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SUPPLEMENTARY INFORMATION

Bridging the chemical- and bio-catalysis: high-valued liquid transportation fuels production from renewable agricultural residues

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1, Supplementary Methods:

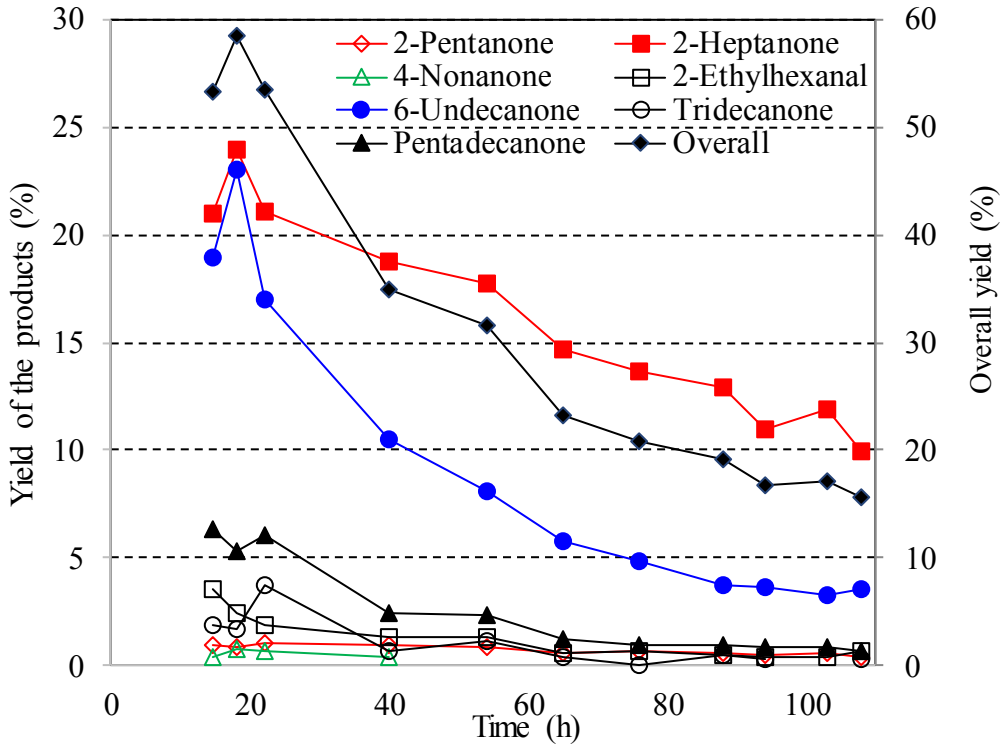
Strain culture and ABE fermentation using glucose

Clostridium acetobutylicum JB200, a mutant strain of *Clostridium acetobutylicum* ATCC55025 obtained by adaption in a fibrous bed bioreactor, was for ABE fermentation using glucose (Xue et al, 2016). The seed culture for fermentation was prepared in Clostridial growth medium (CGM) containing 30 g/L glucose, 2 g/L yeast extract, 1 g/L Tryptone, minerals and vitamins in a phosphate buffer as described by Xue et al. (2016), and incubated at 37 ^{o}C for ~16 h until active growth was well grown. ABE fermentation using glucose as carbon source was conducted using the P2 medium containing glucose (80 g/L), prepared according to the procedures described previously (Xue et al, 2016). The medium was sterilized at 121 ^{o}C for 30 minutes. All solutions were purged with nitrogen for 1 h through a sterile 0.2 mm filter, either before or after autoclaving.

Fed-batch fermentations with glucose for *Clostridium acetobutylicum* JB200 was studied at 37 ^{o}C and pH 5.0, respectively, with intermittent gas stripping to periodically remove butanol from the fermentation broth to alleviate butanol toxicity. When residual glucose decreased to ~1 g/L, the concentrated glucose was pumped into the stirred bioreactor to supplement carbon source for ABE fermentation.

2, Supplementary Figures:

Supplementary Figure 1-The yields of the products by alkylation under continuous mode. Yield based on the acetone in feed. The flow rate of product mixture in feed was controlled at 1.0 ml/h. The product mixture containing ABE solvents derived from glucose;



3, Supplementary Tables:

Supplementary Table 1- ABE fermentation without/with *in situ* product recovery using glucose

Fermentation parameters	Batch fermentation	Fed-batch fermentation with *in situ* product recovery
Acetone, g/L	9.6	32.9
Butanol, g/L	19.1	74.9
Ethanol, g/L	2.6	5.5
Acetic acid, g/L	1.3	0.4
Butyric acid, g/L	1.9	1.0
Total ABE, g/L	31.3	113.3
glucose utilized, g/L	86.4	315.8
Fermentation time, h	78	209
Butanol productivity, g/L/h	0.24	0.36
ABE productivity, g/L/h	0.40	0.54
Butanol yield, g/g	0.22	0.24
ABE yield, g/g	0.36	0.36

Supplementary Table 2-Products obtained from the gas stripping and pervaporation using glucose for ABE fermentation.

	Gas stripping	Pervaporation	Product mixture for alkylation
Acetone, g/L	36.9	161.7	101.0
Butanol, g/L	150.5	446.7	525.5
Ethanol, g/L	8.6	10.9	10.3
ABE, g/L	196.0	619.3	636.8
ABE flux, g/m^2·h	N/A	274.9	N/A
Total flux, g/m^2·h	N/A	444.0	N/A
SF of butanol	15.9	33.0	N/A
SF of ABE	15.0	40.0	N/A

4, Supplementary References

1. C. Xue, F.F. Liu, M.M. Xu, J.B. Zhao, L.J. Chen, J.G. Ren, F.W. Bai and S.T. Yang, *Biotechnol. Bioeng*. 2016, **113,** 120–129.