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Data Article

Data for rapid ethanol production at elevated temperatures by engineered thermotolerant *Kluyveromyces marxianus* via the NADP(H)-preferring xylose reductase–xylitol dehydrogenase pathway

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ABSTRACT

A thermo-tolerant NADP(H)-preferring xylose pathway was constructed in *Kluyveromyces marxianus* for ethanol production with xylose at elevated temperatures (Zhang et al., 2015 [25]). Ethanol production yield and efficiency was enhanced by pathway engineering in the engineered strains. The constructed strain, YZJ088, has the ability to co-ferment glucose and xylose for ethanol and xylitol production, which is a critical step toward enabling economic biofuel production from lignocellulosic biomass. This study contains the fermentation results of strains using the metabolic pathway engineering procedure. The ethanol-producing abilities of various yeast strains under various conditions were compared, and strain YZJ088 showed the highest production and fastest productivity at elevated temperatures. The YZJ088 xylose fermentation results indicate that it fermented well with xylose at either low or high inoculum size. When fermented with an initial cell concentration of $OD_{600}=15$ at 37 °C, YZJ088 consumed 200 g/L xylose and produced 60.07 g/L ethanol; when the initial cell

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concentration was $OD_{600}=1$ at 37 °C, YZJ088 consumed 98.96 g/L xylose and produced 33.55 g/L ethanol with a productivity of 0.47 g/L/h. When fermented with 100 g/L xylose at 42 °C, YZJ088 produced 30.99 g/L ethanol with a productivity of 0.65 g/L/h, which was higher than that produced at 37 °C.

Specifications table

Subject area	Biology
More specific subject area	Xylose metabolism
Type of data	Table; figure
How data was acquired	The metabolic products were acquired by HPLC using an Agilent 1100 series HPLC system. XR and XDH activity were determined using a spectrophotometer to monitor the change in A340 upon oxidation of NAD(P)H.
Data format	Raw and analyzed
Experimental factors	No pretreatment
Experimental features	Batch fermentation; HPLC; enzyme activity
Data source location	Not applicable
Data accessibility	The data are supplied with this article.

The value of the data

- Comparison of the fermentation results of the different engineered strains during pathway engineering revealed the specific role of genes related to xylose metabolism under oxygen-limited conditions.
- Compared with other reported yeast strains, *K. marxianus* YZJ088 showed considerable ethanol production and the highest ethanol productivity.

Table 1
Summary of the fermentation by engineered strains with YP medium containing 100 g/L xylose at 42 °C.

Strains	Time (h)	Residual xylose (g/L)	Xylulose (g/L)	Xylitol (g/L)	Glycerol (g/L)	Acetate (g/L)	Ethanol (g/L)	Ethanol productivity (g/L/h)
YZJ020	18	21.14 ± 1.25	2.8 ± 0.69	10.78 ± 1.02	5.56 ± 1.54	1.06 ± 0.52	25.48 ± 0.57	1.42 ± 0.24
YZJ051	18	16.49 ± 0.96	3.72 ± 0.58	9.21 ± 2.30	5.53 ± 1.44	1.22 ± 0.34	29.73 ± 1.24	1.65 ± 0.52
YZJ061	18	12.2 ± 1.56	3.9 ± 1.34	10.29 ± 2.11	6.84 ± 1.63	1.34 ± 0.40	31.99 ± 2.31	1.78 ± 0.30
YZJ077	18	10.4 ± 1.50	3.97 ± 0.32	9.46 ± 2.13	6.48 ± 1.52	1.24 ± 0.33	31.38 ± 1.47	1.74 ± 0.41
YZJ084	18	11.6 ± 2.41	1.88 ± 0.64	4.80 ± 1.02	6.70 ± 2.01	0.98 ± 0.29	33.90 ± 1.38	1.88 ± 0.74
YZJ086	18	6.57 ± 1.63	9.13 ± 1.61	12.25 ± 2.52	0.13 ± 0.03	0.48 ± 0.31	33.78 ± 1.29	1.88 ± 0.50
YZJ088	18	3.9 ± 0.96	9.00 ± 1.85	11.86 ± 3.44	0.15 ± 0.04	0.70 ± 0.41	35.94 ± 1.24	2.00 ± 0.34
YZJ089	18	3.82 ± 1.32	9.27 ± 2.41	11.94 ± 2.12	0.91 ± 0.32	0.67 ± 0.28	34.36 ± 0.98	1.91 ± 0.69
YZJ091	18	5.39 ± 1.21	5.11 ± 2.31	8.32 ± 2.84	0.19 ± 0.08	0.62 ± 0.19	33.21 ± 2.07	1.85 ± 0.34