

## Supporting Information

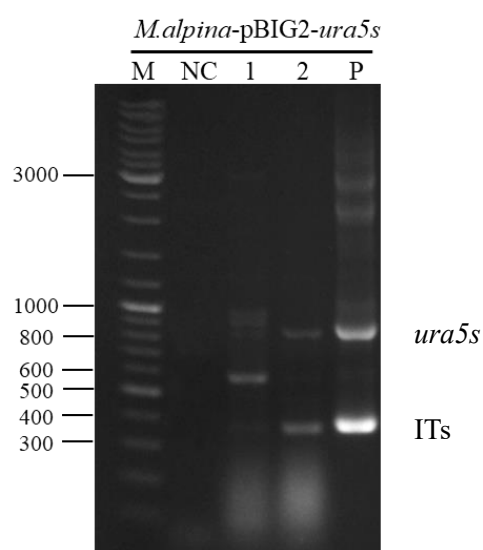


Figure S1. PCR identification of *M. alpina*-pBIG2-*ura5s* complementary-phenotype strains. The lanes are depicted as follows: 1-2, two *M. alpina*-pBIG2-*ura5s* recombinant strains; M, marker; NC, negative control (ddH<sub>2</sub>O); P, plasmid pBIG2-*ura5s*-ITs. The length of PCR products of *ura5s* and ITs are 818bp and 352bp, respectively.

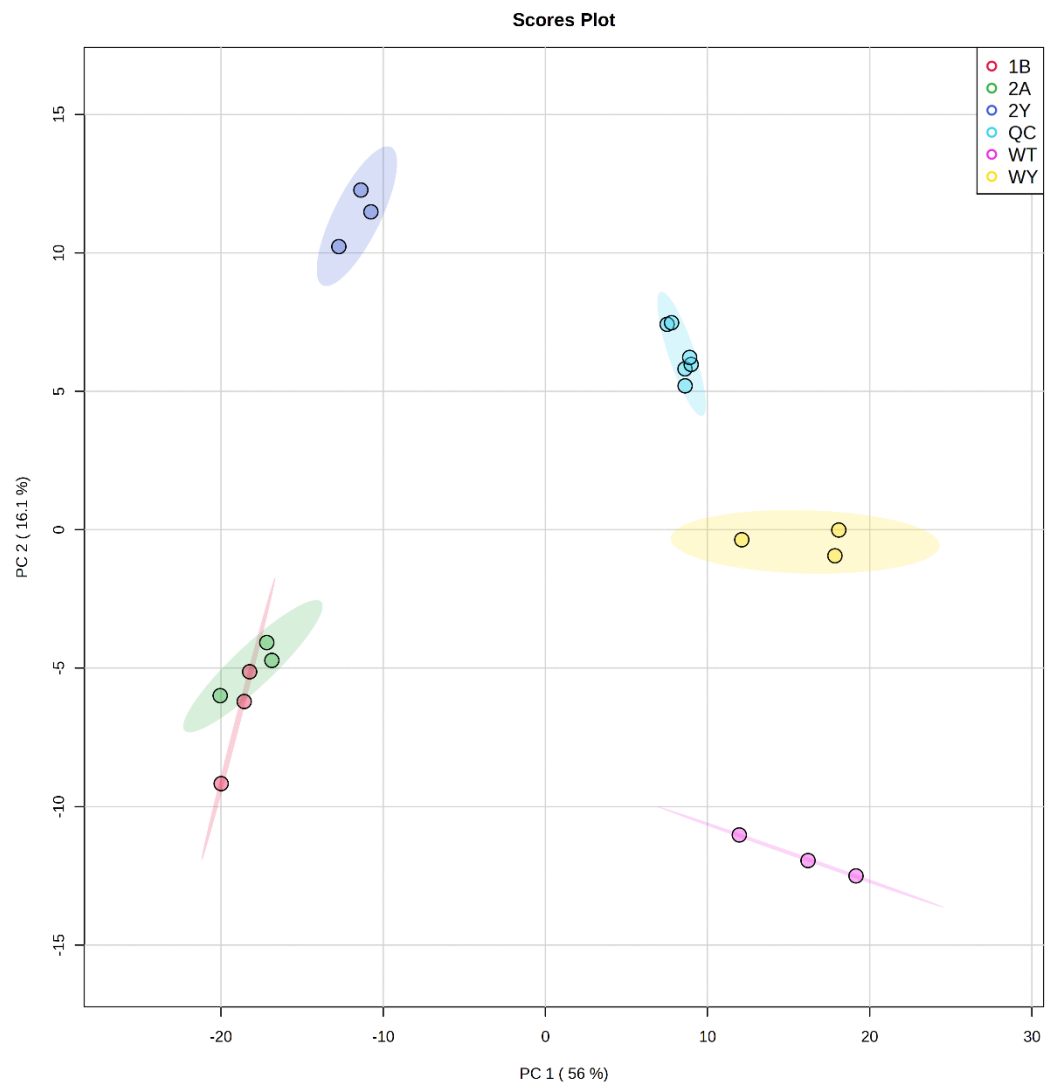


Figure S2. PCA score plot showing the discrimination between each group.

1B: *M. alpina*-MaDGAT1B, 2A: *M. alpina*-MaDGAT2A, 2Y: *M. alpina*-MaDGAT2A with 0.5 g/L linseed oil supplementation, QC: quality control, WT: *M. alpina* ATCC 32222, WY: *M. alpina* ATCC 32222 with 0.5 g/L linseed oil supplementation. For each group, 3 biological replicates were used.

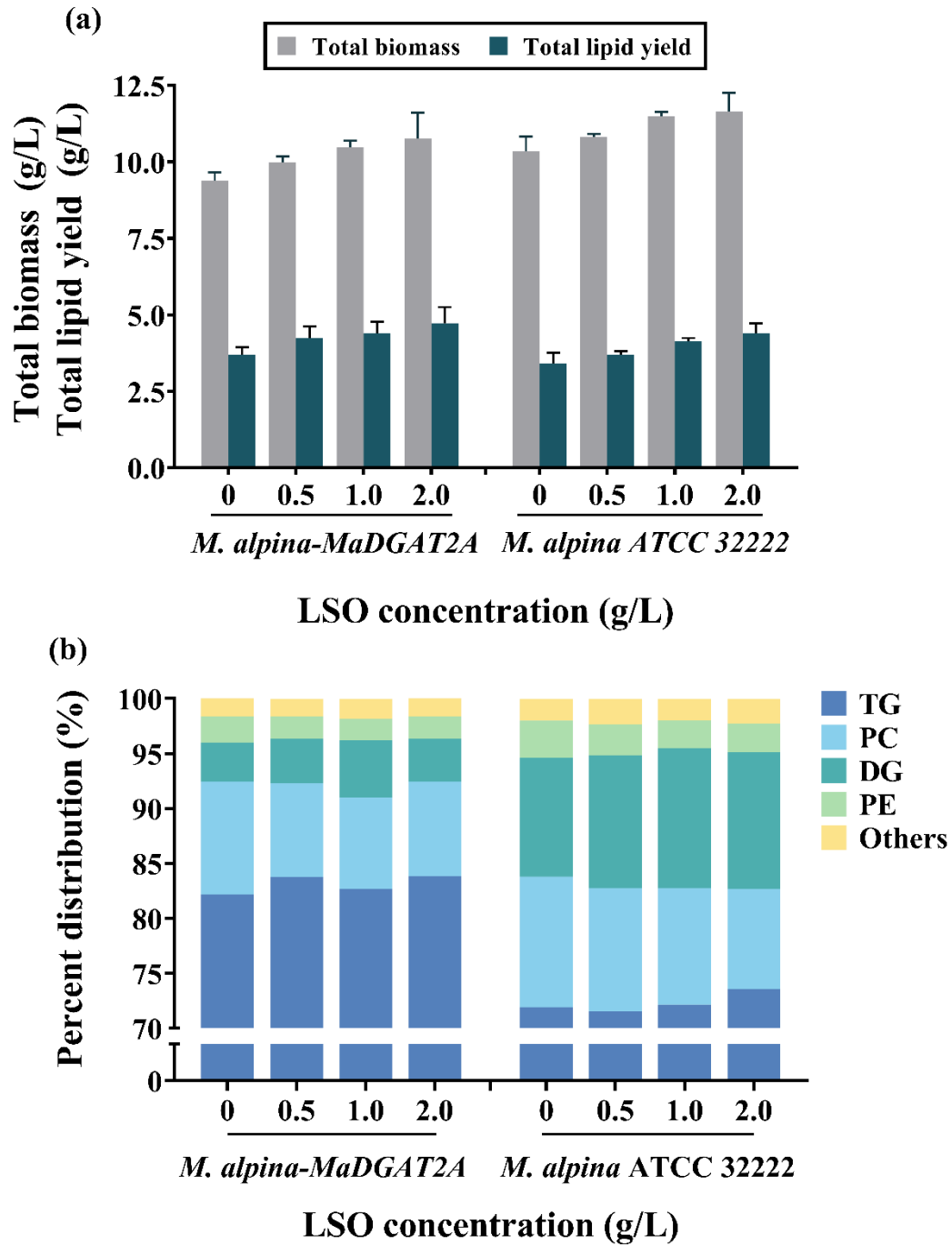


Figure S3. The effect of different concentrations of LSO on *M. alpina-MaDGAT2A* and *M. alpina ATCC 32222*. (a), Total biomass and total lipid yield of *M. alpina-MaDGAT2A* and *M. alpina ATCC 32222*. (b), content of major lipids with different concentrations of LSO in *M. alpina-MaDGAT2A* and *M. alpina ATCC 32222*.

Table S1. Fatty acid profiles of *M. alpina*-MaDGAT1B, *M. alpina*-MaDGAT2A, and *M. alpina* ATCC 32222. Fatty acids that accounting for more than 1% of total fatty acids were listed.

Fatty acid	content of fatty acids (% of TFA)		
	<i>M. alpina</i> ATCC 32222	<i>M. alpina</i> -MaDGAT1B	<i>M. alpina</i> -MaDGAT2A
C16:0	11.84±0.25	15.26±0.25	14.64±0.2
C18:0	12.77±0.41	16.14±0.27	16.07±0.17
C18:1	12.23±0.74	15.01±0.18	13.37±1.03
C18:2	7.27±0.34	9.55±0.19	9.22±0.19
C18:3 (GLA)	4.14±0.12	4.48±0.05	4.5±0.11
C20:0	1.36±0.04	1.21±0.03	1.27±0.03
C20:2	0.97±0.07	0.87±0.03	0.86±0.03
C20:3 (DGLA)	3.55±0.19	4.26±0.1	4.49±0.13
C20:4 (ARA)	41.93±1.31	29.66±0.52	32.02±1.2
C22:0	1.82±0.11	1.45±0.1	1.43±0.02
TFA (mg g <sup>-1</sup> of DCW)	329.56±19.13	402.02±6.17	392.04±16.08

Table S2. Fatty acid profiles of *M. alpina*-MaDGAT2A and *M. alpina* ATCC 32222 with LSO supplementation. Fatty acids that accounting for more than 1% of total fatty acids were listed.

		content of fatty acids (% of TFA)			
		<i>M. alpina</i> -MaDGAT2A		<i>M. alpina</i> ATCC 32222	
Fatty acid	LSO Concentration (g/L)	0.0	0.5	0.0	0.5
C16:0		14.64±0.2	13.16±0.91	11.84±0.25	11.43±0.18
C18:0		16.07±0.17	14.59±1.05	12.77±0.41	12.32±0.34
C18:1		13.37±1.03	12.83±0.68	12.23±0.74	12.13±0.93
C18:2		9.22±0.19	9.59±0.09	7.27±0.34	7.73±0.22
C18:3 (GLA)		4.5±0.11	4.41±0.04	4.14±0.12	3.9±0.03
C18:3 (ALA)		0.02±0.02	3.89±1.26	0.02±0.01	3.04±0.45
C20:0		1.27±0.03	1.18±0.08	1.36±0.04	1.31±0.03
C20:2		0.86±0.03	0.69±0.09	0.97±0.07	0.98±0.09
C20:3 (DGLA)		4.49±0.13	4.19±0.05	3.55±0.19	3.27±0.1
C20:4 (ARA)		32.02±1.2	32.23±1.66	41.93±1.31	40.26±2.11
C22:0		1.43±0.02	1.37±0.09	1.82±0.11	1.72±0.07
TFA (mg g <sup>-1</sup> of MDW)		392.04±16.08	425.57±29.89	329.56±19.13	342.36±6.95