

Additional file 6. Double gene knockout targets for succinic acid production identified by constraints-based flux analysis

Knockouts	Enzyme	<i>max v_{biomass}</i>	
		Biomass (h ⁻¹)	Succinic acid (mmol/gDCW/h)
Wild type strain		0.35	0
PYR → ACAL + CO ₂	pyruvate decarboxylase	0.15	19.57
PYR + NADH ↔ LAC + NAD	lactate dehydrogenase		
ACAL + NADH ↔ ETH + NAD	alcohol dehydrogenase	0.18	18.8
PYR + NADH ↔ LAC + NAD	lactate dehydrogenase		
ACAL + NADH ↔ ETH + NAD	alcohol dehydrogenase	0.35	0.03
FUM ↔ MAL	fumarate hydratase		

The reactions and corresponding enzymes for double gene knockout targets for producing succinic acid are listed. Glucose and oxygen uptake rate are fixed to 11.1 and 0 mmol/gDCW/h, respectively.