August 12, 2016

United States Department of Energy
Sent by Email: sugarandlignin@ee.doe.gov

Subject: Response to Request for Information DE-FOA-0001615 Cellulosic Sugar and Lignin Production Capabilities

Dear US DOE:

This letter is in response to your Request for Information under DE-FOA-0001615 Cellulosic Sugar and Lignin Production Capabilities. Here is the requested information for the start of the response:

Company/Institution Name:	ZeaChem Inc.
Company/Institution Contact:	Tim Eggeman
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ZeaChem operates a nominal 10 ton per day (dry weight) lignocellulosic pretreatment unit. Depending upon composition of the biomass (bulk density, size, ash content, etc.) the throughput can be greater or less. The pretreatment unit is an Andritz horizontal digester that can be operated using different approaches including auto-hydrolysis with or without steam explosion, dilute acid hydrolysis with or without steam explosion, dilute base with or without steam explosion, sulfite processing, organosolv processing, etc. The pretreatment unit can be run in a single stage configuration completing deacetylation or deacetylation and hydrolysis of hemicellulose to xylose rich hydrolysate, or in a dual stage configuration completing hydrolysis of cellulose in the second stage to glucose rich hydrolysate.

If the pretreatment unit is used in a single stage configuration then the hydrolysis of cellulose to glucose rich hydrolysate is performed using enzymatic hydrolysis in our 15,000-liter liquefaction unit and our 150,000 liter bioreactors. The throughput depends upon the enzyme performance generally occurring over 72-96 hours.

The rest of this response contains answers to the specific questions posed in the RFI. Please feel free to contact me directly with any questions.

Sincerely,

Tim Eggeman
President & CEO

Category 2: Lignin

Q1: ZeaChem is willing and able to sell our lignocellulosic sugars to any and all research entities that may request them.

Q2: ZeaChem is willing to provide small (1-10 kg) of lignin when it has such lignin readily available from a production run. Larger quantities of lignin may require dedicated production runs. ZeaChem is willing to complete such production runs pending its facility's availability.

Q3: ZeaChem can accommodate various packaging desires of its customers, either into super sacks or as a bulk product loaded directly into trucks.

Q4: ZeaChem's facility is located next to a bulk loading dock on the Columbia River, a rail spur from the Union Pacific rail line, and Interstate 84.

Q5: Lignin concentrations vary as a function of the type of feedstock and the method of hydrolysis used.

Q6: ZeaChem can process any type of cellulosic biomass through its facility. Feedstocks processed to date include: hardwoods, softwoods, corn stover, wheat straw, sugarcane bagasse, energy cane, bana grass, and sugar beets.

Q7: ZeaChem has a variety of pretreatment and hydrolysis processes at its disposal. It has Andritz digester capable of steam explosion, auto hydrolysis, dilute acid hydrolysis, and sulfite processes. These processes may be combined with enzymatic saccharifications at various scales.

Q8: ZeaChem's pretreatment / hydrolysis unit is capable of processing up to 10 bone dry tons per day of a high density feedstock such as wood chips. Feedstocks of lower bulk densities may be processed at lower feed rates. Currently, ZeaChem's largest vessel for conducting enzymatic saccharifications is 3,000 gallons. It has plans to expand this production volume to 40,000 gallons.

Q9: No. ZeaChem sends its solids out to a 3rd party laboratory for compositional analysis as needed.

Q10: No. ZeaChem sends its solids out to a 3rd party laboratory for compositional analysis as needed.

Q11: Lignin impurities vary as a function of biomass input and hydrolysis process used. ZeaChem sends its solids out to a 3rd party laboratory for compositional analysis as needed.

Q12: ZeaChem has multiple solid liquid separation units, some of which may utilize a washing step.

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Q13: Lignin concentrations vary as a function of the type of feedstock and the method of hydrolysis used.

Q14: Experience indicates that dry solid lignin tends to be stable over long periods of time with limited or no additional treatment.

Q15: ZeaChem provides production runs at its facility based on its daily standard rate. ZeaChem works with third parties to define the scope, schedule and budget of their projects.

Q16: Markets and applications of products from ZeaChem's facility vary extremely widely given the feedstock and process flexibility of its plant.

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