

Table S9. Biomass composition calculations for *P. chrysogenum*.

***BIOMASS COMPOSITION (g/gDW)**

Protein	0.45
RNA	0.08
DNA	0.01
Phospholipids	0.035
Sterolesters	0.01
Triacylglycerol ^b	0.005
Cell wall	0.22
Glycogen	0.03
Free amino acids	0.04
Free nucleotides	0.02
Metabolites	0.02

^aIf nothing else is stated the composition is taken from Table 4.13 in Physiological Engineering Aspects of Penicillin chrysogenum [1]

^bThis proportion is assumed to contain mono-, di-, and triacylglycerides as well as free fatty acids

AMINO ACIDS AND PROTEIN

	Molecular weight (g/mol)	Protein composition (mol/mol amino acids) ^a	Scaled protein composition (mol/mol amino acids) ^d	Protein composition (mmol/g protein)	Free amino acid pool (mol/mol free amino acids) ^{e,f}	Scaled free amino acid composition (mol/mol free amino acids) ^d	Amino acid pool composition (mmol/g free amino acids)
L-alanine	89.09	0.071	0.071753411	0.583943653	0.13	0.1363398	1.04484604
L-2-aminoadipate	161.15	0	0	0	0.006	0.00629261	0.04822366
L-arginine	174.2	0.0675	0.068216271	0.555157698	0.026	0.02726796	0.20896921
L-asparagine ^b	132.12	0.017125	0.017306721	0.140845564	0.034	0.0356581	0.27326743
L-aspartate ^b	133.11	0.051375	0.051920162	0.422536693	0.058	0.06082853	0.46616208
L-cysteine	121.16	0.018	0.018191006	0.148042053	0.005	0.00524384	0.04018639
L-glutamate ^c	147.13	0.088125	0.089060131	0.724789217	0.254	0.266387	2.04146841
L-glutamine ^c	146.15	0.029375	0.02968671	0.241596406	0.166	0.17409544	1.33418802
glycine	75.07	0.0755	0.076301162	0.620954166	0.032	0.03356057	0.25719287
L-histidine	155.16	0.025	0.025265285	0.205613962	0.028	0.0293655	0.22504376
L-isoleucine	131.18	0.042	0.04244568	0.345431457	0.013	0.01363398	0.1044846
L-leucine	131.18	0.0845	0.085396665	0.694975193	0.016	0.01678028	0.12859644
L-lysine	146.19	0.0755	0.076301162	0.620954166	0.022	0.02307289	0.1768201

L-methionine	149.21	0.054	0.054573017	0.444126159	0.005	0.00524384	0.04018639
L-phenylalanine	165.19	0.0335	0.033855483	0.27552271	0.005	0.00524384	0.04018639
L-proline	115.13	0.0515	0.052046488	0.423564762	0.0515	0.05401154	0.41391978
L-serine	105.09	0.0515	0.052046488	0.423564762	0.047	0.04929208	0.37775203
L-threonine	119.12	0.0535	0.054067711	0.440013879	0.031	0.0325118	0.24915559
L-tryptophan	204.23	0.007	0.00707428	0.057571909	0.002	0.00209754	0.01607455
L-tyrosine	118.19	0.0235	0.023749368	0.193277125	0.006	0.00629261	0.04822366
L-valine	117.15	0.07	0.070742799	0.575719094	0.016	0.01678028	0.12859644
TOTAL		0.9895	1		0.9535	1	

Molecular weight of protein (g/mol) 122.8772852

Molecular weight of free amino acid pool (g/mol) 130.4879339

^aData from Table 4.11 in Physiological Engineering Aspects of *Penicillin chrysogenum* [1]. Averaged composition from two studies (Jørgensen 1993;[2])

^bThe pool of aspartate and asparagine is measured. A ratio of 3:1 aspartate/asparagine is assumed (Oura, 1972)

^cThe pool of glutamate and glutamine is measured. A ratio of 3:1 glutamate/glutamine is assumed (Oura, 1972)

^dScaled composition to deal with the molecular balance not closing

^eData from Table 4.7 in Physiological Engineering Aspects of *Penicillin chrysogenum* [1]. Original data from Jørgensen (1993)

^fProline cannot be measured with the applied method. Assumes the same composition as in protein

DNA AND RNA

	RNA composition (mmol/g RNA) ^a		DNA composition (mmol/g DNA) ^a
AMP	0.79	dAMP	0.79
GMP	0.89	dGMP	0.86
CMP	0.61	dCMP	0.86
UMP	0.81	dTMP	0.79

^aFollowing the reasoning in section 4.3.3 in Physiological Engineering Aspects of *Penicillin chrysogenum* [1]

FREE RIBONUCLEOTIDES

	Free ribonucleotide composition (mmol/g DW) ^a	Molecular weight (g/mol)	Composition (mmol/g free ribonucleotides)
GTP	0.0033	532.18	0.213396447
ATP	0.0225	507.18	1.454975775
UTP	0.00145	484.14	0.093765105
CTP	0.0033	483.16	0.213396447

glucocerebroside 2 cardiolipin	926.2806 1502.506836	0.033429704	0.043136656	0.000024
Molecular weight of phospholipid (g/mol)	774.972082			
Molecular weight of acylglycerides (g/mol)	554.6062653			
Molecular weight of sterol esters (g/mol)	455.9649434			

^aComposition calculated only for the acyl chain, not for the fatty acid (lacks the carboxyl group)

^bTotal fatty acid composition for growth on glucose as sole carbon source [3]

^cScaled composition to deal with the molecular balance not closing

^dAssumes the same composition as in the *A. niger* model

^eNo reliable data could be found on the percentage of glucolipids in *Penicillium chrysogenum*. It is therefore assumed that the composition and amount is the same as in *Aspergillus niger* (see the *A. niger* model [4])

^fThe free fatty acid proportion differ between *Penicillium chrysogenum* and *Aspergillus niger* but it is assumed that the proportion relative to the acylglycerides is the same

CELLWALL AND STORAGE^a	Molecular weight of monomer in cell wall (without UDP/GDP) (g/mol) ^b	Cell wall monomer composition (mol/mol total monomers) ^b	Cell wall monomer composition (mmol/g cell wall monomers)
UDP-N-acetyl-D- glucosamine	214.1596	0.27184466	1.54208087
UDP-glucose	162.1442	0.495145631	2.808790156
UDP-D-galactose	162.1442	0.145631068	0.826114752
GDP-mannose	162.1442	0.058252427	0.330445901
trehalose	162.1442	0.029126214	0.16522295
Molecular weight of cell wall and storage (mmol/g)	176.2843087		

^aThe cell wall composition of *Penicillium chrysogenum* is not well researched and there is conflicting data. The cell wall composition is therefore expressed as a polymerization of the monomers.

^bFollowing the reasoning in section 4.3.3 in Physiological Engineering Aspects of *Penicillin chrysogenum* [1]

POLYMERISATION COSTS^a

DNA	11.22
RNA	7.44
Protein (mmol ATP/g protein)	34.9942627

^aFollowing the reasoning in section 4.3.3 in Physiological Engineering Aspects of *Penicillin chrysogenum* [1]

References

1. Nielsen JH (1995) Physiological engineering aspects of penicillium chrysogenum. Denmark: Polyteknisk forlag. x, 223 p. p.
2. Jaklitsch WM, Hampel W, Rohr M, Kubicek CP, Gamerith G (1986) alpha-Aminoadipate pool concentration and penicillin biosynthesis in strains of Penicillium chrysogenum. Can J Microbiol 32: 473-480.
3. Divakaran P, Modak MJ (1968) Fatty acid composition of mycelium of Penicillium chrysogenum grown in different carbohydrates as a sole source of carbon. Experientia 24: 1102.
4. Andersen MR, Nielsen ML, Nielsen J (2008) Metabolic model integration of the bibliome, genome, metabolome and reactome of Aspergillus niger. Mol Syst Biol 4: 178.