Guidelines

European Biochar Certificate

Biochar for use as animal feed additive

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Impressum

These guidelines are effective as of 1 January 2012 and constitute the basis for biochar certification through the independent, governmental accredited inspection agency bio.inspecta AG / q.inspecta.

Hans Peter Schmidt*, Ithaka Institute
Thomas Bucheli, Agroscope Reckenholz
Claudia Kammann, University of Geisenheim
Bruno Glaser, University of Halle
Samuel Abiven, University of Zurich
Jens Leifeld, Agroscope Reckenholz
Nikolas Hagemann, Ithaka Institute

* Corresponding author: schmidt@ithaka-institut.org

9. Biochar for use as a feed additive (EBC-Feed)

Biochar is a traditional feed additive that was often used to treat digestive problems of livestock. Since 2010, biochar is increasingly also used as an additive to daily feed mixtures. The use of biochar (i.e. vegetal carbon) as a feed additive is authorized by the EU-Feed regulation (EU-Parliament, 2011). The EU provides different and additional limits for the use of biochar as feed compared to its use as a soil additive (Directive 2002/32/EC of 7 May 2002 on undesirable substances in animal feed (EU-Parliament, 2011) and Regulation (EC) No 396/2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin (EU-Parliament, 2002). The parameters to be controlled in addition to EBC-AgroOrganic are specified below for the EBC certification of biochar as animal feed (application class EBC-Feed).

9.1 Precondition for certification according to EBC-Feed

Biochar can only be certified under EBC-Feed when all conditions for EBC-AgroOrganic quality are met and the production was certified accordingly. The following parameters specified for the application class EBC-Feed are additional to the EBC-AgroOrganic certification as described in chapters 3 to 8 of the EBC certification guidelines.

9.2 Biomass - only pure plant biomass feedstocks are permitted

When the EBC-Feed Certificate was introduced, only untreated trunk wood was approved as the source material for feed grade biochar production. In the meantime, however, a sufficient number of scientific studies have been published (Schmidt et al., 2019), which show that biochar produced from other plant biomass had just as positive an effect on feed efficiency and animal health as wood based biochar. For this reason, all pure plant biomasses are approved since 2020 for the production of EBC-Feed biochar according to the EBC feedstock list. Mineral additives are not permitted. Feedstocks with chemical additives, contaminations or the risk of contaminations due to non-controllable source are excluded (e.g., chemically treated wood, paper sludge, green waste from municipal collection, etc.).

9.3 Magnetic separation

It is suggested to pass the feedstock or the biochar through a metal separator to prevent any metal impurities. However, if a diligent feedstock selection and control are guaranteed, the milling of the biochar to < 3mm (c.f. chapter 9.11) is considered sufficient to reduce the risk of metal impurities for the animals.

9.4 Pyrolysis temperature and intensity

Although contaminated feedstock is not allowed within EBC feed, trace contaminations e.g. with pharmaceuticals or mycotoxins, can never be excluded completely. To assure the pyrogenic degradation of these organic micropollutants the pyrolysis temperature has to reach at least 500 °C for at least 10 min (Ross et al., 2016).

9.5 Heavy metals

According to feed regulations, the content of heavy metals including arsenic, lead, cadmium and mercury must be stated. Their limits differ from those for EBC-AgroOrganic quality. The use of biochar as feed is based on the following thresholds to be calculated on 88% of the dry matter content: arsenic: 2 mg kg^{-1}; lead: 10 mg kg^{-1}; cadmium 0.8 mg kg^{-1} and mercury: 0.1 mg kg^{-1}.

9.6 Benzo[*a*]pyren < 25 µg/kg

In addition to the PAH-thresholds for EBC-AgroOrganic (4 mg 16 EPA PAH kg^{-1}), biochar for animal feed is subject to the specific reference limit for the carcinogenic PAH benzo[*a*]pyrene of 25 µg kg^{-1} at 88% dry matter content.

9.7 Dioxine, furane, dioxin-like PCB (WHO-PCB) und non-dioxin-like PCB (DIN-PCB).

The EU feed regulations prescribe strict limits for polychlorinated dioxins, furans and PCBs, which are well below the limits of the soil protection ordinance. Therefore, (1) each batch of feed biochars must be analyzed for these substances, and (2) the accredited test method must have a lower detection limit. Consequently, special test methods and limit values for feed grade biochar apply here.

For PCDD / PCDF, a trigger value of 0.5 ng TE kg^{-1} at 88% DM and a limit of 0.75 ng TE kg^{-1} at 88% DM apply. For dl-PCB, a trigger value of 0.35 ng TE kg^{-1} at 88% DM applies. For PCDD / PCDF + dl-PCB the threshold is 1.25 ng TE kg^{-1} at 88% TS. For the sum 6 of DIN PCB, a limit value of 10 µg TE kg^{-1} at 88% DM applies.

9.8 Fluor < 150 mg kg^{-1} (88% TS)

The fluor content must be lower than <150 mg kg-1 (88% TS). However, fluorine salts are usually volatile in pyrolysis conditions and will rarely occur in biochars in significant concentrations.

9.9 Dry matter, crude ash, ash insoluble in hydrochloric acid

The specification of dry matter, crude ash content and HCl-insoluble ash are prescribed standard values of the EU feed regulations and must be stated on the product label. The content of the ashes must be determined by combustion at 550 ° C and given on an 88% dry matter basis.

9.10 Crude protein, crude fibre, crude fat

The indication of crude protein, crude fiber and crude fat contents are prescribed standard values of the EU feed regulations. Crude protein, crude fiber and crude fat are completely decomposed in the course of complete pyrolysis and are therefore no longer present in biochar. A biochar is considered to be completely pyrolyzed if the H / C_{org} ratio is <0.7, which is the prerequisite for EBC certification. Thus, the analysis of crude protein, crude fiber and crude fat is not required and set by definition as 0 g kg^{-1}. The information is mandatory and must be stated on the product label.

9.11 Milling of the biochar to a particle size < 3 mm and packaging

To prevent any risk of choking or other digestive complications due to sharp impurities like glass, stones, or metals, the biochar has to be milled to a particle size below 3 mm before packaging, labeling and trading the biochar under the EBC Feed label. After milling, the biochar has to be packed and sealed or at least tightly closed to avoid any post-production contamination of the feed product.

Annex 2

Analytical Parameters for EBC-Feed

Trace metals *As, Pb, Cd, Hg*
DIN EN 15763:2010-04

For microwave digestion, 0.1 g to 1 g of the dried, ground and homogenized material is weighed into a plastic cup (PTFE, PFA) or quartz cup. After addition of 65% nitric acid in a ratio of 1+5 (sample+acid) and after addition of 30% hydrogen peroxide in a ratio of 1+2.5 to 1+10 (sample+hydrogen peroxide), digestion is performed at the maximum permissible temperature for the system (usually 190°C). Heating phase: 15 min; holding time: 30 min. After cooling, transfer quantitatively to a polypropylene vessel with volume marker and fill it to the mark with 0.1 M nitric acid. The measurement is carried out by ICP-MS or ICP-OES. For mercury, cold vapor AAS or atomic fluorescence spectrometry are used.

Benzo[*a*]pyren for EBC-Feed
DIN EN 16181:2019-08 (extraction method 2)

The material is crushed (<1 mm) and dried at a maximum of 35°C. 10 g of sample is extracted by Soxhlet extraction for 6 h with toluene with addition of appropriate internal standards. Alternatively, an ASE extraction can be used. The extract is concentrated and purified by column chromatography according to DIN ISO 13877 or VDLUFA VII 3.3.3.2. The purified extract can be measured and quantified by HPLC-FLD or GC-mass-spectrometry. MSD, MS/MS, HRMS or TOF instruments are suitable.

PCB
DIN EN 16167, DIN EN 16215

The material is crushed into powder (<1 mm) and dried at a maximum of 35 ° C. Alternatively, it can be dried chemically or by freeze-drying. 5-10 g of sample are extracted by Soxhlet extraction with toluene for 6 h with the addition of suitable internal standards. Alternatively, an ASE extraction can be used. The extract is concentrated and purified according to VDLUFA VII 3.3.2.2 with silica gel column chromatography. The quantification of the purified extract is done with GC-MS or GC-ECD.

PCDD/PCDF/coplanar PCB
DIN EN 16190:2019-10, DIN EN 16215 Nr. 152/2009 (modified by Nr. 2017/771)
HRGC/HRMS method

The material is crushed into powder (<1 mm) and dried at a maximum of 35 ° C. Alternatively, freeze-drying can be used. After the addition of isotope-labeled standards, 2 g of sample material are extracted with toluene in a Soxhlet for 20 h. Alternatively, special hot extractors such as the ASE can be used. After concentration, the extract is purified by multiple column chromatography and can be divided into different fractions. At this point it

is also possible to obtain the DIN-PCB fraction. Finally, the components are measured with GC-HRMS.

Fluor

VDLUFA III 17.3.2, VDLUFA VII 2.2.2.1, DIN EN 16279:2012-09 (ion selective elektrode; according to VDLUFA VII 2.2.2.1), BAFU F-7 2017 (DIN 38405-4:1985-07)

The dried and ground material is ashed and digested with sodium hydroxide. The cooled digestion is dissolved in hydrochloric acid with the addition of a complexing agent (TISAB). A pH value of 5.5 is then adjusted and the fluoride content is determined using an ion-sensitive electrode.

Carbon

Permitted test methods: DIN 51732

A TruSpec CHN is used.

The sample (80-100 mg of the pre-dried and crushed sample) is weighed directly (relative precision 0,1%) into a tin capsule. After that the capsule is closed and is put in the machine for measurement. The TruSpec CHN determines the carbon content, the hydrogen content and the nitrogen content in mass percent.

Dry matter

Permitted test methods: dry matter: DIN 51718; VDLUFA III 3.1;

A minimum of 50 g of the sample is taken and crushed as necessary, avoiding changes in moisture content. 5 g of biochar are weighed (±1 mg) and dried at 103°C for 4 h. After loading the oven, the drying time does not start until 103°C has been reached exactly. After cooling in the desiccator, it is weighed back (±1 mg).

Crude ash

Permitted test methods: analog **to DIN 51719, VDLUFA III 8.1; HCl-insoluble ash: VDLUFA III 8.2**

Approximately 5 g of sample is weighed to the nearest 1 mg into an annealed and tared ashing dish. The dish is placed in a muffle furnace and left at 550°C±5°C until no char particles are visible. After cooling in the desiccator, the sample is weighed back to 1 mg. For difficult samples, ammonium nitrate treatment is carried out according to method VDLUFA 8.1.

References

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