

Category 2: Lignin

Question 1a: To which types of research entities are you willing and able to sell or otherwise provide your lignin? (e.g., university researchers, national laboratories, industry/private sector)?

University researchers, national laboratories and industry/private sector

Question 1b: Are there any types of research entities to whom you are not willing and able to sell your lignin?

We have just started marketing the product. Yet to sell them to any customer. Based on our preliminary evaluation, there is quite a bit of demand for the lignin stream in the market.

Question 2: What are the maximum and minimum quantities of lignin that you are willing and able to sell (kg)?

Insoluble Lignin present in unhydrolyzed solids (UHSL) (after enzyme hydrolysis of AFEX pretreated biomass).

Question 3: In what units do you sell your lignin and is it packaged (e.g., super sacks), or sold in bulk?

We are planning to sell from few grams (5-100 g) to few kilo grams (0.5 to 5 kg). Most of the samples are packed in polypropylene bottles.

Question 4: How do you ship lignin?

We are planning to ship lignin in polypropylene bottles and zip lock bags at room temperature using FedEx or UPS.

Question 5: What is the lignin concentration in your product?

Typically is 40-45 wt% lignin

Question 6: What type(s) of biomass do you use in your process?

Corn stover, switch grass, poplar wood, wheat straw, rice straw, sugar cane bagasse

Question 7: What process do you use that produces lignin (dilute acid, ammonium fiber expansion (AFEX), hot water, organosolv, etc.)?

AFEX pretreatment and enzymatic hydrolysis of the biomass.

Question 8: What details of the scale of your process are you willing to share (e.g. batch and/or continuous or volumetric productivity)?

We do our pretreatment process in batch and have the capability to produce 200 kg of UHSL per batch

Question 9: Do you measure the typical composition of your lignin? If so, what method do you use? How consistent is the composition of your lignin?

Yes, we measure the composition of lignin and use NREL method to measure acid soluble and acid insoluble lignin.

Question 10: Do you routinely test your lignin for consistency within and between lots?
Yes, we do measure lignin for consistency within and between lots.

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

Typical impurities include organic acid (acetic, ferulic, coumaric acid), oligosaccharides, proteins, oils and carbohydrates (cellulose and hemicellulose).

Question 12: Does your process include a purification or filtration step?

We use enzyme hydrolysis, centrifugation, followed by washing in water to remove residual sugars and dried using oven.

Question 13: What is the typical concentration in g/L you can provide?

Our material is solid and typically contains 40-45 wt% lignin.

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

If samples are properly stored in dark containers at 4 °C they are quite stable.

Question 15: What additional information are you willing and able to provide to the research community about the lignin? Please provide any non-proprietary cost information you are willing to share.

UHSL is a lignin-rich solid residue derived from AFEX pretreated biomass followed by enzymatic hydrolysis. It contains about 40-45 wt% of lignin. This residue can be used a raw material for lignin valorization applications, however, it may require further purification steps (depending on the application). This raw material is a by-product of the AFEX-based biorefinery concept.

Question 16: Into what markets do you typically sell your lignin? What is a typical application for your lignin?

We will typically sell the lignin residues through our company "Glydia Biotech LLC" website (website under construction). Typically, research laboratories who are working on transforming lignin to fuels and chemicals or making biopolymers are interested in this lignin-rich product. This type of product can be further refined to produce enriched lignin fractions, which may also be used in biomaterial applications. Our product has been used as starting material to generate polyols for making different kinds of bio-based foams. In some cases, the lignin can be used as bio-based filler in materials production, binding agent, soil amendments, fuel additive and making bio-based plastics like Bakelite.