

DIN standards for the analysis of the biomass, HTC coal and process water

1 Analysis of the biomass and HTC-coal (Biocoal)

1.1 Basic analysis

parameter	unit	LOQ	DIN standard
Dry matter	Wt-% ar	0,1	DIN EN ISO 18134-1:2015-12
Ash (550 °C)	Wt-% d	0,1	DIN EN ISO 18122:2016-03
Ash (815 °C)	Wt-% d	0,1	DIN 51719:1997-07
Higher heating value (HHV)	MJ/kg	0,5	DIN EN ISO 18125:2017-08
Lower heating value (LHV)	MJ/kg	0,5	
Carbon	Wt-% ar	0,1	DIN EN ISO 16948:2015-09
Hydrogen	Wt-% ar	0,1	DIN EN ISO 16948:2015-09
Oxygen	Wt-% ar	0,1	DIN EN ISO 16993:2016-11
Nitrogen	Wt-% ar	0,1	DIN EN ISO 16948:2015-09
Sulphur	Wt-% ar	0,01	DIN EN ISO 16994:2016-12
Carbon	Wt-% d	0,1	DIN EN ISO 16948:2015-09
Hydrogen	Wt-% d	0,1	DIN EN ISO 16948:2015-09
Oxygen	Wt-% d	0,1	DIN EN ISO 16993:2016-11
Nitrogen	Wt-% d	0,1	DIN EN ISO 16948:2015-09
Sulphur	Wt-% d	0,01	DIN EN ISO 16994:2016-12
Temperature at the beginning of shrinkage	°C	10	DIN CEN/TS 15370-1
softening temperature	°C	10	DIN CEN/TS 15370-1
Hemisphere temperature	°C	10	DIN CEN/TS 15370-1
Flow temperature	°C	10	DIN CEN/TS 15370-1
Aluminium	mg/kg d	100	DIN EN ISO 16967:2015-07
Calcium	mg/kg d	100	DIN EN ISO 16967:2015-07
Chlorine	Wt-% d	0,01	DIN EN ISO 16994:2016-12
Iron	mg/kg d	10	DIN EN ISO 16967:2015-07
Potassium	mg/kg d	50	DIN EN ISO 16967:2015-07
Magnesium	mg/kg d	20	DIN EN ISO 16967:2015-07
Sodium	mg/kg d	50	DIN EN ISO 16967:2015-07
Phosphorus	Wt-% d	0,001	DIN EN ISO 16967:2015-07

1.2 Inorganic trace elements

parameter	unit	LOQ	DIN standard
Lead	mg/kg d	3	DIN EN ISO 16968:2015-09
Cadmium	mg/kg d	0,3	DIN EN ISO 16968:2015-09
Chrome	mg/kg d	1	DIN EN ISO 16968:2015-09
Copper	mg/kg d	1	DIN EN ISO 16968:2015-09
Molybdenum	mg/kg d	5	DIN EN ISO 16968:2015-09
Nickel	mg/kg d	1	DIN EN ISO 16968:2015-09
Mercury	mg/kg d	0,05	DIN EN ISO 16968:2015-09
Thallium	mg/kg d	0,5	DIN EN ISO 16968:2015-09
Vanadium	mg/kg d	1	DIN EN ISO 11885:2009-09

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parameter	unit	LOQ	DIN standard
Zinc	mg/kg d	1	DIN EN ISO 16968:2015-09
Tin	mg/kg d	10	DIN EN ISO 16968:2015-09

1.3 Fermentation substrate analysis

parameter	unit	LOQ	DIN standard
Humidity	wt-% ar	0,01	VDLUFA Methods Book Vol. III 3.1 (Sand bath):1976
Dry matter	wt-% ar	0,01	VDLUFA Methods Book Vol. III 3.1 (Sand bath):1976
Organic dry matter	wt-% ar	0,01	calculated
Crude protein	wt-% ar	0,1	VDLUFA Methods Book Vol. III 4.1.1. mod.:1993
Crude fat B	wt-% ar	0,3	VDLUFA Vol. III, 5.1.1, Meth. B:1988
Crude fibre	wt-% ar	0,5	VDLUFA Methods Book Vol. III 6.1.1, mod.
Raw ash	wt-% ar	0,1	DIN EN 12879:2001-02
Carbohydrates	wt-% ar	0,1	calculated
Crude protein	wt-% DM	0,1	VDLUFA Methods Book Vol. III 4.1.1. mod.:1993
Crude fat B	wt-% DM	0,3	VDLUFA Vol. III, 5.1.1, Meth. B:1988
Crude fibre	wt-% DM	0,5	VDLUFA Methods Book Vol. III 6.1.1, mod.
Ashes	wt-% DM	0,1	DIN EN 12879:2001-02
Carbohydrates	wt-% DM	0,1	calculated

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1.4 Organic trace substances

Determination method 2,3,7,8-PCDD/PCDF, dl-PCB: DIN CEN/TS 16190:2012-05

Determination method PCB conductive congeners: DIN 38414-20:1996-01

parameter	Parameter Limit of determination as toxicity equivalent [ngTE/kg TR]
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0,1
1,2,3,6,7,8-HxCDD	0,1
1,2,3,7,8,9-HxCDD	0,1
1,2,3,4,6,7,8-HpCDD	0,05
OCDD	0,003
2,3,7,8-TCDF	0,1
1,2,3,7,8-PeCDF	0,03
2,3,4,7,8-PeCDF	0,3
1,2,3,4,7,8-HxCDF	0,1
1,2,3,6,7,8-HxCDF	0,1
1,2,3,7,8,9-HxCDF	0,1
2,3,4,6,7,8-HxCDF	0,1
1,2,3,4,6,7,8-HpCDF	0,03
1,2,3,4,7,8,9-HpCDF	0,03
OCDF	0,003
PCB 77	0,0002
PCB 81	0,00015
PCB 126	0,05
PCB 169	0,015
PCB 105	0,00015
PCB 114	0,00009
PCB 118	0,00045
PCB 123	0,00009
PCB 156	0,00009
PCB 157	0,00009
PCB 167	0,00009
PCB 189	0,00009

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parameter	unit	LOQ
PCB 28	µg/kg TR	1
PCB 52	µg/kg TR	1
PCB 101	µg/kg TR	1
PCB 138	µg/kg TR	1
PCB 153	µg/kg TR	1
PCB 180	µg/kg TR	1

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2 Analysis of the process water

parameter	unit	LOQ	DIN standard
Dry matter	Wt-% ar	0,1	DIN EN ISO 18134-1:2015-12
Loss on ignition	Wt-% d	0,1	DIN EN ISO 18122:2016-03
TOC	Wt-% TR	0,1	DIN EN 13137:2001-12
DOC	mg/l	0,5	DIN EN 1484:1997-08
TOC	mg/l	0,5	DIN EN 1484:1997-08
TIC	%-LTR	0,1	DIN EN 13137:2001-12
Carbon	Wt-% d		Calculated from TIC
Sulphate	mg/l	1	DIN EN ISO 10304-1:2009-07
Nitrate	mg/l	0,5	DIN EN ISO 10304-1:2009-07
Ammonia	mg/l	0,04	DIN EN ISO 11732:2005-05
Ammoniacal nitrogen	mg/l	0,03	DIN EN ISO 11732:2005-05
Kjeldahl nitrogen	mg/l	1	DIN EN 25663:1993-11
Lead	mg/l	0,01	DIN EN ISO 11885:2009-09
Cadmium	mg/l	0,02	DIN EN ISO 11885:2009-09
Chrome	mg/l	0,01	DIN EN ISO 11885:2009-09
Calcium	mg/l	1	DIN EN ISO 11885:2009-09
Iron, total	mg/l	0,02	DIN EN ISO 11885:2009-09
Copper	mg/l	0,01	DIN EN ISO 11885:2009-09
Nickel	mg/l	0,01	DIN EN ISO 11885:2009-09
Mercury	mg/l	0,0002	DIN EN ISO 11885:2009-09
Zinc	mg/l	0,02	DIN EN ISO 11885:2009-09
Tin	mg/l	0,02	DIN EN ISO 11885:2009-09
Phosphate total	mg/l	0,08	DIN EN ISO 11885:2009-09
Calculated phosphate	mg/l	0,25	DIN EN ISO 11885:2009-09
Sodium	mg/l	1	DIN EN ISO 11885:2009-09
Magnesium	mg/l	0,1	DIN EN ISO 11885:2009-09
Potassium	mg/l	1	DIN EN ISO 11885:2009-09
Aluminium	mg/l	0,1	DIN EN ISO 11885:2009-09
BOD in five days	mg/l	2	DIN EN 1899-1:1998-05
COD	mg/l	15	DIN 38409-41:1980-12
pH-value			DIN EN ISO 10523:2012-04
Chlorine, total	Wt-% ar	0,05	DIN EN ISO 16994:2016-12
Chlorine, total	mg/kg ar	500	DIN EN ISO 16994:2016-12
Chloride	mg/l	0,5	DIN EN ISO 10304-1:2009-07
Sulphur, total	Wt-% ar	0,01	DIN EN ISO 16994:2016-12
Sulphur, total	mg/kg ar	100	DIN EN ISO 16994:2016-12
Organic acids calculated as acetic acid	mg/kg	10	DIN 38414-19:1999-12

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Postscript

The DIN standards listed here represent the current (as of April 2020) standards for the respective parameters. It is suggested by the **HTCycle** and recommended to use these for the respective analyses. Nevertheless, the author assumes no liability for the accuracy of information, instructions and advice as well as for any printing errors.

Appendix: List of abbreviations

Abbreviation	Explanation / definition
ar	Arid (sample in the initial state)
BOD5	Biochemical oxygen demand in five days = the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over five days.
COD	Chemical oxygen demand = measure of the amount of oxygen that can be consumed by reactions in a measured solution
d	Dry (without water)
DIN	Deutsches Institut für Normung (German Institute for Standardization)
DOC	Dissolved organic carbon, sometimes known as dissolved organic material (DOM)
DM	Dry matter = the mass of something when it is completely dried.
HHV	higher heating value, gross calorific value Determined by bringing all the products of combustion back to the original pre-combustion temperature, and in particular condensing any vapor produced.
kg	Kilogram
l	Litre
LHV	lower heating value, net calorific value Determined by subtracting the heat of vaporization of the water from the higher heating value. This treats any H ₂ O formed as a vapor. The energy required to vaporize the water therefore is not released as heat.
LOQ	the detection limit, lower limit of detection → the lowest quantity of a substance that can be distinguished from the absence of that substance (a blank value) with a stated confidence level (generally 99%)
LTR	
mg	Milligram
MJ	Megajoule
ml	Millilitre
Organic acids calculated as acetic acid	VOC, organic acids that have an initial boiling point less than or equal to 250 °C (482 °F) measured at a standard atmospheric pressure of 101.3 kPa (the main policy instrument for the reduction of industrial emissions of volatile organic compounds)
TIC	Total inorganic carbon or also the dissolved inorganic carbon (sum of inorganic carbon species in a solution)
TOC	Total organic carbon, the amount of carbon found in an organic compound

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	(often used as a non-specific indicator of water quality)
TR	Total dissolved solids
wt.%	weight percent or percentage by mass, the mass fraction → to show the relative proportions of elements, one way of expressing the composition of a mixture in a dimensionless size

The individual DIN standards are briefly explained in the supplementary sheet "181207 Supplement to the DIN-standards".

Relzow OT Murchin, 21 April 2020

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