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This report replaces the previous report AR-21-FR-032185-01 from 2021-09-10 because of changes to Batch and/or Sample descriptions.

Title : **Test report for order 12130959**

Test report number : **AR-21-FR-032185-02**

Project name : **Biochar ba-se-27-2-2**

Number of samples : **1**

Sample type: **biochar**

Sample Taker: **delivered by client**

Sample reception date : **2021-07-08**

Sample processing time : **2021-07-08 - 2021-09-10**

The test results refer solely to the analysed test specimen. Unless the sampling was done by our laboratory or in our sub-order the responsibility for the correctness of the sampling is disclaimed. This test report is only valid with signature and may only be further published completely and unchanged. Extracts or changes require the authorisation of the EUROFINS UMWELT in each individual case.

Our General Terms & Conditions of Sale (GTCS) are applicable, as far as no specific agreements do exist. The GTCS are available on <http://www.eurofins.de/umwelt/avb.aspx>.

Accredited test laboratory according to DIN EN ISO/IEC 17025:2018 DAkkS notification under the DAkkS German Accreditation System for Testing. The laboratory is according (D-PL-14081-01-00) accredited.

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Digitally signed 11/29/2021
Dr. Sabine Bandemer
Prüfleitung



Parameter	Lab	Accr.	Method	Limit values				Description		sp-se-27-2-2-1 (03006071 Biokol P1500)		
				EBC-Feed class I	EBC-AgroBio class II	EBC-Agro class III	EBC-material class IV	Sample number		121106650		
				LOQ	Unit				ar	db		
Biochar properties												
Bulk density < 3 mm	FR		in Anlehnung an VDLUFA-Methode A 13.2.1						kg/m ³	-	-	259
specific surface (BET)	SND2/o		DIN ISO 9277: 2014						m ² /g	-	-	197.59
water holding capacity (WHC)	FR		DIN EN ISO 14238, A: 2014-03						%	-	-	173.1
Moisture	FR	RE000 FY	DIN 51718: 2002-06					0.1	% (w/w)	-	43.2	-
Ash content (550°C)	FR	RE000 FY	DIN 51719: 1997-07					0.1	% (w/w)	-	12.6	22.3
Ash content (815°C)	FR	RE000 FY	DIN 51719: 1997-07					0.1	% (w/w)	-	12.3	21.7
Total carbon	FR	RE000 FY	DIN 51732: 2014-07					0.2	% (w/w)	-	40.2	70.8
carbon (organic)	FR	RE000 FY	berechnet						% (w/w)	-	40.0	70.5
Hydrogen	FR	RE000 FY	DIN 51732: 2014-07					0.1	% (w/w)	-	0.8	1.5
Total nitrogen	FR	RE000 FY	DIN 51732: 2014-07					0.05	% (w/w)	-	1.54	2.71
Total nitrogen	FR	RE000 FY	DIN 51732: 2014-07					0.5	g/kg	-	15.4	27.1
Sulphur (S), total	FR	RE000 FY	DIN 51724-3: 2012-07					0.03	% (w/w)	-	0.07	0.12
Oxygen	FR	RE000 FY	DIN 51733: 2016-04						% (w/w)	-	1.9	3.3
Total inorganic carbon (TIC)	FR	RE000 FY	DIN 51726: 2004-06					0.1	% (w/w)	-	0.2	0.3
carbonate-CO2	FR	RE000 FY	DIN 51726: 2004-06					0.4	% (w/w)	-	0.6	1.0
H/C ratio (molar)	FR	RE000 FY	berechnet							-	0.25	0.25
H/Corg ratio (molar)	FR	RE000 FY	berechnet	< 0.7	< 0.7	< 0.7	< 0.7			-	0.25	0.25
O/C ratio (molar)	FR	RE000 FY	berechnet	< 0.4	< 0.4	< 0.4	< 0.4			-	0.035	0.035
Volatile Compounds	FR	RE000 FY	DIN 51720: 2001-03					0.2	% (w/w)	-	4.6	8.1

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				EBC-Feed class I	EBC-AgroBio class II	EBC-Agro class III	EBC-ma-terial class IV	Sample number		121106650		
				LOQ	Unit	ar	db					
gross calorific value (Ho,V)	FR	RE000 FY	DIN 51900-3: 2005-1					200	kJ/kg	-	14700	25900
net calorific value (Hu,p)	FR	RE000 FY	DIN 51900-3: 2005-1					200	kJ/kg	-	13400	25600
pH in CaCl2	FR		DIN ISO 10390: 2005-12							-	9.9	-
Conductivity	FR		BGK III. C2: 2006-09					5	µS/cm	-	2620	-
salt content	FR		BGK III. C2: 2006-09					0.005	g/kg	-	13.8	-
salt content	FR		BGK III. C2: 2006-09					0.005	g/l	-	3.58	-
Protein, crude	FR	RE000 FY	VDLUFA Methodenbuch Band III: 2014-09						% (w/w) dm	nicht bestimmbar	-	-
Crude fibre	FR	RE000 FY	VDLUFA Methodenbuch Band III: 2014-09						% (w/w) dm	nicht bestimmbar	-	-
Fat, crude	FR	RE000 FY	VDLUFA Methodenbuch Band III: 2014-09						% (w/w) dm	nicht bestimmbar	-	-
Crude ash	FR	RE000 FY	DIN 51719: 1997-07					0.1	% (w/w)	-	12.6	22.3
HCl-insoluble ash	ES005 A/o		VDLUFA III 8.2						Ma.-% Raw Product	11	-	-
Fluor total (F)	ES005 A/o	RE000 CR	VDLUFA III, 17.3.2: 2006	150					mg/kg 88% DM	< 10	-	-

Polychlorinated dibenzodioxins/-furans (17 PCDD/F) by GC-HRMS

2,3,7,8-TetraCDD	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.1	-	-
1,2,3,7,8-PentaCDD	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.15	-	-
1,2,3,4,7,8-HexaCDD	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.15	-	-
1,2,3,6,7,8-HexaCDD	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.15	-	-
1,2,3,7,8,9-HexaCDD	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.15	-	-
1,2,3,4,6,7,8-HeptaCDD	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	0.68	-	-
OctaCDD	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	6.5	-	-

Parameter	Lab	Accr.	Method	Limit values				Description		sp-se-27-2-2-1 (03006071 Biokol P1500)		
				EBC-Feed class I	EBC-AgroBio class II	EBC-Agro class III	EBC-ma-terial class IV	Sample number		121106650		
				LOQ	Unit	ar	db					
2,3,7,8-TetraCDF	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.05	-	-
1,2,3,7,8-PentaCDF	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.1	-	-
2,3,4,7,8-PentaCDF	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.1	-	-
1,2,3,4,7,8-HexaCDF	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.1	-	-
1,2,3,6,7,8-HexaCDF	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.1	-	-
1,2,3,7,8,9-HexaCDF	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.1	-	-
2,3,4,6,7,8-HexaCDF	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.1	-	-
1,2,3,4,6,7,8-HeptaCDF	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	0.16	-	-
1,2,3,4,7,8,9-HeptaCDF	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.1	-	-
OctaCDF	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	< 0.2	-	-
WHO(2005)-PCDD/F TEQ (lower-bound)	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	0.0104	-	-
WHO(2005)-PCDD/F TEQ (upper-bound)	ES005 A/o		DIN 38414-S24: 2000-10						ng/kg dw	0.384	-	-
WHO(2005)-PCDD/F TEQ (upper-bound)	ES005 A/o		calculated	0.75					ng/kg 88% DM	0.338	-	-

Parameter	Lab	Accr.	Method	Limit values				Description		sp-se-27-2-2-1 (03006071 Biokol P1500)		
				EBC- Feed class I	EBC- AgroBio class II	EBC- Agro class III	EBC-ma- terial class IV	Sample number		121106650		
								LOQ	Unit	ar	db	
Polychlorinated biphenyl (12 WHO PCB) by GC-HRMS												
PCB 77	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	15	-	-
PCB 81	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	0.49	-	-
PCB 105	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	31	-	-
PCB 118	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	84	-	-
PCB 114	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	< 3	-	-
PCB 123	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	3.7	-	-
PCB 126	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	< 0.3	-	-
PCB 156	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	4.1	-	-
PCB 157	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	< 2	-	-
PCB 167	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	< 2	-	-
PCB 169	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	< 0.3	-	-
PCB 189	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	< 3	-	-
WHO(2005)-PCB TEQ (lower-bound)	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	0.00533	-	-
WHO(2005)-PCB TEQ (upper-bound)	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	0.0446	-	-
WHO(2005)-PCB TEQ (upper-bound)	ES005 A/o		calculated						ng/kg 88% DM	0.0393	-	-
WHO(2005)-PCDD/F+PCB TEQ (upper-bound)	ES005 A/o		DIN 38407-F3: 1998-07						ng/kg dw	0.429	-	-
WHO(2005)-PCDD/F+PCB TEQ (upper-bound)	ES005 A/o		calculated	1.25					ng/kg 88% DM	0.378	-	-

Parameter	Lab	Accr.	Method	Limit values				Description		sp-se-27-2-2-1 (03006071 Biokol P1500)		
				EBC- Feed class I	EBC- AgroBio class II	EBC- Agro class III	EBC-ma- terial class IV	Sample number		121106650		
								LOQ	Unit	ar	db	

Polychlorinated biphenyl (7 PCB) by GC-HRMS

Total 6 Indicator PCB (incl. LOQ)	ES005 A/o		DIN 38414-S20: 1996-01	10					µg/kg 88% DM	3.7	-	-
PCB 28	ES005 A/o		DIN 38414-S20: 1996-01						µg/kg 88% DM	2.6	-	-
PCB 52	ES005 A/o		DIN 38414-S20: 1996-01						µg/kg 88% DM	0.63	-	-
PCB 101	ES005 A/o		DIN 38414-S20: 1996-01						µg/kg 88% DM	0.20	-	-
PCB 153	ES005 A/o		DIN 38414-S20: 1996-01						µg/kg 88% DM	0.11	-	-
PCB 138	ES005 A/o		DIN 38414-S20: 1996-01						µg/kg 88% DM	0.097	-	-
PCB 180	ES005 A/o		DIN 38414-S20: 1996-01						µg/kg 88% DM	< 0.020	-	-

Elements from the micro wave pressure digestion acc. to DIN 22022-1: 2014-07

Copper (Cu)	FR	RE000 FY	DIN EN ISO 17294-2 (E29): 2017-01	70	70	100	250	1	mg/kg	-	-	27
Nickel (Ni)	FR	RE000 FY	DIN EN ISO 17294-2 (E29): 2017-01	25	25	50	250	1	mg/kg	-	-	5
Zinc (Zn)	FR	RE000 FY	DIN EN ISO 17294-2 (E29): 2017-01	200	200	400	750	1	mg/kg	-	-	178
Chromium (Cr)	FR	RE000 FY	DIN EN ISO 17294-2 (E29): 2017-01	70	70	90	250	1	mg/kg	-	-	9
Boron (B)	FR	RE000 FY	DIN EN ISO 17294-2 (E29): 2017-01					1	mg/kg	-	-	21
Manganese (Mn)	FR	RE000 FY	DIN EN ISO 17294-2 (E29): 2017-01					1	mg/kg	-	-	201
Silver (Ag)	FR	RE000 FY	DIN EN ISO 17294-2 (E29): 2017-01					5	mg/kg	-	-	< 5

Parameter	Lab	Accr.	Method	Limit values				Description		sp-se-27-2-2-1 (03006071 Biokol P1500)		
				EBC-Feed class I	EBC-AgroBio class II	EBC-Agro class III	EBC-material class IV	Sample number		121106650		
				LOQ	Unit	ar	db					

Elements from the pressure digestion acc. to DIN EN 13805: 2014-12

Arsenic (As)	ES005 A/o	RE000 CR	DIN EN ISO 17294-2: 2005-02	2					mg/kg 88% DM	0.24	-	-
Lead (Pb)	ES005 A/o	RE000 CR	DIN EN ISO 17294-2: 2005-02	10					mg/kg 88% DM	2.3	-	-
Cadmium (Cd)	ES005 A/o	RE000 CR	DIN EN ISO 17294-2: 2005-02	0.8					mg/kg 88% DM	0.049	-	-
Mercury (Hg)	ES005 A/o	RE000 CR	DIN EN 15763:2010-04	0.1					mg/kg 88% DM	0.018	-	-

Elements fr. the borate digestion of ash 550 °C acc. to DIN 51729-11:1998-11(AR)

Calcium as CaO	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	% (w/w)	-	-	7.9
Iron as Fe2O3	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	% (w/w)	-	-	1.3
Potassium as K2O	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	% (w/w)	-	-	16.7
Magnesium as MgO	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	% (w/w)	-	-	3.7
Sodium as Na2O	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	% (w/w)	-	-	1.0
Phosphorus as P2O5	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	% (w/w)	-	-	9.7
sulphur as SO3	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	% (w/w)	-	-	1.9
Silicon as SiO2	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	% (w/w)	-	-	43.1

Parameter	Lab	Accr.	Method	Limit values				Description		sp-se-27-2-2-1 (03006071 Biokol P1500)		
				EBC- Feed class I	EBC- AgroBio class II	EBC- Agro class III	EBC-ma- terial class IV	Sample number		121106650		
								LOQ	Unit	ar	db	

Elements fr. the borate digestion of ash 550°C acc. to DIN 51729-11:1998-11(OS)

Calcium as CaO	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	g/kg	-	-	17.6
Iron as Fe ₂ O ₃	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	g/kg	-	-	2.9
Potassium as K ₂ O	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	g/kg	-	-	37.1
Magnesium as MgO	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	g/kg	-	-	8.2
Sodium as Na ₂ O	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	g/kg	-	-	2.2
Phosphorus as P ₂ O ₅	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	g/kg	-	-	21.5
sulphur as SO ₃	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	g/kg	-	-	4.3
Silicon as SiO ₂	FR	RE000 FY	DIN EN ISO 11885 (E22): 2009-09					0.1	g/kg	-	-	95.9

Organic contaminants from toluene extraction acc. to EN 16181:2019-08 (method 2)

Naphthalene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	660	-	-
Acenaphthylene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	170	-	-
Acenaphthene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	26	-	-
Fluorene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	78	-	-
Phenanthrene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	310	-	-
Anthracene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	61	-	-
Fluoranthene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	160	-	-
Pyrene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	200	-	-

Parameter	Lab	Accr.	Method	Limit values				Description		sp-se-27-2-2-1 (03006071 Biokol P1500)		
				EBC-Feed class I	EBC-AgroBio class II	EBC-Agro class III	EBC-material class IV	Sample number		121106650		
				LOQ	Unit	ar	db					
Benz(a)anthracene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	56	-	-
Chrysene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	39	-	-
Benzo(b)fluoranthene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	70	-	-
Benzo(k)fluoranthene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	18	-	-
Benzo(a)pyrene	ES005 A/o		DIN ISO 13877: 2000	25				10	µg/kg 88% DM	59	-	-
Indeno(1,2,3-cd)pyrene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	44	-	-
Dibenz(a,h)anthracene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	< 10	-	-
Benzo(g,h,i)perylene	ES005 A/o		DIN ISO 13877: 2000					10	µg/kg 88% DM	230	-	-
Total 16 EPA-PAH excl. LOQ	ES005 A/o		DIN ISO 13877: 2000						µg/kg 88% DM	2200	-	-
Total 16 EPA-PAH excl. LOQ	ES005 A/o		calculated	4	4	6	30		mg/kg dw	2.5	-	-

Special analyses

Plausibility check	FR									-	OK	-
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Explanations

LOQ - Limit of quantification

ar - as received

db - dry basis

Lab - Abbreviation of the performing laboratory

Accr. - Abbreviation of the accreditation of the performing laboratory

nicht bestimmbar - not determined:

These methods apply for animal feed conventional type. The methods are not validated for the matrix biochar and can lead to implausible results.

"Crude protein, crude fibre and crude fat are completely decomposed in the process of pyrolysis and therefore no longer existent in the biochar. Biochar is considered as completely pyrolyzed, if the H/Corg ratio is below 0.7. If the H/Corg ratio is below 0.7 according to EBC-AgroBio, the analysis of crude protein, crude fibre and crude fat can be spared, as their content is specified as 0 g/kg by definition." [1]

[1] - EBC (2012) 'European Biochar Certificate - Guidelines for a Sustainable Production of Biochar.' European Biochar Foundation (EBC), Arbaz, Switzerland. (<http://european-biochar.org>). Version 9.4E of 19th July 2021

The parameters identified by ES005A have been performed by the laboratory SGS Analytics Germany GmbH (Jena) (Jena). The accreditation code RE000CR identifies the parameters accredited according to DIN EN ISO/IEC 17025:2018 DAkkS D-PL-14004-10-00 .

The parameters identified by FR have been performed by the laboratory Eurofins Umwelt Ost GmbH (Bobritzsch-Hilbersdorf). The accreditation code RE000FY identifies the parameters accredited according to DIN EN ISO/IEC 17025:2018 DAkkS D-PL-14081-01-00 .

The parameters identified by SND2 have been performed by the laboratory Ruhr Lab GmbH (Gelsenkirchen).

/o - The analysis has been outsourced.

Explanations regarding Limits

Analysis performed according to guidelines for the sustainable production of biochar - EBC, Version 9.4E - as of 19/07/2121.

Ho,V / Hu,p: complies calorific value at constant volume or pressure

AR: related to ash

OS: related to original substance

EUROFINS UMWELT assumes no responsibility for the legal liability of the cited limits.