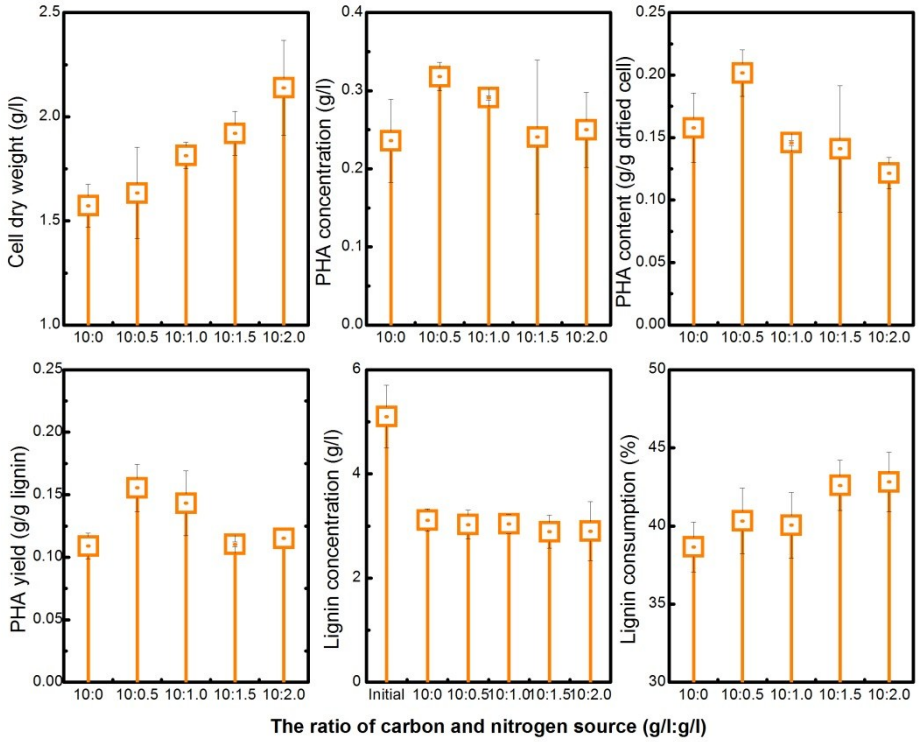
Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

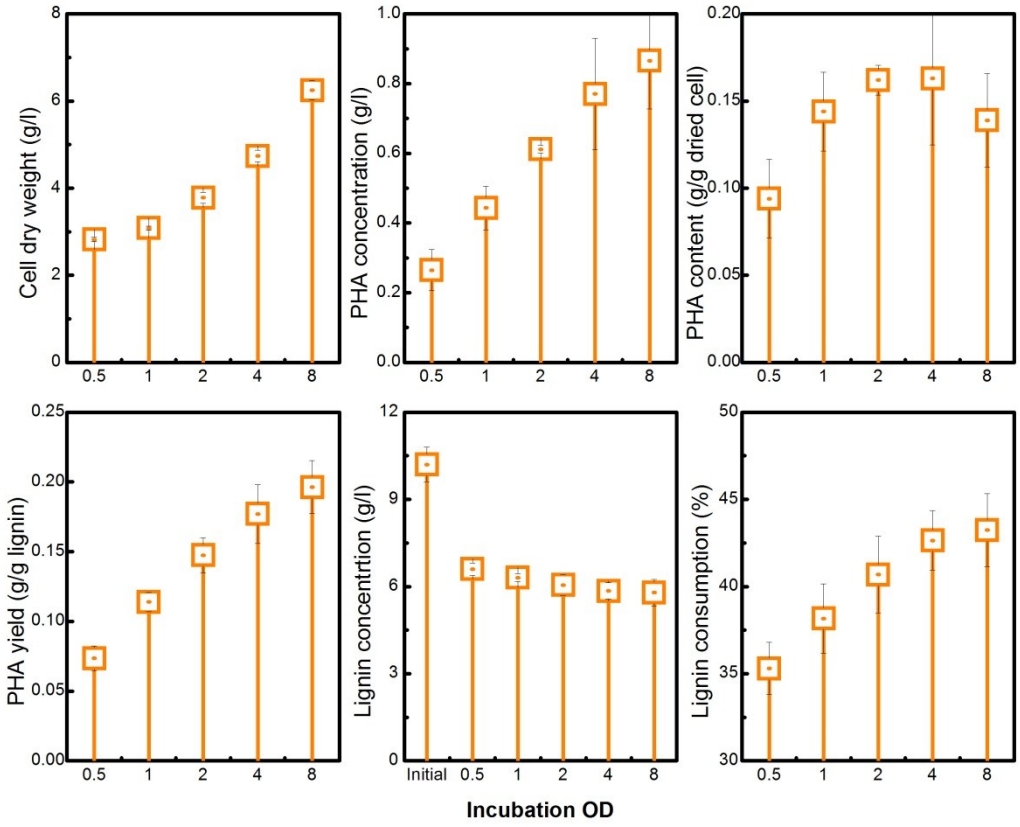
Electronic supplemental information A Cultivation strategies for improving the polyhydroxyalkanoate (PHA) production using alkaline pretreated lignin stream as a carbon source by *P. putida* KT2440

Parameters	Effects of C/N ratio	Effects of OD	Effects of $FeSO_4$	Effects of soluble substrates	Effects of cultivation mode	Effects of glucose addition
C:N ratio (g/l:g/l)	10:0, 10:0.5, 10:1.0, 10:1.5, 10:2.0	10:0.5	10:0.5	10:0.5	10:0.5	10:0.5
OD	1.0	0.5, 1.0, 2.0, 4.0, 8.0	1.0	1.0	1.0	1.0
$FeSO_4$ (mg/l)	2.5	0, 1, 2.5, 5, 10	2.5	2.5	2.5	2.5
Soluble substrate (g/l)	10	20	20	7.5, 10, 20, 30, 40, 60	60	20
Cultivation mode	Batch	Batch	Batch	Batch	Batch 1:60 g/l (0 h) FB 1: 30 g/l (0 h)+30 g/l (18 h) FB 2: 20 g/l (0 h)+20 g/l (18 h)+20 g/l (18 h)	Batch
Glucose (g/l)	0	0	0	0	0	0, 2, 5, 10, 15

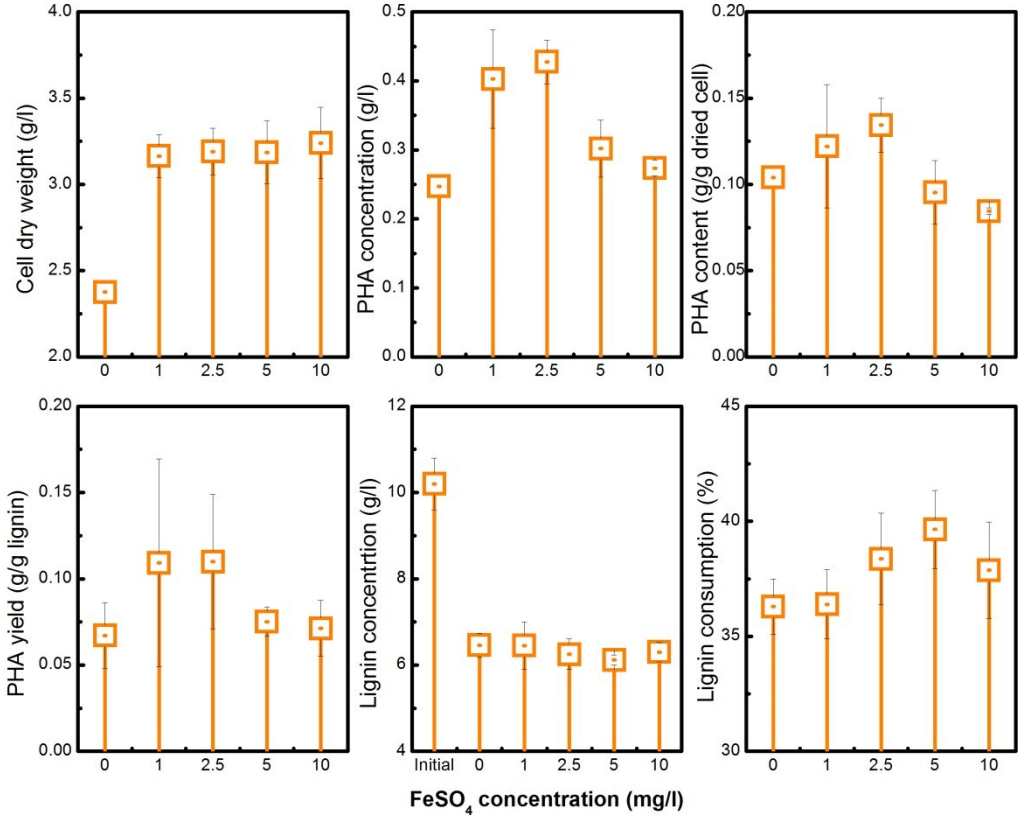
C:N represents the carbon to nitrogen ratio; NH_4Cl was used as nitrogen source in the cultivation; FB mode represents fed-batch mode.



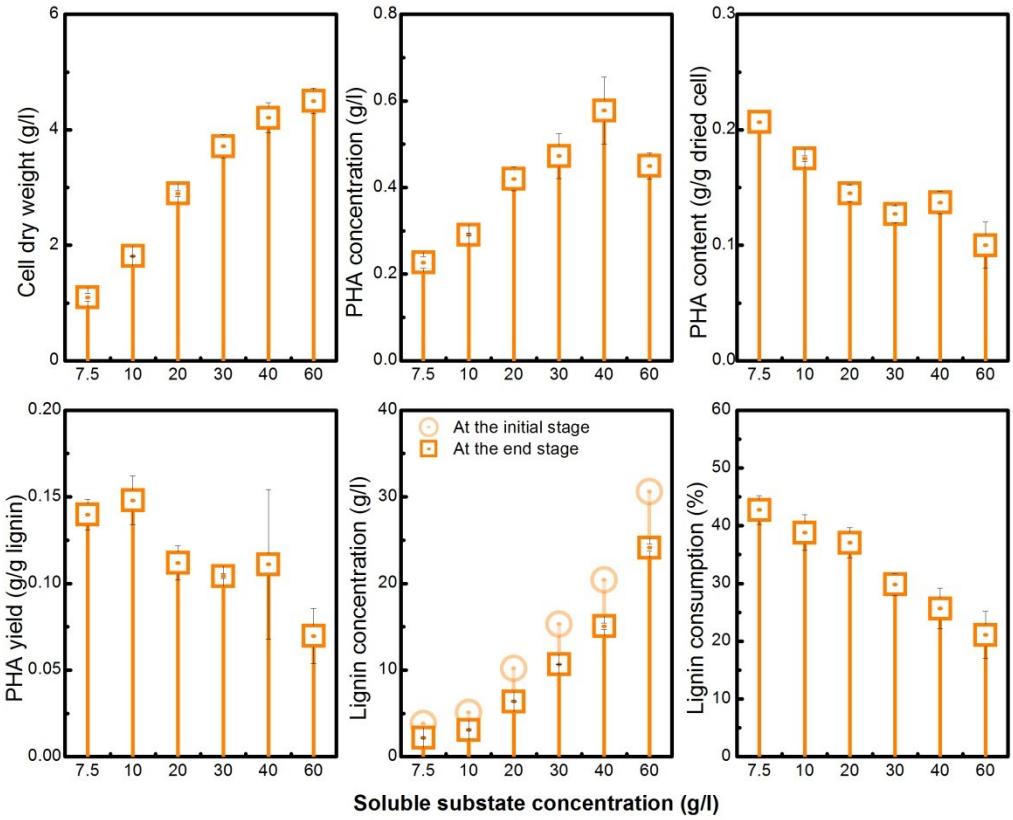
Electronic supplemental information B Effects of carbon to nitrogen ratio (C:N) in lignin medium on the cultivation performance by *P. putida* KT2440. Cultivation was conducted at 10 g/l soluble substrate concentration (SSC), inoculum OD 1.0, pH 7.0, 28°C, and 200 rpm for 18 h. Initial represents the lignin concentration at the initial stage of cultivation



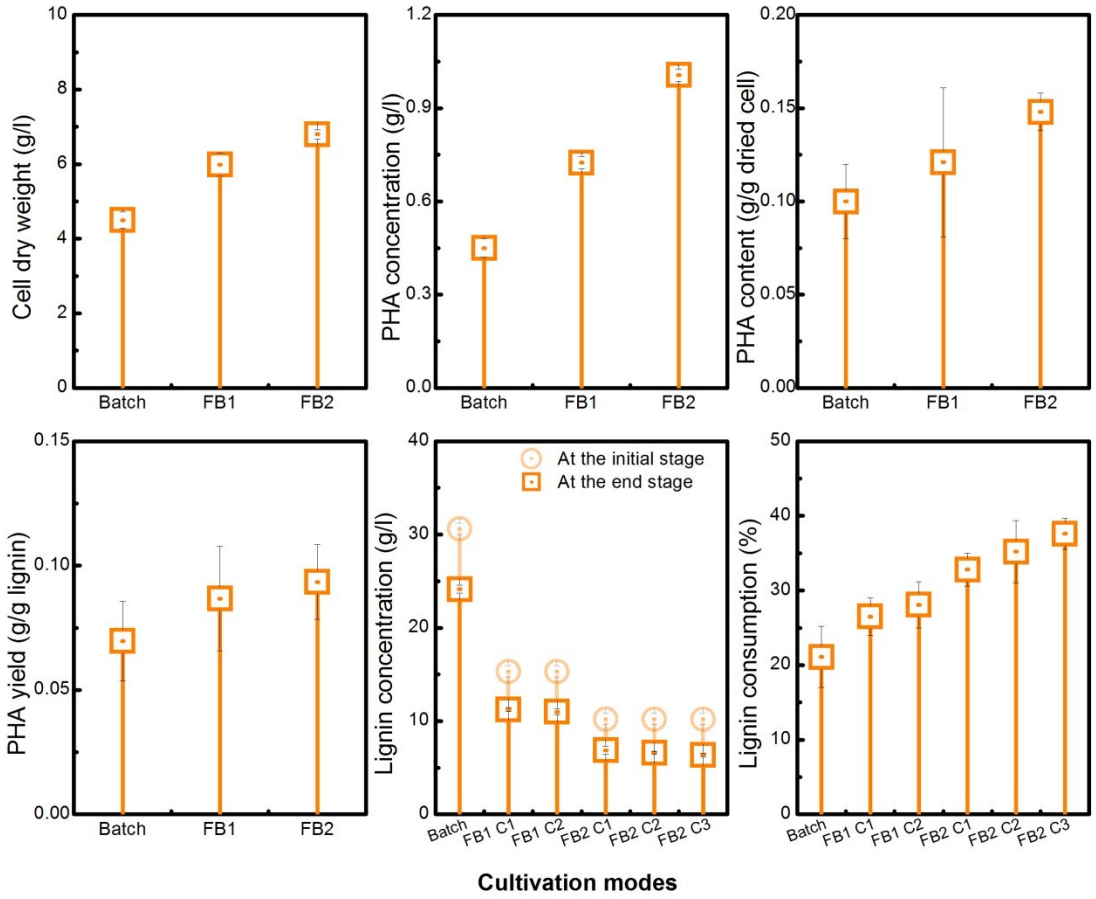
Electronic supplemental information C Effects of inoculum OD on the cultivation performance of lignin stream by *P. putida* KT2440. Cultivation was conducted at 20 g/l soluble substrate concentration (SSC), pH 7.0, 28°C, and 200 rpm for 18 h. Initial represents the lignin concentration at the initial stage of cultivation



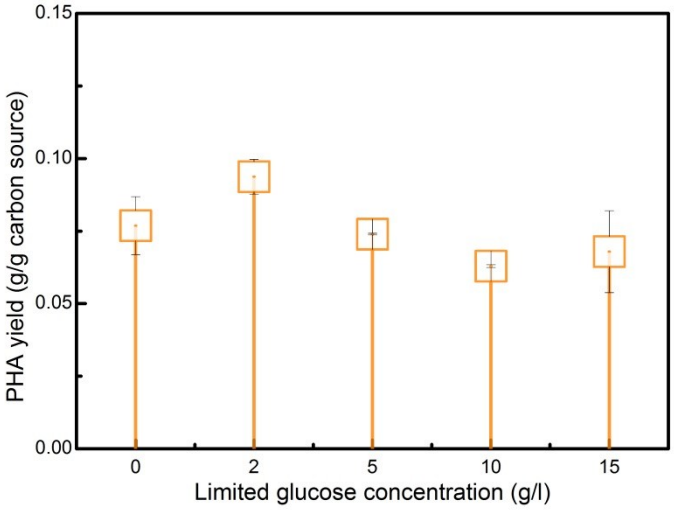
Electronic supplemental information D Effects of $FeSO_4$ on the cultivation performance of lignin stream by *P. putida* KT2440. Cultivation was conducted at 20 g/l soluble substrate concentration (SSC), inoculum OD 1.0, pH 7.0, 28°C and 200 rpm for 18 h. Initial represents the lignin concentration at the initial stage of cultivation



Electronic supplemental information E Effects of the soluble substrate concentration (SSC) in the lignin stream on the cultivation performance of polyhydroxyalkanoate (PHA) by *P. putida* KT2440. Cultivation was conducted at inoculum OD 1.0, pH 7.0, 28°C, and 200 rpm for 18 h.



Electronic supplemental information F Fed-batch cultivation of the soluble lignin stream for the polyhydroxyalkanoate (PHA) production by *P. putida* KT2440. FB 1 C1 represents fed-batch cultivation cycle 1. Cultivation was conducted at inoculum OD 1.0, pH 7.0, 28°C and 200 rpm.

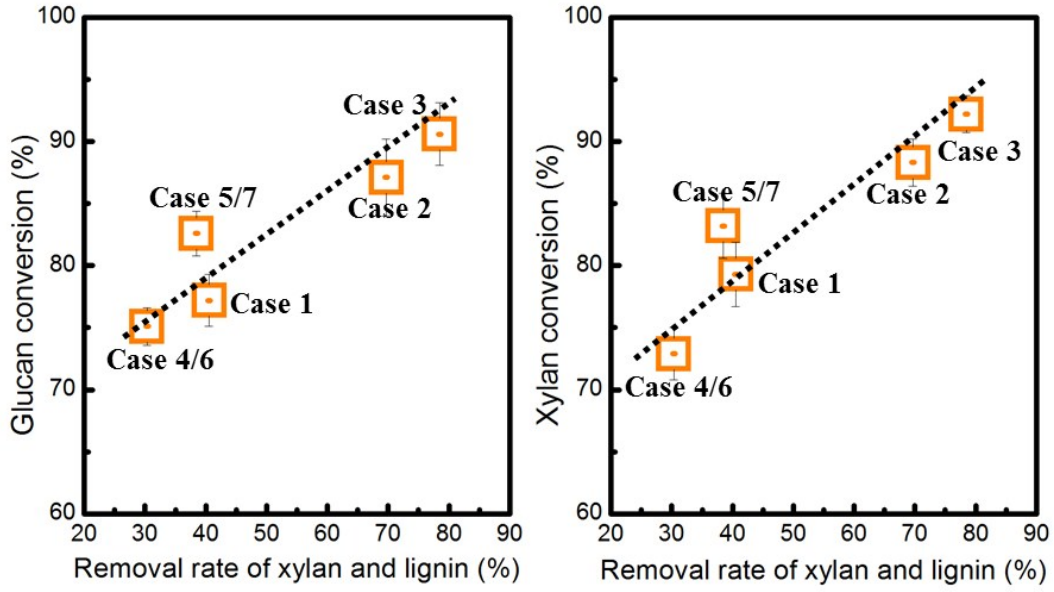


Electronic supplemental information G Polyhydroxyalkanoate (PHA) yield based on total carbon source during cultivation using the soluble lignin stream with the addition of limited glucose by *P. putida* KT2440. Cultivation was conducted at pH 7.0, 28°C, and 200 rpm for 18 h.

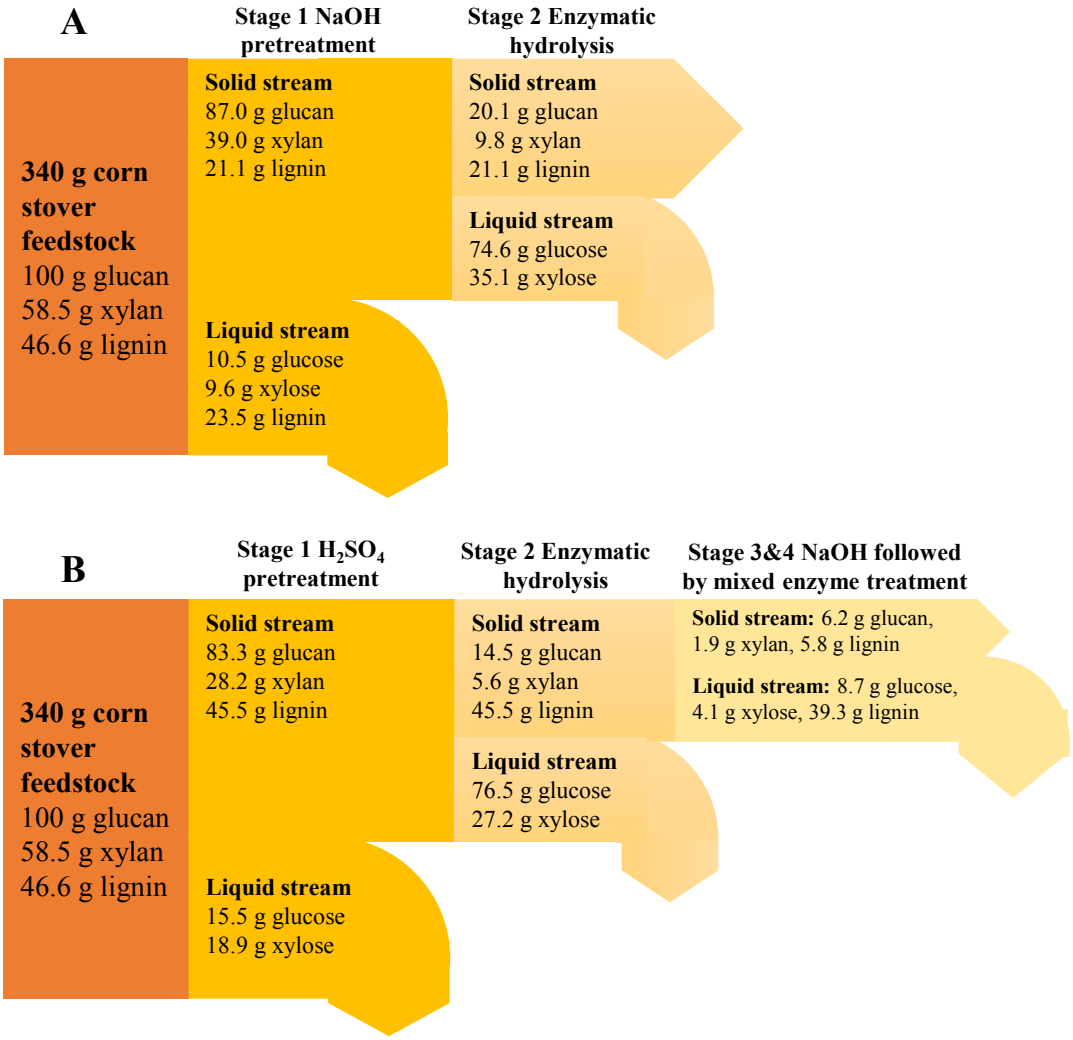
Electronic supplemental information H Compositions in untreated corn stover and solid fractions produced from each biorefinery

	Glucan	Xylan	Arabinan	Galactan	Lignin	Ash	Solid recovery
UCS	29.4 (1.1)	17.2 (0.2)	0.9 (1.1)	0.7 (0.9)	13.7 (1.7)	5.8 (1.0)	
Stage 1							
Case 1	43.6 (1.2)	20.0 (0.3)	1.0 (1.2)	1.7 (1.1)	10.7 (1.0)	3.6 (0.2)	57.9 (2.1)
Cases 2, 4, 6	45.5 (0.2)	16.3 (0.9)	0.7 (1.1)	1.4 (1.9)	24.6 (3.2)	3.4 (1.3)	54.0 (5.8)
Cases 3, 5, 7	50.8 (2.1)	12.6 (1.3)	0.5 (1.5)	1.4 (1.2)	25.9 (0.7)	3.1 (1.2)	48.6 (1.1)
Stage 2							
Case 1	24.3 (1.0)	14.9 (0.9)	0.2 (1.3)	2.1 (1.1)	32.6 (3.1)	2.1 (0.2)	33.0 (3.6)
Case 2	65.2 (2.1)	15.2 (1.2)	0.7 (1.6)	1.8 (0.1)	13.2 (1.5)	1.6 (0.6)	63.0 (2.6)
Case 3	73.8 (1.9)	12.1 (0.5)	0.7 (1.0)	1.4 (1.6)	10.2 (1.8)	1.2 (1.1)	59.7 (3.1)
Cases 4, 6	24.4 (0.3)	9.8 (1.4)	1.0 (1.5)	1.7 (1.2)	37.7 (1.1)	1.9 (1.2)	64.0 (1.9)
Cases 5, 7	23.6 (0.7)	6.3 (0.9)	0.7 (1.9)	1.9 (1.3)	47.9 (3.4)	1.4 (2.1)	52.6 (1.2)

UCS represents untreated corn stover; Water and ethanol extractives in untreated corn stover were 21.4% and 4.2%, respectively; Composition content (%) was calculated based on dry weight. Biorefinery strategies are shown in Table 1 and the detailed information is shown in materials and methods; Standard deviations are shown in parentheses.



Electronic supplemental information I Correlations between glucan/xylan conversion in enzymatic hydrolysis and the removal rate of lignin and xylan in pretreated solid produced from each biorefinery. Biorefinery strategies are shown in Table 1.



Electronic supplemental information J Mass balance in the integrated biorefinery of corn stover. A, Biorefinery using sodium hydroxide pretreatment (Case 1); B, Integrated biorefinery design incorporated with lignin and residual sugar valorization (Case 7)