

Supplementary Materials

1. Analytical methods

1.1. Dry matter and ash content

Dry matter was determined according to DIN EN 12880 and the ash content was analyzed according to DIN EN 12879.

1.2. Total nitrogen

For the determination of the total nitrogen content (Table S1), 150 mg sample was weighed into a Kjeldahl reaction tube and boiling stones, anti-foaming agent and a Kjeltab S (5 g K₂SO₄, 5 mg Se), as well as 10 mL 96% H₂SO₄ were added. The thermal degradation was performed in a Kjeldathrem from Gerhardt GmbH & Co. KG (Königswinter, Germany) with the following temperature gradient.

Table S1. Temperature gradient applied for thermal degradation.

Temperature	Time
100 °C	30 min
200 °C	60 min
300 °C	60 min
420 °C	60 min
RT	30 min

The distillation and titration was carried out with a Vapodest from Gerhardt GmbH & Co. KG (Königswinter, Germany) using 33 % NaOH, 2 % B(OH)₃ and 0.05m H₂SO₄. The nitrogen amount was calculated with the following equation:

$$\%N = \frac{V_{\text{H}_2\text{SO}_4} [\text{mL}]}{m_{\text{sample}} [\text{g}] \cdot 1000} \cdot z \cdot c \cdot M(N) \cdot 100\%$$

$V_{\text{H}_2\text{SO}_4}$ = Titration volume of the volumetric standard solution in mL

m_{sample} = mass of the sample in g

z = stoichiometric coefficient, here $z = 2$

c = concentration of the volumetric standard solution, here $c_{\text{H}_2\text{SO}_4} = 0.05 \text{ mol/L}$

$M(N)$ =14.007 g/mol

1.3. Colorimetric assays

Amino nitrogen was analyzed with ninhydrin according to MEBAK [25].

The total carbohydrate was determined with anthrone in 80% H₂SO₄ according to MEBAK [25].

The determination of reducing sugars was carried out with 3,5-dinitrosalicylic acid, described by Miller [26].

Polyphenols and Flavonoids were analyzed in accordance with MEBAK [25]. Furthermore, for the determination of polyphenols the Folin-Ciocalteu method was used [27].

The measurement was conducted on T80 UV/Vis-spectrophotometer from PG Instruments Ltd. (Leicester, UK).

1.4. Fatty Acids

Fatty acids were derivatized to fatty acid methyl esters as described by Lewis et al [28]. and analyzed by GC-MS on a GC-17A from Shimadzu (Kyoto, Japan) equipped with a Zebron™ ZB-WAX plus (60 m x 0.25 mm x 0.25 μm) column. The carrier gas was He with a flow rate of 1.4 mL/min. The temperature gradient started at 60 °C. It was heated up to 150 °C with 30 °C/min, and further up to 240 °C with 13 °C/min and hold for 30 min, then heat to 255 °C with 40 °C/min and hold for further 5 min.

1.5. Carbohydrates

Carbohydrates were hydrolyzed in accordance to a method described by Sluiter et al. of the National Renewable Energy Laboratory (NREL) [29]. The monomeric sugars were analyzed by high-performance anion-exchange chromatography (HPAEC) coupled with pulsed amperometric detection on a Dionex ICS-5000 system with a Dionex™ Carbopac PA20 (3 × 150 mm) column from Thermo scientific (Sunnyvale, USA). The gradient of the mobile phase is described in Table S2, the flow rate was 0.3 mL/min at 30 °C.

Table S2. Solvent gradient for HPAEC-PAD measurement of carbohydrates.

Zeit	A Water	B 10 mm NaOH	C 200 mm NaOH	D 25 mm NaOH + 1 m NaOAc
0-36 min	50%	50%	–	–
38 min	50%	–	50%	–
48 min	20%	–	50%	30%
51 min	–	–	40%	60%
51.5 min	–	–	100%	–
58 min	–	–	100%	–
63 min	50%	50%	–	–
63-73 min	50%	50%	–	–

1.6. Inhibitors

The inhibitors were measured by high-performance liquid chromatography (HPLC) on a Dionex™ ICS-5000 system from Thermo scientific (Sunnyvale, USA) equipped with a Aminex® HPX-87H column (300 × 7.8 mm) from Bio-Rad (Hercules, USA), and a refraction index detector RI-101 from Shodex (Tokyo, Japan). The mobile phase was 5mm sulfuric acid with a flow rate of 0.7 mL/min (60 °C).

1.7. Soluble Ions

Soluble ions were measured by ion chromatography (IC) on a Dionex™ ICS-1000 system from Thermo scientific (Sunnyvale, USA). The parameters are described in Table S3:

Table S3: Parameters for anion and cation analysis by IC

	Parameters	Parameters
	Cations	Anions
precolumn	Dionex™ IonPac CG16 5 × 50 mm	Dionex™ IonPac AG11-HC, 4 × 50 mm
column	Dionex™ IonPac CS16 250 × 5 mm	Dionex™ IonPac AS11-HC, 250 × 4 mm
temperature	60 °C	RT
eluent	36 mm methylsulfonic acid	25 mm NaOH
flow rate	1 mL/min	1 mL/min
suppressor power	106 mA	62 mA
suppressor type	CSRS 300 4 mm	ASRS 300 4 mm

1.8. Trace elements

The samples were degraded in a Mars Xpress microwave from CEM (Kamp-Lintfort, Deutschland) prior to analysis by inductively coupled plasma atomic emission spectroscopy (ICP-OES). 500 mg sample were weighed into a vessel and 6 mL conc. HNO₃ Suprapur and 2 mL H₂O₂ Suprapur were added. The sample was heated up to 190 °C in 15 min and hold for further 15 min.

For ICP-OES analysis the degraded sample was diluted and measured with an iCAP 6300 Duo from Thermo Fisher Scientific, Inc. (Sunnyvale, USA). The used plasma parameters and integration times are described in Table S4:

Table S4: Plasma and measurement parameters applied for trace element analysis by ICP-OES

	UV	Vis
plasma power	1350 W	1150 W
spray gas flow	0.5 L/min	0.65 L/min
stabilizing time	5 s	
integration time axial	55 s	25 s
integration time radial	45 s	20 s

2. Composition of nutrient sources (mildly chemically hydrolyzed)

2.1. Corn Gluten

General Data		
Dry matter	[%]	92.6
Total nitrogen (TN)	[%]	5.80 ± 0.02
Amino nitrogen (AN)	[%]	1.80 ± 0.02
Hydrolysis degree (AN/TN)	[%]	31.0 ± 0.27
Ash	[%]	5.9

Amino acids [g/100 g]	free	total
Alanine	0.16 ± 0.001	1.84 ± 0.028
Asparagine	ND	ND
Asparatic acid	1.15 ± 0.039	2.98 ± 0.050
Cystathionine	ND	ND
Glutamic acid	0.03 ± 0.005	3.66 ± 0.074
Glycine	0.04 ± 0.004	1.30 ± 0.012
Histidine	0.34 ± 0.005	1.56 ± 0.046
Isoleucine	ND	0.83 ± 0.014
Leucine	0.29 ± 0.002	2.16 ± 0.034
Lysine	0.24 ± 0.012	1.64 ± 0.036
Methionine	0.09 ± 0.002	0.54 ± 0.010
Phenylalanine	0.22 ± 0.002	1.50 ± 0.026
Proline	0.18 ± 0.003	2.64 ± 0.016
Serine	0.15 ± 0.014	1.82 ± 0.031
Threonine	0.03 ± 0.013	1.28 ± 0.010
Tryptophan	ND	ND
Tyrosine	0.13 ± 0.004	1.00 ± 0.020
Valine	0.07 ± 0.003	1.48 ± 0.011

Fatty acids	[mg/g]
(10:0)	ND
(18:0)	1.15 ± 0.202
(18:3n6)	0.216 ± 0.069

Carbohydrates			[mg/g]
Total			532.2 ± 4.788
Reducing sugar			272.4 ± 2.751
Carbohydrates [mg/g]	free	total (NREL)	
Rhamnose	ND	ND	
Arabinose	11.8	10.7 ± 0.022	
Galactose	1.48	1.98 ± 0.059	
Glucose	ND	ND	
Sucrose	ND	ND	
Xylose	3.92	9.14 ± 0.157	
Mannose	0.66	1.18 ± 0.015	
Fructose	5.39	6.89 ± 2.015	

Inhibitors [mg/g]	free	total (NREL)
Formate	6.31	5.95 ± 0.123
Acetate	2.91	2.25 ± 0.114
Levulinic acid	0.37	8.22 ± 0.124
Hydroxymethylfurfural	0.86	4.91 ± 0.035
Furfural	0.41	2.77 ± 0.145

Polyphenols	[mg/g]
with MEBAK	1.54 ± 0.040
with Folin-Ciocalteu	18.1 ± 0.884

Flavonoids		1.00 ± 0.008
Soluble ions		[mg/g]
Na ⁺		1.37 ± 0.019
NH ₄ ⁺		17.3 ± 0.136
K ⁺		3.25 ± 0.001
Mg ²⁺		0.847 ± 0.016
Ca ²⁺		8.87 ± 0.038
F ⁻		3.31 ± 0.036
Cl ⁻		0.926 ± 0.007
NO ₂ ⁻		ND
SO ₄ ²⁻		59.6 ± 0.405
NO ₃ ⁻		ND
Br ⁻		2.10 ± 0.004
PO ₄ ³⁻		6.10 ± 0.012

Trace elements, λ		[mg/kg]
Ag	328.068	ND
Al	396.152	1.42 ± 0.096
As	189.042	ND
B	249.773	4.58 ± 0.106
Ba	455.403	0.133 ± 0.001
Be	234.861	ND
Bi	223.061	ND
Ca	422.673	13075.6 ± 15.74
Cd	214.438	ND
Co	228.616	ND
Cr	267.716	0.434 ± 0.010
Cu	324.754	5.49 ± 0.074
Fe	259.940	25.4 ± 0.172
K	766.490	3239.4 ± 30.27
Li	670.784	0.502 ± 0.045
Mg	280.270	1788.6 ± 2.756
Mn	293.930	1.72 ± 0.020
Mo	202.030	0.241 ± 0.010
Na	589.592	1232.3 ± 1.519
Ni	231.604	0.561 ± 0.002
P	177.495	568.1 ± 3.195
Pb	220.353	ND
S	182.034	24894.3 ± 103.4
Sb	217.581	ND
Se	203.985	ND
Sr	407.771	5.06 ± 0.112
Ti	337.280	0.502 ± 0.029
Tl	190.856	ND
V	292.464	1.25 ± 0.027
W	239.709	ND
Zn	206.200	1.73 ± 0.136

ND not detectable

2.2. DDGS (Distillers' Dried Grains with Solubles)

General Data		
Dry matter	[%]	88.1
Total nitrogen (TN)	[%]	2.66 ± 0.05
Amino nitrogen (AN)	[%]	0.31 ± 0.003
Hydrolysis degree (AN/TN)	[%]	11.6 ± 0.10
Ash	[%]	15.9

Amino acids [g/100 g]	free	total
Alanine	ND	0.34 ± 0.018
Asparagine	ND	ND
Asparatic acid	1.61 ± 0.084	0.75 ± 0.030
Cystathionine	ND	ND
Glutamic acid	ND	2.45 ± 0.291
Glycine	ND	0.54 ± 0.008
Histidine	ND	0.74 ± 0.014
Isoleucine	ND	ND
Leucine	2.88 ± 0.037	0.50 ± 0.005
Lysine	ND	0.48 ± 0.013
Methionine	0.64 ± 0.004	0.17 ± 0.005
Phenylalanine	1.76 ± 0.003	0.39 ± 0.003
Proline	1.45 ± 0.020	1.02 ± 0.014
Serine	3.23 ± 0.298	0.55 ± 0.022
Threonine	ND	0.40 ± 0.008
Tryptophan	ND	ND
Tyrosine	ND	0.34 ± 0.004
Valine	ND	0.38 ± 0.002

Fatty acids	[mg/g]
(10:0)	2.59 ± 0.067
(18:0)	0.426 ± 0.019

Carbohydrates	[mg/g]
Total	270.7 ± 3.220
Reducing sugar	322.9 ± 3.230

Carbohydrates [mg/g]	free	total (NREL)
Rhamnose	ND	ND
Arabinose	47.6	51.6 ± 0.631
Galactose	6.49	18.6 ± 0.057
Glucose	20.9	125.0 ± 2.492
Sucrose	ND	1.73 ± 0.115
Xylose	46.0	ND
Mannose	ND	31.2 ± 0.234
Fructose	19.4	7.75 ± 0.122

Inhibitors [mg/g]	free	total (NREL)
Formate	239.1	ND
Acetate	9.34	7.01 ± 0.066
Levulinic acid	0.10	7.43 ± 0.115
Hydroxymethylfurfural	0.61	3.16 ± 0.085
Furfural	2.85	24.2 ± 0.033

Polyphenols	[mg/g]
with MEBAK	2.19 ± 0.070
with Folin-Ciocalteu	20.3 ± 0.081
Flavonoids	0.355 ± 0.003

Soluble ions	[mg/g]
Na ⁺	5.21 ± 0.039
NH ₄ ⁺	ND
K ⁺	22.8 ± 0.037
Mg ²⁺	3.96 ± 0.050
Ca ²⁺	17.4 ± 0.020
F ⁻	6.40 ± 0.018
Cl ⁻	3.62 ± 0.007
NO ₂ ⁻	1.10 ± 0.000
SO ₄ ²⁻	73.2 ± 0.381
NO ₃ ⁻	ND
Br ⁻	2.13 ± 0.002
PO ₄ ³⁻	6.86 ± 0.011

Trace elements, λ	[mg/kg]
Ag	328.068
Al	396.152
As	189.042
B	249.773
Ba	455.403
Be	234.861
Bi	223.061
Ca	422.673
Cd	214.438
Co	228.616
Cr	267.716
Cu	324.754
Fe	259.940
K	766.490
Li	670.784
Mg	280.270
Mn	293.930
Mo	202.030
Na	589.592
Ni	231.604
P	177.495
Pb	220.353
S	182.034
Sb	217.581
Se	203.985
Sr	407.771
Ti	337.280
Tl	190.856
V	292.464
W	239.709
Zn	206.200

ND not detectable

NA not assignable (relative standard deviation > 50%)

2.3. Sunflower Meal

General Data		
Dry matter	[%]	88.4
Total nitrogen (TN)	[%]	4.96 ± 0.03
Amino nitrogen (AN)	[%]	0.79 ± 0.03
Hydrolysis degree (AN/TN)	[%]	16.0 ± 0.46
Ash	[%]	25.9

Amino acids	free	total
[g/100 g]		
Alanine	ND	0.83 ± 0.009
Asparagine	ND	ND
Asparatic acid	0.62 ± 0.026	2.67 ± 0.033
Cystathionine	ND	ND
Glutamic acid	0.02 ± 0.007	4.40 ± 0.053
Glycine	ND	2.07 ± 0.012
Histidine	ND	1.02 ± 0.033
Isoleucine	ND	0.50 ± 0.001
Leucine	0.05 ± 0.001	1.01 ± 0.004
Lysine	0.21 ± 0.006	0.88 ± 0.073
Methionine	0.08 ± 0.002	0.32 ± 0.007
Phenylalanine	0.05 ± 0.001	0.78 ± 0.013
Proline	0.05 ± 0.006	1.26 ± 0.008
Serine	0.05 ± 0.003	1.29 ± 0.031
Threonine	ND	0.99 ± 0.030
Tryptophan	ND	ND
Tyrosine	0.11 ± 0.004	0.49 ± 0.035
Valine	ND	0.95 ± 0.007

Fatty acids	[mg/g]
(6:0)	0.241 ± 0.011
(10:0)	0.074 ± 0.016
(18:0)	0.223 ± 0.016

Carbohydrates	[mg/g]
Total	205.6 ± 1.766
Reducing sugar	320.8 ± 2.579

Carbohydrates	free	total (NREL)
[mg/g]		
Rhamnose	ND	8.20 ± 0.025
Arabinose	75.9	53.5 ± 0.510
Galactose	19.2	36.1 ± 0.358
Glucose	28.8	55.4 ± 0.775
Sucrose	ND	ND
Xylose	7.55	14.5 ± 0.056
Mannose	1.07	4.69 ± 0.053
Fructose	57.1	ND

Inhibitors	free	total (NREL)
[mg/g]		
Formate	4.73	16.4 ± 0.057
Acetate	22.4	23.2 ± 0.156
Levulinic acid	0.25	25.7 ± 0.045
Hydroxymethylfurfural	1.31	5.64 ± 0.139
Furfural	0.26	15.5 ± 0.361

Polyphenols	[mg/g]
with MEBAK	33.9 ± 0.816
with Folin-Ciocalteu	24.1 ± 0.181
Flavonoids	0.148 ± 0.004

Soluble ions	[mg/g]
Na ⁺	0.765 ± 0.002
NH ₄ ⁺	2.63 ± 0.003
K ⁺	41.2 ± 0.040
Mg ²⁺	16.0 ± 0.074
Ca ²⁺	23.4 ± 0.346
F ⁻	4.39 ± 0.017
Cl ⁻	2.40 ± 0.016
NO ₂ ⁻	ND
SO ₄ ²⁻	130.7 ± 0.137
NO ₃ ⁻	ND
Br ⁻	2.12 ± 0.001
PO ₄ ³⁻	7.36 ± 0.097

Trace elements, λ	[mg/kg]
Ag	328.068
Al	396.152
As	189.042
B	249.773
Ba	455.403
Be	234.861
Bi	223.061
Ca	422.673
Cd	214.438
Co	228.616
Cr	267.716
Cu	324.754
Fe	259.940
K	766.490
Li	670.784
Mg	280.270
Mn	293.930
Mo	202.030
Na	589.592
Ni	231.604
P	177.495
Pb	220.353
S	182.034
Sb	217.581
Se	203.985
Sr	407.771
Ti	337.280
Tl	190.856
V	292.464
W	239.709
Zn	206.200

ND not detectable

2.5 Rape Cake

General Data		
Dry matter	[%]	89.5
Total nitrogen (TN)	[%]	6.15 ± 0.05
Amino nitrogen (AN)	[%]	0.92 ± 0.01
Hydrolysis degree (AN/TN)	[%]	15.0 ± 0.08
Ash	[%]	18.3

Amino acids	free	total
[g/100 g]		
Alanine	ND	1.18 ± 0.017
Asparagine	0.03 ± 0.012	ND
Asparatic acid	0.84 ± 0.028	2.95 ± 0.033
Cystathionine	ND	ND
Glutamic acid	0.10 ± 0.774	7.15 ± 0.258
Glycine	ND	1.59 ± 0.019
Histidine	0.51 ± 0.001	1.46 ± 0.058
Isoleucine	ND	0.72 ± 0.012
Leucine	0.05 ± 0.023	1.84 ± 0.045
Lysine	0.21 ± 0.026	1.71 ± 0.085
Methionine	0.08 ± 0.004	0.39 ± 0.006
Phenylalanine	0.06 ± 0.045	1.02 ± 0.038
Proline	0.07 ± 0.001	2.86 ± 0.041
Serine	0.15 ± 0.118	1.62 ± 0.018
Threonine	ND	1.65 ± 0.016
Tryptophan	ND	ND
Tyrosine	0.10 ± 0.067	0.69 ± 0.025
Valine	ND	1.53 ± 0.010

Fatty acids	[mg/g]
(10:0)	ND
(18:0)	0.266 ± 0.008

Inhibitors	free	total (NREL)
[mg/g]		
Formate	32.2	11.7 ± 0.030
Acetate	7.34	3.63 ± 0.031
Levulinic acid	0.37	15.3 ± 0.031
Hydroxymethylfurfural	0.93	3.85 ± 0.012
Furfural	0.44	11.1 ± 0.315

Carbohydrates	[mg/g]
Total	205.4 ± 1.923
Reducing sugar	309.0 ± 5.158

Carbohydrates	free	total (NREL)
[mg/g]		
Rhamnose	ND	2.79 ± 0.152
Arabinose	ND	62.4 ± 0.605
Galactose	12.6	40.6 ± 0.217
Glucose	44.2	67.4 ± 1.390
Sucrose	ND	ND
Xylose	3.91	6.72 ± 0.033
Mannose	0.25	1.52 ± 0.0005

Fructose	61.3	4.15 ± 0.278
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Polyphenols	[mg/g]
with MEBAK	1.56 ± 0.069
with Folin-Ciocalteu	20.4 ± 0.612
Flavonoids	0.081 ± 0.003

Soluble ions	[mg/g]
Na ⁺	0.381 ± 0.002
NH ₄ ⁺	2.93 ± 0.055
K ⁺	29.6 ± 0.023
Mg ²⁺	8.58 ± 0.032
Ca ²⁺	19.7 ± 0.298
F ⁻	3.94 ± 0.009
Cl ⁻	3.41 ± 0.027
NO ₂ ⁻	ND
SO ₄ ²⁻	96.0 ± 0.139
NO ₃ ⁻	ND
Br ⁻	2.09 ± 0.001
PO ₄ ³⁻	6.91 ± 0.013

Trace elements, λ	[mg/kg]
Ag	328.068
Al	396.152
As	189.042
B	249.773
Ba	455.403
Be	234.861
Bi	223.061
Ca	422.673
Cd	214.438
Co	228.616
Cr	267.716
Cu	324.754
Fe	259.940
K	766.490
Li	670.784
Mg	280.270
Mn	293.930
Mo	202.030
Na	589.592
Ni	231.604
P	177.495
Pb	220.353
S	182.034
Sb	217.581
Se	203.985
Sr	407.771
Ti	337.280
Tl	190.856
V	292.464
W	239.709
Zn	206.200

ND not detectable

2.6 Rapeseed Meal

General Data		
Dry matter	[%]	87.3
Total nitrogen (TN)	[%]	4.80 ± 0.01
Amino nitrogen (AN)	[%]	0.97 ± 0.01
Hydrolysis degree (AN/TN)	[%]	20.1 ± 0.22
Ash	[%]	19.5

Amino acids [g/100 g]	free	total
Alanine	ND	0.82 ± 0.010
Asparagine	ND	ND
Asparatic acid	1.02 ± 0.012	2.54 ± 0.056
Cystathionine	ND	ND
Glutamic acid	0.09 ± 0.001	4.28 ± 0.589
Glycine	ND	1.19 ± 0.024
Histidine	0.33 ± 0.002	1.12 ± 0.042
Isoleucine	ND	0.36 ± 0.008
Leucine	0.05 ± 0.002	1.13 ± 0.008
Lysine	0.20 ± 0.002	1.34 ± 0.033
Methionine	0.08 ± 0.002	0.26 ± 0.013
Phenylalanine	0.05 ± 0.002	0.69 ± 0.015
Proline	0.08 ± 0.003	1.73 ± 0.018
Serine	0.15 ± 0.007	1.29 ± 0.036
Threonine	ND	1.31 ± 0.020
Tryptophan	ND	ND
Tyrosine	0.10 ± 0.003	0.63 ± 0.025
Valine	ND	0.98 ± 0.013

Fatty acids	[mg/g]
(10:0)	0.066 ± 0.010
(13:0)	NA
(14:0)	0.215 ± 0.098
(18:0)	0.370 ± 0.112
(18:3n6)	NA

Carbohydrates	[mg/g]
Total	287.6 ± 1.165
Reducing sugar	392.0 ± 2.923

Carbohydrates [mg/g]	free	total (NREL)
Rhamnose	ND	5.44 ± 0.472
Arabinose	ND	64.3 ± 0.637
Galactose	24.5	43.6 ± 0.232
Glucose	ND	86.3 ± 0.519
Sucrose	ND	ND
Xylose	15.5	11.2 ± 0.091
Mannose	ND	2.64 ± 0.261
Fructose	79.4	3.32 ± 0.122

Inhibitors [mg/g]	free	total (NREL)
Formate	13.0	14.6 ± 0.272
Acetate	10.3	7.20 ± 0.492
Levulinic acid	0.57	27.4 ± 0.782
Hydroxymethylfurfural	2.27	5.08 ± 0.173
Furfural	0.69	13.8 ± 0.141

Polyphenols	[mg/g]
with MEBAK	1.96 ± 0.080
with Folin-Ciocalteu	22.9 ± 1.024
Flavonoids	0.080 ± 0.002

Soluble ions	[mg/g]
Na ⁺	3.69 ± 0.005
NH ₄ ⁺	3.68 ± 0.011
K ⁺	24.8 ± 0.029
Mg ²⁺	11.7 ± 0.143
Ca ²⁺	12.7 ± 0.234
F ⁻	3.01 ± 0.008
Cl ⁻	3.02 ± 0.005
NO ₂ ⁻	1.10 ± 0.007
SO ₄ ²⁻	90.8 ± 0.287
NO ₃ ⁻	ND
Br ⁻	2.23 ± 0.002
PO ₄ ³⁻	7.25 ± 0.009

Trace elements, λ	[mg/kg]
Ag	328.068
Al	396.152
As	189.042
B	249.773
Ba	455.403
Be	234.861
Bi	223.061
Ca	422.673
Cd	214.438
Co	228.616
Cr	267.716
Cu	324.754
Fe	259.940
K	766.490
Li	670.784
Mg	280.270
Mn	293.930
Mo	202.030
Na	589.592
Ni	231.604
P	177.495
Pb	220.353
S	182.034
Sb	217.581
Se	203.985
Sr	407.771
Ti	337.280
Tl	190.856
V	292.464
W	239.709
Zn	206.200

ND not detectable

NA not assignable (relative standard deviation > 50%)

2.7 Wheat gluten

General Data		
Dry matter	[%]	91.4
Total nitrogen (TN)	[%]	11.3 ± 0.05
Amino nitrogen (AN)	[%]	2.68 ± 0.01
Hydrolysis degree (AN/TN)	[%]	23.7 ± 0.04
Ash	[%]	7.7

Amino acids [g/100 g]	free	total
Alanine	ND	1.45 ± 0.033
Asparagine	ND	0.18 ± 0.022
Asparatic acid	1.03 ± 0.033	2.52 ± 0.031
Cystathionine	ND	ND
Glutamic acid	0.18 ± 0.027	16.3 ± 0.638
Glycine	0.08 ± 0.008	2.45 ± 0.071
Histidine	0.34 ± 0.004	1.92 ± 0.031
Isoleucine	ND	1.51 ± 0.027
Leucine	0.07 ± 0.001	3.84 ± 0.120
Lysine	0.19 ± 0.004	1.29 ± 0.015
Methionine	0.08 ± 0.003	0.71 ± 0.033
Phenylalanine	0.07 ± 0.002	2.86 ± 0.137
Proline	0.15 ± 0.006	8.86 ± 0.311
Serine	0.07 ± 0.017	3.63 ± 0.053
Threonine	ND	1.86 ± 0.010
Tryptophan	0.28 ± 0.001	ND
Tyrosine	0.12 ± 0.004	2.04 ± 0.102
Valine	ND	2.33 ± 0.024

Fatty acids	[mg/g]
(10:0)	0.042 ± 0.003
(16:0)	0.386 ± 0.160
(18:0)	0.955 ± 0.026
(18:2n6tr.)	5.34 ± 0.100

Carbohydrates	[mg/g]
Total	185.7 ± 1.454
Reducing sugar	192.3 ± 1.720

Carbohydrates [mg/g]	free	total (NREL)
Rhamnose	ND	ND
Arabinose	5.49	6.11 ± 0.038
Galactose	4.33	2.91 ± 0.007
Glucose	ND	74.6 ± 0.618
Sucrose	ND	ND
Xylose	2.01	ND
Mannose	2.08	0.14 ± 0.028
Fructose	12.68	3.61 ± 0.022

Inhibitors [mg/g]	free	total (NREL)
Formate	2.28	5.45 ± 0.016
Acetate	2.95	1.21 ± 0.008
Levulinic acid	0.49	7.10 ± 0.098
Hydroxymethylfurfural	1.43	3.58 ± 0.090
Furfural	0.41	0.77 ± 0.129

Polyphenols	[mg/g]
with MEBAK	1.40 ± 0.040
with Folin-Ciocalteu	20.0 ± 0.109
Flavonoids	0.179 ± 0.004

Soluble ions	[mg/g]
Na ⁺	1.08 ± 0.021
NH ₄ ⁺	37.5 ± 0.073
K ⁺	3.36 ± 0.057
Mg ²⁺	0.694 ± 0.033
Ca ²⁺	15.0 ± 0.162
F ⁻	2.14 ± 0.155
Cl ⁻	1.25 ± 0.062
NO ₂ ⁻	1.05 ± 0.005
SO ₄ ²⁻	79.4 ± 1.400
NO ₃ ⁻	2.93 ± 0.007
Br ⁻	2.08 ± 0.000
PO ₄ ³⁻	7.82 ± 0.048

Trace elements, λ	[mg/kg]
Ag	328.068
Al	396.152
As	189.042
B	249.773
Ba	455.403
Be	234.861
Bi	223.061
Ca	422.673
Cd	214.438
Co	228.616
Cr	267.716
Cu	324.754
Fe	259.940
K	766.490
Li	670.784
Mg	280.270
Mn	293.930
Mo	202.030
Na	589.592
Ni	231.604
P	177.495
Pb	220.353
S	182.034
Sb	217.581
Se	203.985
Sr	407.771
Ti	337.280
Tl	190.856
V	292.464
W	239.709
Zn	206.200

ND not detectable

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