

Eurofins Umwelt Ost GmbH - Lindenstraße 11 - Gewerbegebiet Freiberg Ost - D-09627 Bobritzsch-Hilbersdorf

**Biomass to biochar Ltd.
Derrycon upper
Mountshannon
- Clare
IRELAND**

Title : **Analytical Report for Order 12211848**

Test report number : **AR-22-FR-015502-01**

Project name : **Biochar**

Number of samples : **1**

Sample type: **biochar *Juncus effusus***

Sample Taker: **delivered by client**

Sample reception date : **2022-03-21**

Sample processing time : **2022-03-21 - 2022-04-28**

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 analytical 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 4/28/2022
Annett Rietschel
Prüfleitung



| Parameter | Lab | Accr. | Method | Limit values | | | | | | Description | | Biochar | |
|-------------------------------------|--------|----------|---|--------------|------------------|----------|-----------|------------------------|---------------------|---------------|-------------------|---------|--------|
| | | | | EBC-Feed | EBC-Agro Organic | EBC-Agro | EBC-Urban | EBC-Consumer Materials | EBC-Basic Materials | Sample number | | ar | db |
| | | | | | | | | | | 122042756 | | | |
| LOQ | Unit | | | | | | | | | | | | |
| Biochar properties | | | | | | | | | | | | | |
| Bulk density < 3 mm | FR | | in Anlehnung an VDLUFA-Methode A 13.2.1 | | | | | | | | kg/m ³ | - | 44 |
| specific surface (BET) | SND2/o | | DIN ISO 9277: 2014 | | | | | | | | m ² /g | - | 92.58 |
| water holding capacity (WHC) < 2 mm | FR | | DIN EN ISO 14238, A: 2014-03 | | | | | | | | % | - | 570.5 |
| Moisture | FR | RE000 FY | DIN 51718: 2002-06 | | | | | | | 0.1 | % (w/w) | 8.9 | - |
| Ash content (550°C) | FR | RE000 FY | DIN 51719: 1997-07 | | | | | | | 0.1 | % (w/w) | 20.4 | 22.4 |
| Total carbon | FR | RE000 FY | DIN 51732: 2014-07 | | | | | | | 0.2 | % (w/w) | 60.2 | 66.1 |
| carbon (organic) | FR | RE000 FY | berechnet | | | | | | | | % (w/w) | 59.7 | 65.6 |
| Hydrogen | FR | RE000 FY | DIN 51732: 2014-07 | | | | | | | 0.1 | % (w/w) | 1.6 | 1.7 |
| Total nitrogen | FR | RE000 FY | DIN 51732: 2014-07 | | | | | | | 0.05 | % (w/w) | 1.62 | 1.78 |
| Sulphur (S), total | FR | RE000 FY | DIN 51724-3: 2012-07 | | | | | | | 0.03 | % (w/w) | 0.29 | 0.32 |
| Oxygen | FR | RE000 FY | DIN 51733: 2016-04 | | | | | | | | % (w/w) | 9.2 | 10.1 |
| Total inorganic carbon (TIC) | FR | RE000 FY | DIN 51726: 2004-06 | | | | | | | 0.1 | % (w/w) | 0.5 | 0.5 |
| carbonate-CO2 | FR | RE000 FY | DIN 51726: 2004-06 | | | | | | | 0.4 | % (w/w) | 1.8 | 2.0 |
| H/C ratio (molar) | FR | RE000 FY | berechnet | | | | | | | | | 0.31 | 0.31 |
| H/Corg ratio (molar) | FR | RE000 FY | berechnet | < 0.7 | < 0.7 | < 0.7 | < 0.7 | < 0.7 | < 0.7 | | | 0.32 | 0.31 |
| O/C ratio (molar) | FR | RE000 FY | berechnet | | | | | | | | | 0.115 | 0.115 |
| pH in CaCl2 | FR | | DIN ISO 10390: 2005-12 | | | | | | | | | 9.8 | - |
| salt content | FR | | BGK III. C2: 2006-09 | | | | | | | 0.005 | g/kg | 80.8 | - |
| salt content | FR | | BGK III. C2: 2006-09 | | | | | | | 0.005 | g/l | 3.56 | - |
| Conductivity at 1,2 t pressure | FR | | Inhouse Method | | | | | | | 0.01 | mS/cm | - | < 0.01 |

| Parameter | Lab | Accr. | Method | Limit values | | | | | | Description | | Biochar | |
|---|-----|----------|-----------------------------------|--------------|------------------|----------|-----------|------------------------|---------------------|---------------|-------|---------|--------|
| | | | | EBC-Feed | EBC-Agro Organic | EBC-Agro | EBC-Urban | EBC-Consumer Materials | EBC-Basic Materials | Sample number | | ar | db |
| | | | | | | | | | | 122042756 | | | |
| | | | | | | | | | | LOQ | Unit | | |
| Conductivity at 2 t pressure | FR | | Inhouse Method | | | | | | | 0.01 | mS/cm | - | < 0.01 |
| Conductivity at 3 t pressure | FR | | Inhouse Method | | | | | | | 0.01 | mS/cm | - | < 0.01 |
| Conductivity at 4 t pressure | FR | | Inhouse Method | | | | | | | 0.01 | mS/cm | - | < 0.01 |
| Conductivity at 5 t pressure | FR | | Inhouse Method | | | | | | | 0.01 | mS/cm | - | < 0.01 |
| Elements from the micro wave pressure digestion acc. to DIN 22022-1: 2014-07 | | | | | | | | | | | | | |
| Arsenic (As) | FR | RE000 FY | DIN EN ISO 17294-2 (E29): 2017-01 | | 13 | 13 | 13 | 13 | | 0.8 | mg/kg | - | < 0.8 |
| Lead (Pb) | FR | RE000 FY | DIN EN ISO 17294-2 (E29): 2017-01 | | 45 | 120 | 120 | 120 | | 2 | mg/kg | - | 3 |
| Cadmium (Cd) | FR | RE000 FY | DIN EN ISO 17294-2 (E29): 2017-01 | | 0.7 | 1.5 | 1.5 | 1.5 | | 0.2 | mg/kg | - | 0.4 |
| Copper (Cu) | FR | RE000 FY | DIN EN ISO 17294-2 (E29): 2017-01 | 70 | 70 | 100 | 100 | 100 | | 1 | mg/kg | - | 37 |
| Nickel (Ni) | FR | RE000 FY | DIN EN ISO 17294-2 (E29): 2017-01 | 25 | 25 | 50 | 50 | 50 | | 1 | mg/kg | - | 16 |
| Mercury (Hg) | FR | RE000 FY | DIN 22022-4: 2001-02 | | 0.4 | 1 | 1 | 1 | | 0.07 | mg/kg | - | < 0.07 |
| Zinc (Zn) | FR | RE000 FY | DIN EN ISO 17294-2 (E29): 2017-01 | 200 | 200 | 400 | 400 | 400 | | 1 | mg/kg | - | 229 |
| Chromium (Cr) | FR | RE000 FY | DIN EN ISO 17294-2 (E29): 2017-01 | 70 | 70 | 90 | 90 | 90 | | 1 | mg/kg | - | 25 |
| Boron (B) | FR | RE000 FY | DIN EN ISO 17294-2 (E29): 2017-01 | | | | | | | 1 | mg/kg | - | 27 |
| Manganese (Mn) | FR | RE000 FY | DIN EN ISO 17294-2 (E29): 2017-01 | | | | | | | 1 | mg/kg | - | 7800 |
| Silver (Ag) | FR | RE000 FY | DIN EN ISO 17294-2 (E29): 2017-01 | | | | | | | 5 | mg/kg | - | < 5 |

| Parameter | Lab | Accr. | Method | Limit values | | | | | | Description | | Biochar | |
|-----------|-----|-------|--------|--------------|------------------|----------|-----------|------------------------|---------------------|---------------|------|---------|----|
| | | | | EBC-Feed | EBC-Agro Organic | EBC-Agro | EBC-Urban | EBC-Consumer Materials | EBC-Basic Materials | Sample number | | ar | db |
| | | | | | | | | | | LOQ | Unit | | |

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) | - | 7.1 |
| Iron as Fe ₂ O ₃ | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | % (w/w) | - | 1.8 |
| Potassium as K ₂ O | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | % (w/w) | - | 24.4 |
| Magnesium as MgO | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | % (w/w) | - | 5.2 |
| Sodium as Na ₂ O | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | % (w/w) | - | 6.6 |
| Phosphorus as P ₂ O ₅ | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | % (w/w) | - | 7.4 |
| sulphur as SO ₃ | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | % (w/w) | - | 3.4 |
| Silicon as SiO ₂ | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | % (w/w) | - | 20.6 |

Macronutrients

| | | | | | | | | | | | | | |
|----------------|----|----------|--------------------|--|--|--|--|--|--|-----|------|------|------|
| Total nitrogen | FR | RE000 FY | DIN 51732: 2014-07 | | | | | | | 0.5 | g/kg | 16.2 | 17.8 |
|----------------|----|----------|--------------------|--|--|--|--|--|--|-----|------|------|------|

Macronutrients-LiBO₂/Li₂B₄O₇/LiBr-melt of ash 550°C [DIN 51729-11:1998-11] (OS)

| | | | | | | | | | | | | | |
|---|----|----------|---------------------------------|--|--|--|--|--|--|-----|------|---|------|
| Phosphorus as P ₂ O ₅ | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | g/kg | - | 16.5 |
| Potassium as K ₂ O | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | g/kg | - | 54.7 |
| Calcium as CaO | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | g/kg | - | 16.0 |
| Magnesium as MgO | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | g/kg | - | 11.7 |
| Sodium as Na ₂ O | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | g/kg | - | 14.7 |
| sulphur as SO ₃ | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | g/kg | - | 7.7 |

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

| | | | | | | | | | | | | | |
|--------------|----|----------|---------------------------------|--|--|--|--|--|--|-----|------|---|------|
| Iron (Fe) | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | g/kg | - | 2.8 |
| Silicon (Si) | FR | RE000 FY | DIN EN ISO 11885 (E22): 2009-09 | | | | | | | 0.1 | g/kg | - | 21.6 |

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

| Parameter | Lab | Accr. | Method | Limit values | | | | | | Description | | Biochar | | |
|----------------------------|-----|----------|----------------------|--------------|------------------|-----------------|-----------|------------------------|---------------------|---------------|-------|---------|-------|-------|
| | | | | EBC-Feed | EBC-Agro Organic | EBC-Agro | EBC-Urban | EBC-Consumer Materials | EBC-Basic Materials | Sample number | | ar | db | |
| | | | | | | | | | | 122042756 | | | | |
| | | | | | | | | | | LOQ | Unit | | | |
| Naphthalene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | 5.1 |
| Acenaphthylene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | 0.4 |
| Acenaphthene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | 0.4 |
| Fluorene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | 0.3 |
| Phenanthrene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | 1.1 |
| Anthracene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | 0.1 |
| Fluoranthene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | 0.4 |
| Pyrene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | 0.4 |
| Benz(a)anthracene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | < 0.1 |
| Chrysene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | 0.1 |
| Benzo(b)fluoranthene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | < 0.1 |
| Benzo(k)fluoranthene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | < 0.1 |
| Benzo(a)pyrene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | < 0.1 |
| Indeno(1,2,3-cd)pyrene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | < 0.1 |
| Dibenz(a,h)anthracene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | < 0.1 |
| Benzo(g,h,i)perylene | FR | RE000 FY | DIN EN 16181:2019-08 | | | | | | | | 0.1 | mg/kg | - | < 0.1 |
| Total 8 EFSA-EPA excl. LOQ | FR | RE000 FY | DIN EN 16181:2019-08 | 1 | 1 | 1 | 1 | 1 | 4 | | | mg/kg | - | 0.1 |
| Total 16 EPA-PAH excl. LOQ | FR | RE000 FY | DIN EN 16181:2019-08 | | 4 ¹⁾ | 6 ¹⁾ | | | | | | mg/kg | - | 8.3 |
| Benzo(e)pyrene | FR | RE000 FY | DIN EN 16181:2019-08 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.1 | mg/kg | - | < 0.1 | |
| Benzo-(j)-fluoranthene | FR | RE000 FY | DIN EN 16181:2019-08 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.1 | mg/kg | - | < 0.1 | |

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

The parameters identified by FR have been performed by the laboratory Eurofins Umwelt Ost GmbH (Lindenstraße 11, Gewerbegebiet Freiberg Ost, 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 (Glückaufstraße 56, Gelsenkirchen).

/o - The analysis has been outsourced.

Explanations regarding Limits

Analysis performed according to guidelines for the sustainable production of biochar - EBC, Version 10.1E - of 10/01/2022.

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

AR: related to ash

OS: related to original substance

¹⁾ The very low PAH limit values only allow an analytical accuracy of 50% for the limit value: "sum 16 EPA-PAH" of 4 mg/kg and of 40% for the limit value of 6 mg/kg which implies an accuracy of ± 2 mg/kg db and ± 2.4 mg/kg db, respectively.

The presentation of comparative values in the analytical report is a service provided by EUROFINS UMWELT. The cited comparative values (limit, guideline or other allocation values) are partially simplified and do not take into account all comments, ancillary provisions and/or exemptions of the corresponding regulations.