

Supplementary Information for:

CRISPRi-based dynamic control of carbon flow for efficient N-acetyl
glucosamine production and its metabolomic effects in *Escherichia*
coli

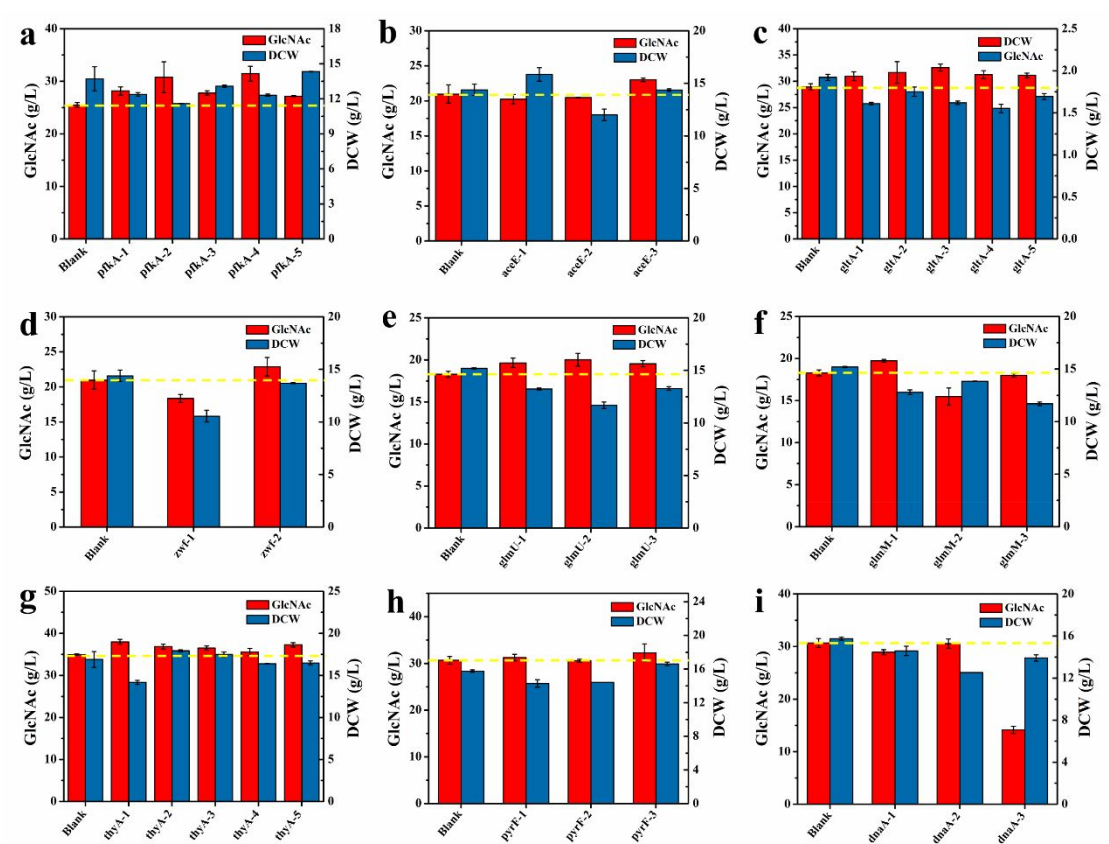


Fig. S1 Effects of transcriptional repression of key cell growth-related genes on GlcNAc synthesis and cell growth at 30 h of shake flask fermentation.

Table S1 Primers used in this study

Primer	Sequence (5'→3')
nagBAC-UF	CCTACCGAGTCGCTGGA
nagBAC-UR	CCAGACTATCATTGACGATATGGCGAGCAG
nagBAC-DF	TATCGTCAATGATAGTCTGGCGTCGGAAGTAA
nagBAC-DR	CAGTCTGCGAAGGATAGTTGGT

nagBAC-F	AGTCCTAGGTATAATACTAGTGCCGATCGTCCGTTTGTAC TGTTTTAGAGCTAGAA
nagBAC-R	TTCTAGCTCTAAAACAGTACAAACGGACGATCGGCACTA GTATTATACCTAGGACT
manXYZ-UF	GGCCTGATGCTGAAATGACG
manXYZ-UR	GTCCAGCAGCAATGGTCACTTGCTACCTCCTT
manXYZ-DF	GTGACCATTGCTGCTGGGACTGTAAGACTGTTGT
manXYZ-DR	TCCAGACATTGGCGAAGAAAA
manXYZ-F	AGTCCTAGGTATAATACTAGTGGCTGGATCGATTTCGTTC CGTTTTAGAGCTAGAA
manXYZ-R	TTCTAGCTCTAAAACGGAACGAAATCGATCCAGCCACTA GTATTATACCTAGGACT
LacI-UF	ACAACAACCTGGCGGGCAAAC
LacI-UR	GAATTATCTCCGCCGAGACAGAACTTAATGGG
LacI-DF	ACTGTGCCGGCAGGTAGCAGAGCGGGTAAACTGGCTCGG ATT
LacI-DR	GGATTTTCCTTACGCGAAATACG
T7RNAP-F	TGTCTCGGCGGAGATAATTCACAAGTGTGCGCT
T7RNAP-R	CTGCTACCTGCCGGCACAGTATCAAGGTATTT
LacI-F	AGTCCTAGGTATAATACTAGTCGTCGTGACTGGGAAAACC CGTTTTAGAGCTAGAA
LacI-R	TTCTAGCTCTAAAACGGGTTTTCCAGTCACGACGACTAG TATTATACCTAGGACT
nagE-UF	TTTTCCAGCGACTCGGTAGGG
nagE-UR	AGTCGTATTAAGCACCAGGCAGAAGAATCCG
nagE-DF	GGGTTTTTTGGTCTGGGTGCTTCTGGGGTAG
nagE-DR	ACGCGTGGGTGGTGTTGAAG
Fgna1-F	GCCTGGTGCTTAATACGACTCACTATAGGGTCTAGAAATA ATTTTGTTTAACTTTAAGAAGGAGATATACCATGAGCTTA CCCGATGGATTTT
Fgna1-R	GCACCCAGACCAAAAAACCCCTCAAGACCCGTTTAGAGG CCCCAAGGGGTTATGCTAGACCGTCATTAGGGGCAACTC
nagE-F	AGTCCTAGGTATAATACTAGTCAGCACGCTATCCATGCAG GGTTTTAGAGCTAGAA
nagE-R	TTCTAGCTCTAAAACCCTGCATGGATAGCGTGCTGACTAG TATTATACCTAGGACT
yghX-UF	CAAAGTGCGTAATGCCCAA
yghX-UR	AAGAATCCGGATTTTCCCGTGAGCGTAATAGTC
yghX-DF	CAAACAGACTTGGACACCCGAATCAACGA
yghX-DR	CTGGCGATCTCCGGTCTTT
Sgna1-F	ACGGGAAAATCCGGATTCTTCTGCCTGGT
Sgna1-R	CGGGTGTCCAAGTCTGTTTGTTTCAGTTTCACTACCC
yghX-F	AGTCCTAGGTATAATACTAGTCTCAACCTTGCGGCGAAGT GGTTTTAGAGCTAGAA

yghX-R	TTCTAGCTCTAAAACCACTTCGCCGCAAGGTTGAGACTAG TATTATACCTAGGACT
JSgna1-F	CAAAGTGCCTAATGCCCAA
JSgna1-R	CCTGCGTTGCTAAACCCACATT
yjiV-UF	GTGCTGGAGGGATGATTGTTG
yjiV-UR	TAAACAAAATTATTTCTAGACCCTATAGTGAGTCGTATTA CGCAGTACTTCCTGCTGGCT
FglmS-F	TCTAGAAATAATTTTGTTTAACTTTAAGAAGGAGATATAC CATGTGTGGAATTGTTGGCGC
FglmS-R	CGGTAATTTCGAAAAAACCCCTCAAGACCCGTTTAGAGG CCCCAAGGGGTTATGCTAGGGAGTTGGCAGGATGTTTGAT T
yjiV-F	GGGTTTTTTTGCGAATTACCGGCGTTCACTATA
yjiV-R	TCACCTCCACCAGCACATCC
JFglmS-F	CAGGCAAAATCCATCGGC
JFglmS-R	GCCTTGTTTCAGCTCCAGT
yjiV-F	AGTCCTAGGTATAATACTAGTATCCCGCATTTCTTAAAGT CGTTTTAGAGCTAGAA
yjiV-R	TTCTAGCTCTAAAACGACTTTAAGAAATGCGGGATACTAG TATTATACCTAGGACT
ycjV-UF	GAATGCGCCGACGATTTTAG
ycjV-UR	TAAACAAAATTATTTCTAGACCCTATAGTGAGTCGTATTA GCCGACAAACACGATGAACTC
ycjV-DF	TTGGGGCCTCTAAACGGGTCTTGAGGGGTTTTTTGCCACC ATGATCTACGTGACCC
ycjV-DR	CACCAGCACGGACCACTAACT
DglmS-F	TCTAGAAATAATTTTGTTTAACTTTAAGAAGGAGATATAC CATGTGTGGAATTGTTGGCGC
DglmS-R	GACCCGTTTAGAGGCCCAAGGGGTTATGCTAGGGAGTT GGCAGGATGTTTGATT
ycjV-F	AGTCCTAGGTATAATACTAGTCAAAGCACGCAATATAGC GAGTTTTAGAGCTAGAA
ycjV-R	TTCTAGCTCTAAAACGCTATATTGCGTGCTTTGACTAGT ATTATACCTAGGACT
JSglmS-F	CATCTCAATCCGGCGTTACC
JSglmS-R	GCCTTGTTTCAGCTCCAGT
FaraBAD-UF	TCCTGGCGGGAACAGCA
FaraBAD-UR	TCTTATCCATCGTTTCACTCCATCCAAAAAAC
FaraBAD-DF	ATGAACATAACTCAATTTGTAGGGCAAACGCTGCTGGAT AAACA
FaraBAD-DR	GTGAGGTGATAAACCGCTCCAT
FdCas9-F	GAGTGAAACGATGGATAAGAAATACTCAATAGGCTTAG
FdCas9-R	CCTACAAATTGAGTTATGTTTCATGCTGCATAAAATTGCGA TTGG

FaraBAD-F	AGTCCTAGGTATAATACTAGTCGTCGCGGACGTTGCAGCG CGTTTTAGAGCTAGAA
FaraBAD-R	TTCTAGCTCTAAAACGCGCTGCAACGTCCGCGACGACTAG TATTATACCTAGGACT
JFdCas9-F	CCCAAACAGGTGCTGAAAT
JFdCas9-R	TTTTGATACTGTGGCGGTCTGT
SaraBAD-UF	ACCTTTGACAACGGCTCTATTCC
SaraBAD-UR	AGCTGTTTCATCACCTTATCATCAAAGAGGTGAGC
SaraBAD-DF	AGGTGACTAAGCAAACGCTGCTGGATAAACA
SaraBAD-DR	GTGAGGTGATAAACCGCTCCAT
SdCas9-F	GATAAGGTGATGAAACAGCTTAAACGTCGCC
SdCas9-R	CAGCGTTTGCTTAGTCACCTCCTAGCTGACTCAAA
SaraBAD-F	ATGCACAGGAGACTTTCTGAAGGAATATCCGCAATAATT ATGGGTCATAGTAATCCAGCAACT
SaraBAD-R	AGTTGCTGGATTACTATGACCCATAATTATTGCGGATATT CCTTCAGAAAGTCTCCTGTGCAT
JSdCas9-F	TTTGTGGAGCAGCATAAGCATT
JSdCas9-R	CGCAGCGGAAGACGGTAA
Ilvg-UF	ACCGAGGAGCAGACAATGAATAA
Ilvg-UR	ATTCCCTTTTGGTGATGGCAACAACAGGGATGGA
pfkA-2-F	TGTTGCCATCACCAAAAGGGAATAAGGGCGACAC
pfkA-2-R	TGATCCCCGGCGAAGTTCCTATACTTTCTAGAGAATAGGA ACTTCGCAGGGTCGGAACAGGAGA
Cm-1-F	TTCCGACCCTGCGAAGTTCCTATTCTCTAGAAAGTATAGG AACTTCGCCGGGGATCAGCCCCGG
Cm-1-R	CGTAGATAGGAAGTTCCTATACTTTCTAGAGAATAGGAAC TTCGGAATAGGAACTTCTTACGCCCCGCCCTGCCA
Ilvg-DF	GGGGCGTAAGAAGTTCCTATTCCGAAGTTCCTATTCTCTA GAAAGTATAGGAACTTCCTATCTACGCGCCGTTGTTGT
Ilvg-DR	GCGCTGGCTAACATGAGGAA
fhiA-UF	CGAAAGGTTCCAGTTGTTGTAGATA
fhiA-UR	ATTCCCTTTTCTAAGGTAAAGCGGGCAGAAAC
zwf-2-F	TTTACCTTAGAAAAGGGAATAAGGGCGACAC
zwf-2-R	TGATCCCCGGCGAAGTTCCTATACTTTCTAGAGAATAGGA ACTTCCTCACATGTTCTTTCCTGCGTTA
Cm-2-F	ACATGTGAGGAAGTTCCTATTCTCTAGAAAGTATAGGAAC TTCGCCGGGGATCAGCCCCGG
Cm-2-R	GCTGGAGGGGAAGTTCCTATACTTTCTAGAGAATAGGAA CTTCGGAATAGGAACTTCTTACGCCCCGCCCTGCCA
fhiA-DF	GGGGCGTAAGAAGTTCCTATTCCGAAGTTCCTATTCTCTA GAAAGTATAGGAACTTCCCCTCCAGCGAAACCTACG
fhiA-DR	CGAACGAACGGATGGGTAAT
ylbE-UF	ACCCAACCTTACGCAACCAG
ylbE-UR	ATTCCCTTTTTTGTTCGATAACCGCAGCAT

glmM-1-F	ATCGAACAAAAAAGGGAATAAGGGCGACAC
glmM-1-R	ATCCCCGGCGAAGTTCCTATACTTTCTAGAGAATAGGAAC TTCCTCACATGTTCTTTCTGCGTTA
Cm-3-F	AACATGTGAGGAAGTTCCTATTCTCTAGAAAGTATAGGA ACTTCGCCGGGGATCAGCCCCGG
Cm-3-R	CACGCCAGCGGAAGTTCCTATACTTTCTAGAGAATAGGA ACTTCGGAATAGGAACCTTACGCCCCGCCCTGCCA
ylbE-DF	GGGCGTAAGAAGTTCCTATCCGAAGTTCCTATTCTCTAG AAAGTATAGGAACCTCCGCTGGCGTGCTTTGAA
ylbE-DR	GGCGTAACTCAGCAGGCAG

Table S2 Relative abundances of detected intracellular metabolites at different fermentation time in three strains

Metabolites	Retention Time	Strains	1 h before induction	2 h after induction	12 h after induction	24 h after induction
Lactic acid	12.901	blank	27.26±0.46	7.43±2.63	23.42±9.74	7.56±0.1
		<i>pfkA</i> repressed strain	27.02±1.36	7.45±0.24	10.64±4.6	12.04±3.42
		<i>zwf</i> repressed strain	11.09±1.3	10.03±3.86	7.47±1.22	16.17±5.99
Propanoic acid	12.55	blank	ND	1.93±0.69	20.66±6.34	3.47±1.97
		<i>pfkA</i> repressed strain	20.48±5.23	4.14±2.83	3.45±1.44	0.81±0.03
		<i>zwf</i> repressed strain	18.82±0.49	6.41±2.10	1.97±0.26	ND
L-Alanine	14.3	blank	10.95±0.67	12.93±3.92	38.34±5.19	16.78±0.61
		<i>pfkA</i> repressed strain	19.46±0.98	21.89±7.14	21.77±8.79	13.57±2.22
		<i>zwf</i> repressed strain	16.33±2.19	8.98±6.15	11.64±0.11	12.26±6.56
Hydroxylamine	14.635	blank	22.95±3.22	18.79±2.41	17.88±0.90	13.51±0.50
		<i>pfkA</i> repressed strain	27.50±1.95	19.45±2.27	23.56±18.22	13.00±2.92
		<i>zwf</i> repressed strain	20.44±4.38	17.55±2.33	16.88±0.96	20.31±6.14

Metabolites	Retention Time	Strains	1 h before induction	2 h after induction	12 h after induction	24 h after induction
		strain				
L-Leucine	16.002	blank	27.53±0.46	18.66±0.69	18.38±1.43	17.21±0.42
		<i>pfkA</i> repressed strain	21.98±1.06	20.40±2.95	20.37±8.45	21.44±1.03
		<i>zwf</i> repressed strain	14.63±0.75	15.08±4.22	16.55±1.70	16.94±1.53
Phosphoric acid	16.888	blank	529.90±7.72	473.94±44.14	600.24±39.76	484.84±8.30
		<i>pfkA</i> repressed strain	682.75±12.41	519.28±54.99	462.52±92.68	540.94±49.89
		<i>zwf</i> repressed strain	433.42±12.75	574.26±41.76	523.03±17.67	534.40±37.35
L-Valine	18.136	blank	13.6±0.98	12.55±0.79	11.83±1.48	9.59±0.28
		<i>pfkA</i> repressed strain	9.28±1.1	11.59±1.9	9.64±2.14	12.57±1.19
		<i>zwf</i> repressed strain	6.66±1.15	7.78±3.19	8.5±0.24	9.67±1.05
Urea	19.189	blank	16.33±0.72	11.12±0.89	9.15±0.15	10.85±0.33
		<i>pfkA</i> repressed strain	9.55±0.39	10.70±1.61	9.94±1.95	11.44±0.67
		<i>zwf</i> repressed strain	4.41±0.66	8.44±2.23	10.26±0.18	9.00±1.79
Silanamine	19.821	blank	16.53±1.17	30.90±5.06	15.98±0.48	16.35±1.23
		<i>pfkA</i> repressed strain	16.94±1.07	26.61±5.41	11.51±1.73	18.54±1.00
		<i>zwf</i> repressed strain	7.34±0.53	18.05±4.69	13.92±2.37	18.62±2.25
Succinic acid	21.328	blank	ND	ND	34.41±2.59	ND
		<i>pfkA</i> repressed strain	14.92±1.48	3.83±6.64	9.45±8.71	ND

Metabolites	Retention Time	Strains	1 h before induction	2 h after induction	12 h after induction	24 h after induction
		<i>zwf</i> repressed strain	13.47±0.42	ND	ND	ND
Glyceric acid	22.09	blank	1.29±0.05	2.23±0.25	3.95±1.62	3.25±0.57
		<i>pfkA</i> repressed strain	5.42±0.61	1.56±0.14	2.66±0.79	1.85±0.63
		<i>zwf</i> repressed strain	2.17±0.15	1.96±0.97	2.04±0.49	1.30±0.63
Uracil	22.274	blank	50.05±2.19	29.50±2.53	21.05±0.10	34.87±0.39
		<i>pfkA</i> repressed strain	32.08±0.38	25.26±4.50	21.06±4.62	45.86±3.80
		<i>zwf</i> repressed strain	15.26±0.38	23.14±1.40	26.53±1.24	37.97±2.60
Fumaric acid	22.383	blank	ND	4.83±1.14	26.99±1.65	8.21±0.34
		<i>pfkA</i> repressed strain	9.04±0.64	6.03±4.67	4.74±2.43	ND
		<i>zwf</i> repressed strain	3.84±0.32	5.13±4.35	2.93±0.61	1.96±3.40
Citrulline	22.943	blank	ND	0.20±0.18	1.10±0.09	0.51±0.13
		<i>pfkA</i> repressed strain	ND	0.47±0.07	0.51±0.20	0.30±0.05
		<i>zwf</i> repressed strain	ND	0.16±0.28	0.31±0.05	0.67±0.22
Serine	23.046	blank	2.19±1.4	0.39±0.07	1.10±0.06	0.60±0.34
		<i>pfkA</i> repressed strain	0.47±0.42	0.45±0.16	0.37±0.32	0.69±0.21
		<i>zwf</i> repressed strain	0.28±0.25	0.49±0.45	0.52±0.19	0.46±0.43
L-Threonine	23.932	blank	2.30±1.69	0.76±0.30	6.93±1.15	3.56±1.43
		<i>pfkA</i> repressed	3.07±0.71	1.76±1.32	2.92±2.10	5.13±1.26

Metabolites	Retention Time	Strains	1 h before induction	2 h after induction	12 h after induction	24 h after induction
		strain				
		<i>zwf</i> repressed strain	3.05±1.68	0.81±0.71	0.94±0.03	1.91±1.21
Pyrimidine	24.337	blank	4.98±0.23	11.43±0.78	4.79±0.28	3.90±0.33
		<i>pfkA</i> repressed strain	1.55±0.08	10.04±1.98	2.80±0.88	3.38±0.05
		<i>zwf</i> repressed strain	0.62±0.23	8.83±2.10	3.90±0.23	4.34±0.43
L-Aspartic acid	24.953	blank	1.00±0.35	0.43±0.03	1.29±0.34	0.83±0.10
		<i>pfkA</i> repressed strain	ND	0.76±0.33	0.60±0.12	0.99±0.23
		<i>zwf</i> repressed strain	0.17±0.30	0.44±0.10	0.44±0.01	0.53±0.16
β-Alanine	25.066	blank	1.07±0.02	0.70±0.12	0.52±0.07	ND
		<i>pfkA</i> repressed strain	3.57±0.05	0.88±0.21	0.72±0.17	ND
		<i>zwf</i> repressed strain	2.34±0.16	0.50±0.32	0.48±0.02	ND
Malic acid	27.108	blank	0.89±0.12	0.97±0.07	0.84±0.04	0.93±0.13
		<i>pfkA</i> repressed strain	ND	0.58±0.08	0.37±0.16	0.57±0.11
		<i>zwf</i> repressed strain	ND	0.62±0.07	0.60±0.09	0.38±0.66
Glycerol	27.427	blank	2.35±0.89	2.71±0.26	4.65±0.74	2.41±0.12
		<i>pfkA</i> repressed strain	2.71±0.19	2.52±0.36	3.80±1.37	2.60±0.29
		<i>zwf</i> repressed strain	1.69±0.03	2.65±0.36	3.04±0.21	3.80±0.80
L-Methionine	27.983	blank	4.46±1.60	4.97±0.26	4.11±0.37	2.73±0.31
		<i>pfkA</i>	4.53±0.35	4.12±1.02	4.23±1.44	3.24±0.33

Metabolites	Retention Time	Strains	1 h before induction	2 h after induction	12 h after induction	24 h after induction
		repressed strain				
		<i>zwf</i> repressed strain	3.04±0.96	2.45±0.34	3.41±0.15	2.69±0.14
5-Oxo-proline	28.064	blank	6.25±1.66	5.62±0.35	10.15±1.58	6.13±0.63
		<i>pfkA</i> repressed strain	7.46±0.47	6.73±1.83	9.49±2.90	8.29±1.25
		<i>zwf</i> repressed strain	5.19±1.03	5.17±0.85	7.59±0.12	4.44±0.39
Cytosine	28.254	blank	7.29±1.69	5.99±1.01	5.27±0.81	6.07±0.53
		<i>pfkA</i> repressed strain	9.43±0.39	5.48±1.63	8.16±3.39	5.88±0.41
		<i>zwf</i> repressed strain	7.23±0.59	4.93±0.33	6.81±0.34	6.10±1.35
Phenylalanine	28.778	blank	8.66±0.59	7.32±0.66	6.78±0.97	6.72±1.25
		<i>pfkA</i> repressed strain	7.04±0.19	5.63±1.20	6.23±0.47	8.31±0.68
		<i>zwf</i> repressed strain	3.39±0.80	3.86±0.88	6.74±0.20	6.71±0.71
L-Cysteine	29.098	blank	ND	0.56±0.22	0.54±0.16	0.26±0.08
		<i>pfkA</i> repressed strain	0.41±0.05	0.38±0.09	0.99±0.52	0.19±0.01
		<i>zwf</i> repressed strain	0.14±0.12	0.26±0.04	0.34±0.02	ND
2-Deoxy-D-Ribose	29.739	blank	1.91±0.33	1.78±0.07	ND	2.29±0.17
		<i>pfkA</i> repressed strain	0.88±0.04	1.67±0.41	1.58±0.45	2.99±0.12
		<i>zwf</i> repressed strain	0.93±0.28	1.64±0.12	3.61±4.00	3.48±0.45
Ribofuranose	29.998	blank	0.46±0.18	0.98±0.17	0.82±0.30	2.22±0.44

Metabolites	Retention Time	Strains	1 h before induction	2 h after induction	12 h after induction	24 h after induction
		<i>pfkA</i> repressed strain	4.58±0.42	0.74±0.22	1.39±0.62	2.82±0.21
		<i>zwf</i> repressed strain	2.06±0.30	1.17±0.09	0.52±0.10	2.71±1.26
D-Erythro-Pentitol	30.555	blank	ND	0.60±0.10	0.92±0.35	0.83±0.12
		<i>pfkA</i> repressed strain	ND	0.99±0.18	1.12±0.31	1.08±0.05
		<i>zwf</i> repressed strain	ND	0.81±0.09	0.77±0.11	2.03±0.46
Glutamic acid	30.944	blank	2.40±0.90	2.97±0.22	2.24±0.21	3.71±0.29
		<i>pfkA</i> repressed strain	7.36±0.13	3.21±1.13	2.96±0.49	3.39±0.59
		<i>zwf</i> repressed strain	6.15±1.22	2.27±0.49	2.10±0.06	1.71±0.37
Xylose	32.078	blank	2.02±0.30	ND	71.91±5.30	6.05±0.13
		<i>pfkA</i> repressed strain	0.74±0.03	0.34±0.59	12.23±2.27	11.25±0.92
		<i>zwf</i> repressed strain	ND	0.27±0.04	14.00±0.28	10.78±0.17
D-Ribose	32.915	blank	12.02±0.62	5.00±0.26	14.98±2.65	36.26±0.85
		<i>pfkA</i> repressed strain	67.36±1.49	4.60±1.36	22.66±13.19	51.33±4.46
		<i>zwf</i> repressed strain	53.47±1.78	5.71±0.57	6.15±0.12	34.69±10.26
1,2-Propanediol-1-Phosphate	33.402	blank	8.36±0.66	31.05±5.16	18.25±1.62	19.77±0.67
		<i>pfkA</i> repressed strain	22.20±0.87	25.25±9.23	13.53±1.85	23.17±1.89
		<i>zwf</i> repressed strain	6.85±0.79	16.49±3.65	12.53±6.52	20.93±3.37

Metabolites	Retention Time	Strains	1 h before induction	2 h after induction	12 h after induction	24 h after induction
Rhamnose	34.007	blank	1.03±0.53	5.36±0.51	5.31±0.66	0.81±0.13
		<i>pfkA</i> repressed strain	1.71±0.31	5.31±0.58	4.03±0.79	0.65±0.14
		<i>zwf</i> repressed strain	0.56±0.06	7.27±0.30	3.65±0.29	0.56±0.44
1,4-Butanediamine	34.185	blank	86.46±5.75	57.38±8.82	18.28±0.49	15.41±0.52
		<i>pfkA</i> repressed strain	61.48±1.18	58.79±10.81	27.34±4.21	14.80±0.44
		<i>zwf</i> repressed strain	33.07±2.85	60.38±2.67	25.84±1.89	12.95±0.69
Benzoic acid	34.401	blank	ND	ND	0.24±0.01	0.77±0.12
		<i>pfkA</i> repressed strain	5.23±0.28	0.84±0.34	1.20±1.28	0.62±0.12
		<i>zwf</i> repressed strain	ND	ND	ND	0.94±0.20
Orotic acid	34.509	blank	ND	ND	1.43±0.51	ND
		<i>pfkA</i> repressed strain	ND	ND	ND	ND
		<i>zwf</i> repressed strain	ND	ND	0.20±0.01	ND
Ribonic acid	35.33	blank	1.10±0.08	ND	0.57±0.03	0.37±0.10
		<i>pfkA</i> repressed strain	ND	ND	ND	0.61±0.12
		<i>zwf</i> repressed strain	ND	ND	ND	0.66±0.20
Hypoxanthine	36.297	blank	29.72±2.19	21.59±2.29	19.96±1.85	24.52±1.07
		<i>pfkA</i> repressed strain	19.84±0.39	23.41±4.04	16.97±3.66	22.42±1.27
		<i>zwf</i> repressed	10.32±0.65	21.03±2.60	18.00±0.67	19.24±2.21

Metabolites	Retention Time	Strains	1 h before induction	2 h after induction	12 h after induction	24 h after induction
		strain				
Citric acid	36.578	blank	3.11±0.77	1.53±0.37	1.30±0.10	1.73±0.47
		<i>pfkA</i> repressed strain	3.88±0.33	2.23±0.13	0.67±0.12	1.79±0.42
		<i>zwf</i> repressed strain	1.21±0.18	1.96±0.67	1.79±0.44	2.72±0.49
Cadaverine	36.751	blank	10.66±1.53	19.26±3.72	7.99±0.53	19.63±1.97
		<i>pfkA</i> repressed strain	4.83±0.19	11.44±2.51	7.21±2.01	9.99±0.82
		<i>zwf</i> repressed strain	1.53±0.30	15.24±2.25	7.46±0.14	8.98±0.72
N- α -Acetyl-L-Lysine	37.156	blank	3.90±1.19	1.99±0.43	1.35±0.93	ND
		<i>pfkA</i> repressed strain	2.38±0.61	3.02±0.47	1.01±0.07	ND
		<i>zwf</i> repressed strain	1.79±0.68	2.55±0.61	2.41±0.49	ND
Adenine	37.68	blank	3.11±0.66	3.34±1.01	3.77±0.17	5.16±0.06
		<i>pfkA</i> repressed strain	10.85±0.22	3.96±0.39	4.35±1.07	3.88±0.21
		<i>zwf</i> repressed strain	5.78±0.27	5.54±0.56	4.85±0.46	5.13±1.69
Phenyllactic acid	38.485	blank	ND	2.43±0.09	5.22±0.74	ND
		<i>pfkA</i> repressed strain	2.30±0.19	2.18±0.80	12.08±6.79	1.23±0.14
		<i>zwf</i> repressed strain	ND	3.20±0.32	2.73±0.13	2.03±0.38
L-Lysine	38.982	blank	10.48±1.18	11.13±1.03	14.76±1.50	2.22±0.24
		<i>pfkA</i> repressed strain	16.34±1.03	11.41±2.72	13.87±2.75	5.76±0.32
		<i>zwf</i>	10.61±1.60	9.70±1.69	16.28±0.59	1.65±0.47

Metabolites	Retention Time	Strains	1 h before induction	2 h after induction	12 h after induction	24 h after induction
		repressed strain				
Histidine	39.063	blank	0.88±0.16	0.75±0.10	1.55±0.28	1.41±0.40
		<i>pfkA</i> repressed strain	ND	0.99±0.50	1.37±0.16	1.76±0.12
		<i>zwf</i> repressed strain	ND	ND	0.67±0.11	0.59±0.16
L-Tyrosine	39.452	blank	6.91±0.71	8.71±1.00	10.89±1.18	9.03±0.97
		<i>pfkA</i> repressed strain	6.76±0.17	8.75±2.31	11.31±2.37	10.23±0.77
		<i>zwf</i> repressed strain	4.43±0.53	6.84±1.77	12.03±2.49	8.09±2.67
D-Mannitol	39.581	blank	ND	3.40±1.36	21.92±7.60	2.50±0.15
		<i>pfkA</i> repressed strain	28.16±0.61	4.94±2.79	95.56±64.11	1.77±0.93
		<i>zwf</i> repressed strain	67.14±2.54	3.96±1.76	6.01±0.52	5.92±5.71
Pantothenic acid	40.867	blank	1.08±0.11	1.76±0.19	1.58±0.23	0.83±0.07
		<i>pfkA</i> repressed strain	2.11±0.07	1.55±0.22	1.54±0.49	0.78±0.06
		<i>zwf</i> repressed strain	ND	2.45±0.07	1.78±0.04	0.87±0.11
7H-Purine	41.553	blank	4.52±0.55	12.67±1.24	10.33±0.98	18.93±0.67
		<i>pfkA</i> repressed strain	12.11±0.11	16.33±2.89	11.90±2.36	22.20±1.83
		<i>zwf</i> repressed strain	6.11±0.88	14.93±2.24	14.13±0.58	15.07±5.39
N-Acetyl-D-glucosamine	43.071	blank	438.13±10.9 0	589.42±69.8 8	1153.03±71.23	605.76±20.8 0
		<i>pfkA</i> repressed	857.91±25.6 3	593.71±60.4 8	1682.53±226.47	398.61±20.1 9

Metabolites	Retention Time	Strains	1 h before induction	2 h after induction	12 h after induction	24 h after induction
		strain				
		<i>zwf</i> repressed strain	368.28±22.50	783.45±41.89	2150.68±25.20	429.25±13.62
9H-purin-2-amine	43.935	blank	14.56±1.81	1.50±0.41	3.25±0.07	ND
		<i>pfkA</i> repressed strain	5.86±0.61	1.74±0.28	5.86±2.34	0.82±0.1
		<i>zwf</i> repressed strain	2.32±0.34	2.99±1.34	6.91±1.16	4.20±0.77
Ribose	44.465	blank	2.59±0.73	1.02±0.18	4.88±0.46	5.47±0.12
		<i>pfkA</i> repressed strain	5.98±0.16	1.21±0.81	7.20±0.57	8.21±0.51
		<i>zwf</i> repressed strain	4.13±0.27	2.44±0.18	4.79±1.17	5.67±1.45
Spermine per	45.351	blank	3.95±1.57	1.33±0.73	323.90±81.57	1.55±0.25
		<i>pfkA</i> repressed strain	1.95±0.33	0.85±0.41	1.18±0.66	0.69±0.13
		<i>zwf</i> repressed strain	1.40±0.22	1.36±0.15	1.56±0.76	0.99±0.55
Pseudo uridine	48.641	blank	0.59±0.07	0.92±0.28	1.41±0.34	0.80±0.04
		<i>pfkA</i> repressed strain	1.12±0.07	1.87±0.46	1.57±0.15	1.34±0.08
		<i>zwf</i> repressed strain	0.93±0.09	1.56±0.45	2.49±0.08	1.51±0.24
Glucitol	49.246	blank	ND	10.55±0.45	35.39±7.59	7.46±0.15
		<i>pfkA</i> repressed strain	27.65±0.70	18.85±8.11	24.76±3.22	8.61±1.05
		<i>zwf</i> repressed strain	21.92±0.55	12.99±4.96	15.09±0.99	13.81±5.21
Inosine	53.221	blank	1.29±0.23	3.45±0.54	4.74±0.33	6.97±0.34
		<i>pfkA</i>	16.76±0.60	5.11±0.60	5.56±1.19	6.59±0.10

Metabolites	Retention Time	Strains	1 h before induction	2 h after induction	12 h after induction	24 h after induction
		repressed strain				
		<i>zwf</i> repressed strain	9.92±0.79	7.07±0.49	5.80±0.16	5.79±0.67
Adenosine	54.372	blank	11.35±0.10	1.67±0.50	1.62±0.15	2.60±0.03
		<i>pfkA</i> repressed strain	18.55±0.17	1.09±0.30	1.86±0.36	1.52±0.03
		<i>zwf</i> repressed strain	9.00±0.33	2.93±0.22	1.75±0.21	1.63±0.93
Glucose	56.819	blank	1.52±0.21	1.41±0.09	4.02±0.76	1.17±0.91
		<i>pfkA</i> repressed strain	2.22±0.14	1.85±0.38	4.05±1.98	0.91±0.31
		<i>zwf</i> repressed strain	1.50±0.06	2.39±0.25	1.75±0.09	0.74±0.24