



REFERTIL BIOCHAR ANALYTICAL ACCREDITATION

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Introduction

Biochar is new product; therefore material specific consideration is needed for all analytical items to determine product quality & safety performance with internationally accredited methods and standards. The REFERTIL partner the **Environmental Testing Laboratory of WESSLING is the first laboratory in Europe who obtained accredited status**, under Wessling-NAT-1-1398/2012(2014.10.08), for comprehensive analyses of biochar samples.

REFERTIL in brief

The project is providing advanced solutions to the added value transformation of the organic biowaste streams from Europe's agriculture and food industries. The targeted high quality output products aiming to reduce the use of mineral fertilizers and intensive chemicals in agriculture; enhancing the environmental, ecological and economical sustainability of food crop production. Furthermore reducing the negative footprint of the cities and overall contributing to climate change mitigation, while creating new bioeconomy.

Within the project more than one hundred biochar samples, both plant based biochars (PBC) and animal bone based biochars (ABC) have been investigated. Samples were REFERTIL produced and also were obtained from several EU producers.



Risk of biochars – polyaromatic hydrocarbons

PAH content of biochar is primarily depending on the carbonisation processing technology performance. The analysis results clearly justified that all the **high quality biochars contained less than 1 mg/kg PAH16**. During REFERTIL project in the Fertiliser Regulation EC 2003/2003 revision supporting document PAH16 maximum allowable limit value was defined as 6 mg/kg, but for environmentally justified reasons Member States can describe more strict rules. As an example the national regulation in Hungary (36/2006 (V.18.) FVM decree) requires PAH19 content under 1 mg/kg for soil improvers.

Biochar benefits in soil

Animal bone biochar (ABC)

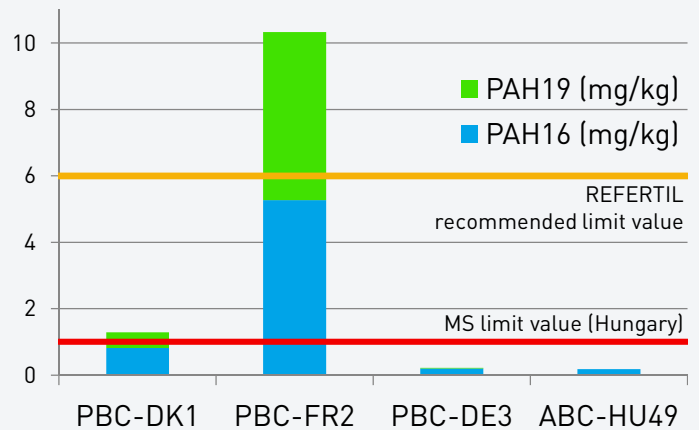
organic phosphorus fertiliser, soil improver, growing media

- made from food grade category 3 bones.
- 90% mineral content and 10% Carbon
- 30% P₂O₅ and 38 – 42 % CaO + Mg; K
- controlled release, organic fertiliser with different formulation options.
- dose: 0.1t/ha - <1 t/ha.

Plant based biochar (PBC)

soil improver, growing media

- made from plant biomass materials
- 90% stabile carbon content
- high water holding and nutrient retention capacity
- negligible P and Ca content - no direct soil fertilization effect with economical value
- dose: 3t/ha - 20 t/ha



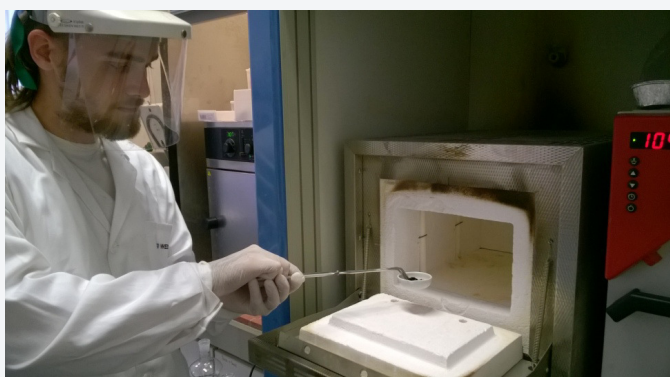
During the limit value definition it is very important to define how many components are under PAHs. The PAH19 concentration can be twice as much as PAH16, because 1- and 2-methylnaphthalenes (measured only under PAH19) are dominant beyond the typical PAH16 components in biochar: mostly naphthalene and phenanthrene, but in some ABC samples anthracene and phenanthrene are also present. **Polycyclic aromatic hydrocarbons can be considered as the key organic pollutants and an important indicator of biochar products quality.**

Accredited biochar analysis at WESSLING Hungary Ltd.

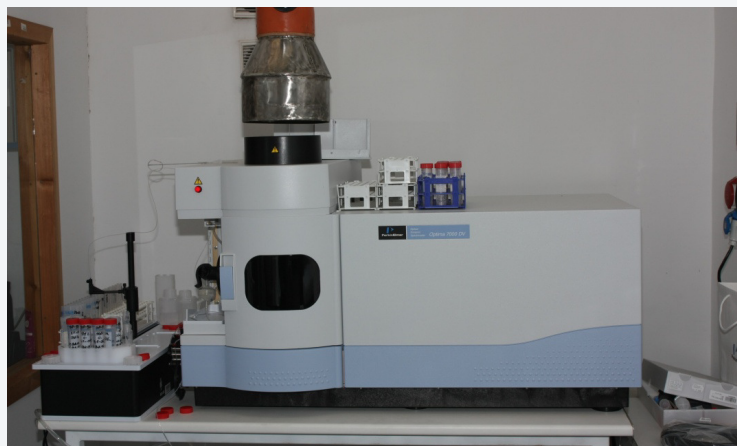
To determine quality & safety performance of biochars, internationally accredited methods and standards are needed. Accreditation of the analytical activities related to the REFERTIL project is an important step to be able to support the research work with analysis that have a **recognized quality management background**, in addition to the proper professionalism. It is also an important step to **support the legal standardization and mandatory permit process of biochar industrial production**, application and commercialisation.

Most of the standards selected for biochar qualification were chosen among currently valid CEN/ISO standards. As biochar is a new product, for a number of parameters it was necessary to adopt soil or waste analytical methods, which were validated to assess their analytical performance. Validation methods were developed to check the suitability of not entirely standard methods to be used in laboratory practice.

The accreditation procedure was initiated at NAT (National Accreditation Body) after almost a year of continuous work. According to the mutual recognition agreements^{1;2}, activities of NAT and organizations accredited by NAT are **recognized internationally** by all other signatories. According to Regulation EC 765/2008, authorities of the member states of the European Union are obligated to accept the results of organizations accredited by NAT.



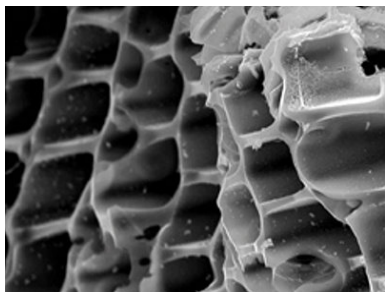
Ash content determination



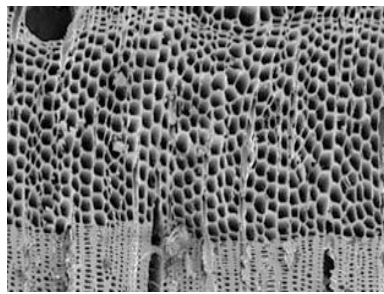
Detection of PTEs using ICP-OES

¹Multilateral Agreement of the European Cooperation for Accreditation (EA MLA) in the areas of analysis, calibration, control, product certification, management system certification and person certification.

²Mutual Recognition Arrangement of the International Laboratory Accreditation Cooperation (ILAC MRA) in the areas of analysis and calibration.

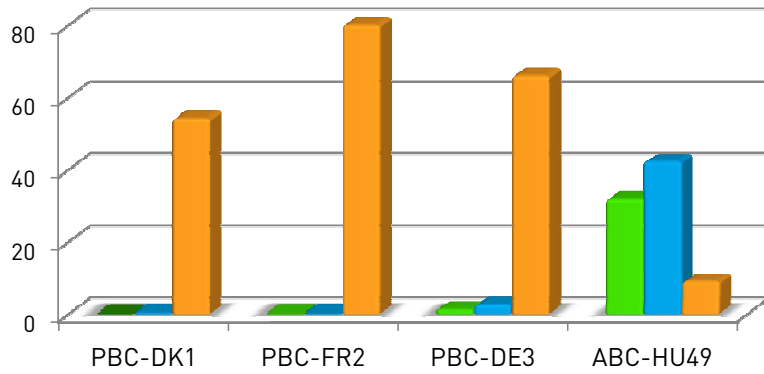


ABC: macroporous 50-63.000 nm



PBC: micro-, mesoporous 1-50 nm

■ P205 (%) ■ CaO (%) ■ Total C (%)



Chlorinated hydrocarbons

In no any cases have polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) been identified as target contamination. These compounds are predominantly formed at temperatures exceeding 1000°C. Pyrolysis conducted on lower temperature while the the feed material streams having low chlorine content. Therefore, the risk of dioxins and furans contamination in biochar products is low. **PCB7 were also not detected** in the investigated more than one hundred biochar samples (ABC & PBC).

Potentially toxic elements

Measuring PTEs (metals) in biochars is very important, because of the 3-5 times re-concentration tendency during phase separated processing. This results much higher PTE concentration in solid output products than in original input average. The higher the organic matter content in feedstock, the less the yield of biochar, thus **PTE high accumulation occurs especially in PBCs**. All ABCs and high

quality PBCs were well below a strict MS regulation and REFERTIL recommended biochar quality & safety parameters. In the case of pyrolysis of **waste material streams with high and/or varying PTE input concentrations there is a high risk that PTEs in final biochar products may reach the recommended safety criteria, therefore the concentration of PTEs should be regularly monitored**. Organic waste streams generally containing high levels of light and heavy metals, which remain and concentrate in the final biochar product should be excluded from biochar production.

PTE	REFER-TIL proposal	MS regulation (Hungary)	PBC-DK1	PBC-FR2	PBC-DE3	ABC-HU49
As	10	10	<1	<1	1	<1
Cd	1,5	2	<0,3	<0,3	0,4	<0,3
Cr	100	100	6	9	15	<1
Cu	200	100	3	9	49	8
Pb	120	100	1	8	14	<1
Hg	1	1	<0,02	0,04	<1	<0,03
Ni	50	50	3	13	14	<1
Zn	600	600	19	150	294	203
Co	-	50	<1	1	3	<1
Se	-	5	<0,3	<0,3	0,5	<0,3