Arabinose	10.478	186473	7138	2.539
4	Formic Acid	13.659	18434	797	0.708
5	Acetic Acid	14.812	263958	12382	7.471
6	Ethanol	22.217	0	0	0.000
7	HMF	27.612	14636	420	0.166
8	Furfural	40.878	27653	561	0.316

*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 through out 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.*

