

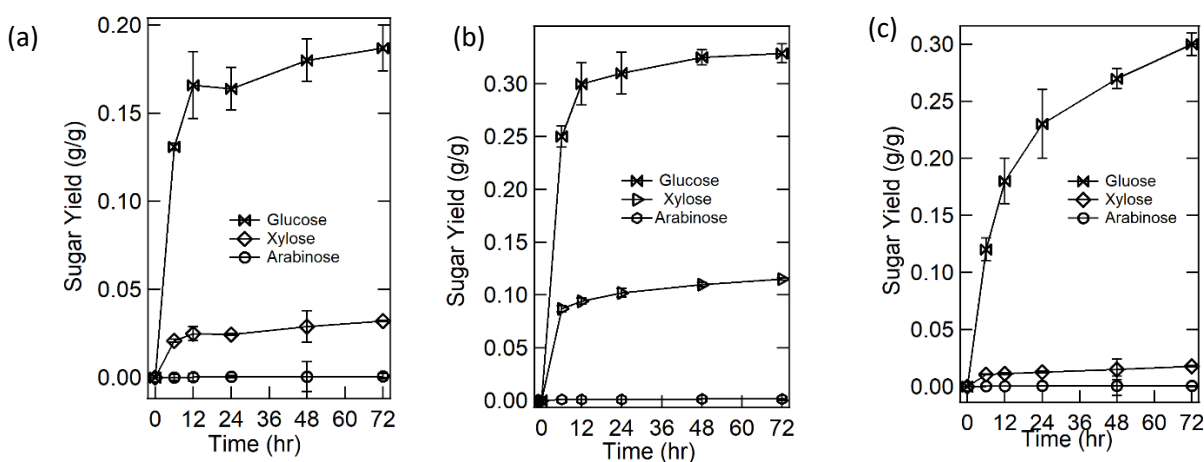
## Supplementary Material

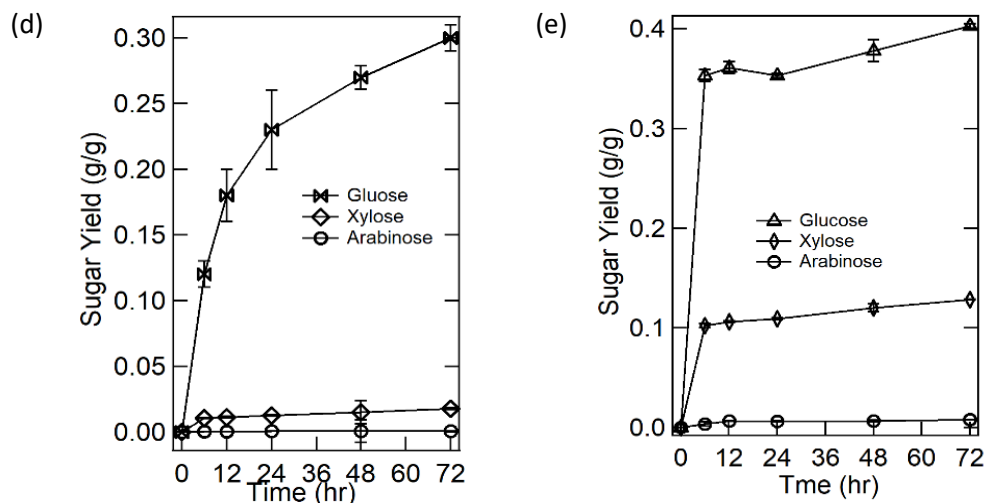
The Supporting Information provides more detailed data on: 1) hydrolysis yields obtained from the different experiments (Table S1) and plots of time resolved sugar yields (Figure S1), 2) x-ray diffractograms of the samples described in Table 1 in the main text (Figure S2), 3) additional details of the economic analysis (Figures S3 and S4).

### 1. Sugar Yield Data

**Table S1.** Hydrolysis yields obtained from enzymatic hydrolysis of bamboo following different pretreatments.

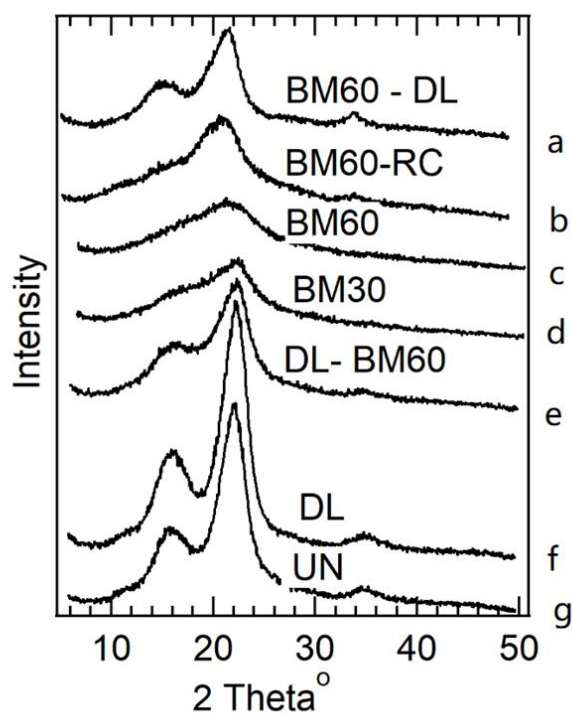
Sample	Glucose (g/g biomass)	Xylose (g/g biomass)	Arabinose (g/g biomass)	Glucose Initial Rate (mg/g-hr)	Xylose Initial Rate (mg/g-hr)	Source
bamboo-UN	0.029 ± 0.016	0.004 ± 0.001	$1.82 \times 10^{-4} \pm 9.17 \times 10^{-6}$	1.16 ± 0.39	0.04 ± 0.02	Ekwe et al 2021
bamboo-BM30	0.170 ± 0.022	0.062 ± 0.012	$7.17 \times 10^{-4} \pm 2.46 \times 10^{-4}$	21.06 ± 1.23	8.42 ± 0.38	Ekwe et al 2021
bamboo-BM60	0.252 ± 0.009	0.095 ± 0.003	$0.001 \pm 3.114 \times 10^{-5}$	33.14 ± 2.23	11.56 ± 0.77	Ekwe et al 2021
bamboo-DL	0.326 ± 0.007	0.107 ± 0.003	$0.001 \pm 1.738 \times 10^{-4}$	28.77 ± 1.37	11.81 ± 0.57	This study
bamboo-DL + L	0.300 ± 0.013	0.0177 ± 0.0006	$0.00062 \pm 8.633 \times 10^{-5}$	19.83 ± 0.29	1.76 ± 0.05	This study
bamboo BM60-RC	0.187 ± 0.013	0.0321 ± 0.0005	0.000675 ± 0.00151	21.94 ± 0.10	3.5 ± 0.0	This study
bamboo-BM60-DL	0.329 ± 0.009	0.115 ± 0.001	$0.002 \pm 7.594 \times 10^{-5}$	44.25 ± 2.46	15.5 ± 0.9	This study
bamboo-DL-BM60	0.403 ± 0.002	0.1284 ± 0.0006	0.0080 ± 0.0002	63.61 ± 4.14	18.33 ± 1.15	This study





**Figure S1.** Time-resolved data observed for enzymatic hydrolysis of (a) bamboo-BM60-RC, (b) bamboo-BMDL, (c) bamboo-DL +L, (d) bamboo-DL and (e) bamboo-DLBM. Conditions: 50 °C, 50 FPU/g cellulase concentration

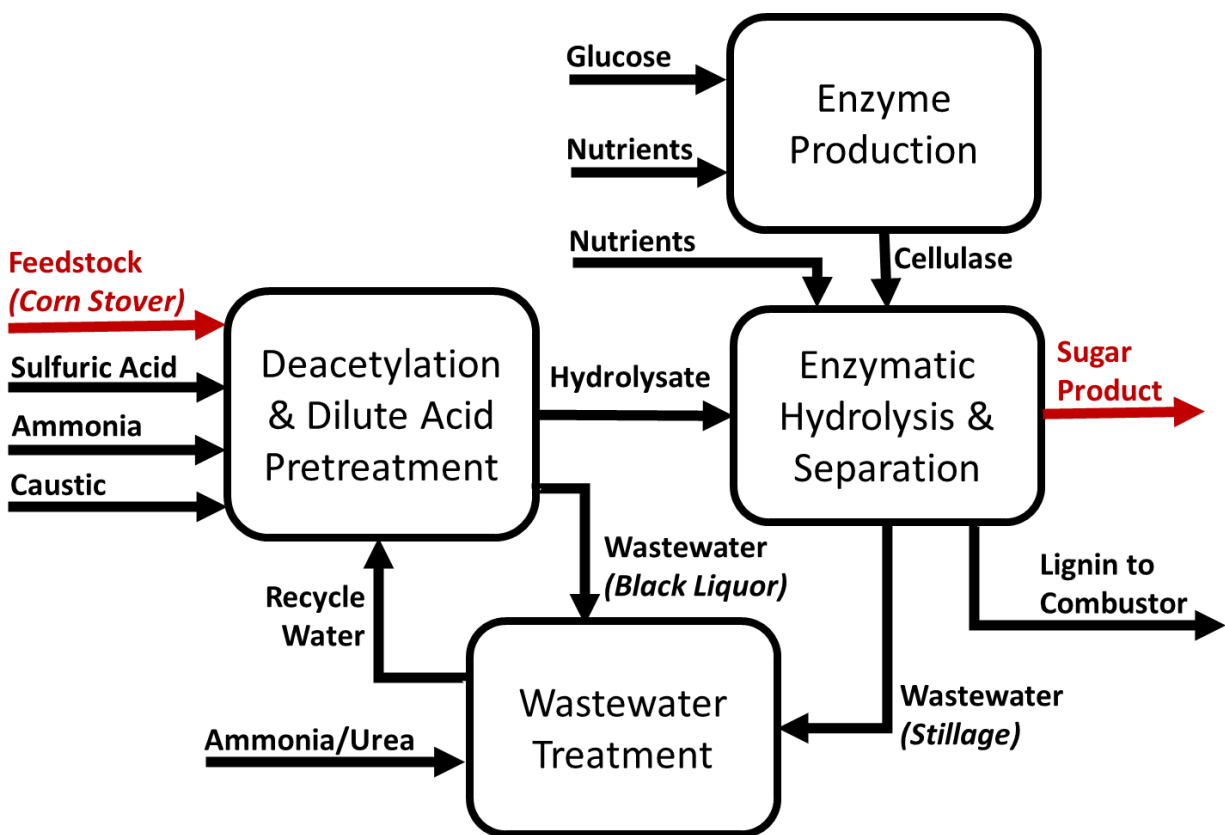
## 2. XRDS Diffractograms



**Figure S2.** X-ray diffractograms of (a) bamboo-UN, (b) bamboo-BM30, (c) bamboo-BM60, (d) bamboo-DL, (e) bamboo-BM60-RC, (f) bamboo-BM-60-DL, and (g) bamboo-DL-BM60

### 3. Techno-economic analysis details.

A techno-economic (TEA) model was used and adjusted for the integrated biomass to sugar process. The model is adopted from a 2017 NREL biochemical sugar model [1] that converts corn stover into sugar via a sequential pretreatment and enzymatic hydrolysis process. **Figure S3** provides a simplified process flow diagram for the baseline corn stover to sugar process modelled by the NREL TEA. Deacetylation and dilute acid pretreatment steps are performed on the corn stover to enhance the subsequent enzyme hydrolysis performance. Enzyme production is also included in the model, which requires glucose and nutrients to produce the cellulase enzyme. Hydrolysis and separation are performed to produce a sugar product stream containing a mixture of xylose, mannose, arabinose, galactose, and glucose sugar monomers. The insoluble lignin fraction is fed to a combustor to provide energy to the entire process. Wastewater is treated through a combined aerobic/anaerobic digester system before recycling the water stream.



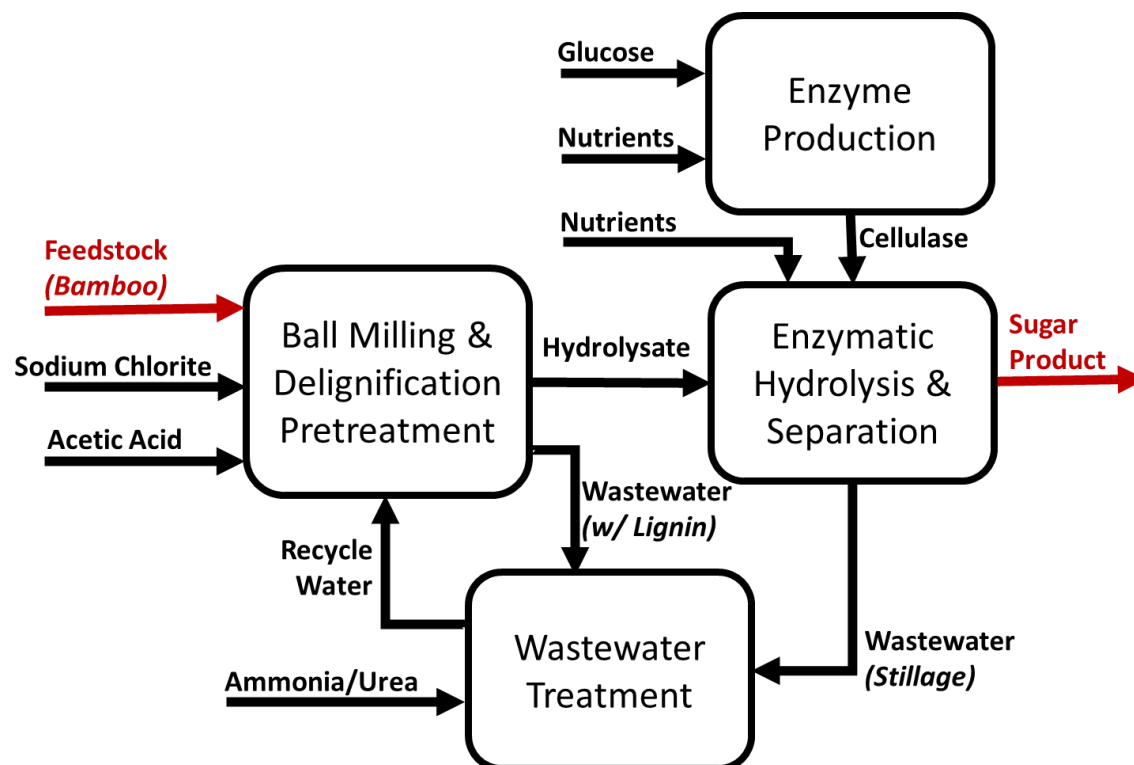
**Figure S3.** Process flow of the corn stover to sugars process

The model includes an itemized capital expenditure (CAPEX) for process equipment costs. The CAPEX includes both direct costs such as equipment installation, piping, warehouse, and site development) as well as indirect costs such as pro-rateable/field expenses, home office construction fees and project contingencies. Equipment costs are based on dozens of equipment supplier quotes sourced from NREL. The chemical engineering plant cost index (CEPCI) is used to normalize all quote costs into 2014 dollars. Equipment is scaled based on process throughput at a scaling factor between 0.5 and 1, dependent on the specific process unit.

Operating expenditures (OPEX) for the process include feedstock, makeup water, other chemicals, ash waste disposal, utility & labor costs. Quoted prices for feedstock/chemicals and

labor are used and sourced from NREL and scaled into 2014 dollars using indices from SRI and the Bureau of labor statistics, respectively.

Combining the total capital and operating expenses are used to calculate a 30-year net present value (NPV) based on a discounted cash flow rate of return (DCFROR) method. Consistent with the NREL process model, a 10-year loan at 8% interest and a 3-year construction period is used as a basis for the NPV calculation. Other assumptions include a sugar selling price of \$396/mt [2], a feedstock cost of \$84/dry ton and operating the process for 7,884 hours per year. The NREL TEA was altered to model the ball milling and delignification process, shown in **Figure S4**. The delignification process uses sodium chlorite and acetic acid as the reactants to produce the hydrolysate stream, which also solubilizes the lignin. The dissolved lignin leads to an additional operational cost for the water treatment unit instead of being delivered to a combustor unit. Due to the increased growth rate of bamboo, the TEA process throughputs are increased at each stage based on the bamboo production rate within a 15-kilometer radius. The CAPEX is scaled using the relevant scaling factor and variable OPEX are scaled linearly with the feedstock throughput. Labor costs remain constant between the two models. The net present value of the bamboo to sugar process is calculated using the same DCFROR model assumptions.



**Figure S4.** Process flow of the corn stover to sugars process

1. "NREL 2017 Biochemical Sugar Model." Biorefinery Analysis Process Models, h.w.n.g.e.b.a.-m.A.N.
2. <https://www.macrotrends.net/2537/sugar-prices-historical-chart-data#:~:text=The%20price%20shown%20is%20in.>