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## REFERTIL PARTNERS



### 'ABC' - Animal Bone bioChar

## REFERTIL IN BRIEF

The REFERTIL project is providing advanced solutions to the added value transformation of the organic bio-waste streams from Europe's agriculture and food industries. In this context, the REFERTIL project is improving the current compost systems and developing new generation zero emission industrial scale biochar technology for safe, economical and ecological nutrient recovery process, most importantly Phosphorous, for conservation agriculture. 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; reducing the



negative footprint of the cities and overall contributing to climate change mitigation, while creating new bio-economy. Moreover, the REFERTIL project provides strong policy support to the European Commission for the revision of the Fertiliser Regulation, that will standardize and law harmonize the safe biochar and compost products use as organic P-fertilisers and/or soil improver products.

## THE KEY OBJECTIVES

- Science and technology RTD for definition of improved and safe compost & biochar standards in the EU 28.
- Providing strong policy support to the European Commission for revision of the Fertiliser Regulation (Reg. EC No. 2003/2003.).
- Economical scale industrial transformation of the organic bio-waste streams from Europe's agriculture and food industries towards zero emission conversion performance into proven safe compost & biochar products.
- Improvement of advanced, safe and economical bio-waste treatment and nutrient recovery industrial process for compost & biochar products.
- Bridge over biochar applied science into industrial engineering, economical and environmental industrial practice, for the benefits and interest of the SME farmers and consumers.





## “ABC”:

### Animal Bone bioChar

ABC is high calcium phosphate apatite mineral and low carbon content macroporous slow release natural organic P-fertilizer product.

ABC is produced from food grade category 3 animal bones between 600°C – 650°C reductive thermal processing and negative pressure conditions with advanced zero emission environmental performance.

ABC is composed principally of high Phosphorous content hydroxyapatite mineral natural inorganic and carbon constituent. Having low carbon content and as high as 30% P<sub>2</sub>O<sub>5</sub> nutrient composition with sequenced release P-fertilization effect. ABC is highly macroporous, formulation optimized for significant enhancing of soil microbiological life, having high water holding and macromolecular organic nutrient retention.

## BIOCHAR DEFINITION: ABC and plant based biochar

### Biochar

Biochar is plant and/or animal biomass by-product or organic waste based stabile carboniferous substance for conservation agriculture applications. The biochar must be well defined and controlled quality, that is processed under reductive thermal conditions, and applied to improve the soil physical and/or chemical and/or biological properties or the soil activity and/or consists of organic materials of biological origin.



“3R” Zero emission pyrolysis equipment for ABC biochar production

## “PBC”:

### Plant based biochar

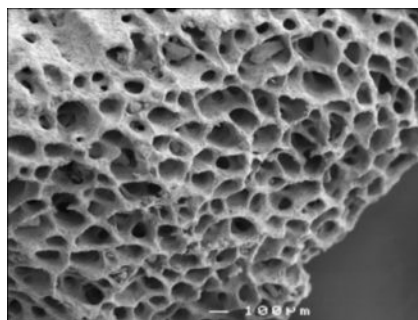
PBC is high stabile carbon content plant origin micro- and meso porous carboniferous soil improver product, with relatively high water holding, nutrient retention and C-sequestration capacity, but almost no soil fertilization effects with economical value.

Plant biochar is produced from plant biomass materials between 450°C – 550°C reductive thermal processing negative pressure conditions with zero emission or near zero mission environmental performance.

## BIOCHAR TYPES

Plant based biochar (PBC) is soil improver while ABC is organic P-fertilizer. In this context the biochar is soil improver and/or organic fertilizer or both. The REFERTIL is strongly recommending that only one grade and minimum, but high enough, environmental quality biochar type is to be defined for conservation agriculture application.

‘ABC’ porous material



## BIOCHAR FEED STOCKS

Wide range of organic feed stocks can be used for biochar production.

**Requirements:** not competing with human food, animal feed and plant nutrition production and supply; and originating from environmental and climate protection sustainable source and supply.



Food grade category 3 bones feedstock for ‘ABC’ production



## REFERTIL BIOCHAR POLICY SUPPORT

The REFERTIL proposed mandatory parameters for biochar (mg/kg)

Biochar parameters	ORGANIC P-FERTILISER	SOIL IMPROVER
Potential toxic elements (mg/kg)		
As	10	10
Cd	1.5	1.5
Cr	100	100
Cu	200	200
Pb	120	120
Hg	1	1
Ni	50	50
Zn	600	600
Organic pollutants		
PAH 16	6	6
PCB 7	0.2	0.2
PCDD/F (ng/kg I-TEQ)	20	20
Particle size distribution	ABC: 1-5mm, 90%	PBC: 1-20 mm, 90%
Bulk density	declaration	declaration
Dry matter content	>80%	>60%
pH	6 - 10	6 - 10
Total Organic C	declaration	20%
N and K total	declaration	declaration
Total P (P <sub>2</sub> O <sub>5</sub> )	>25%	declaration
Total Ca, Mg	declaration	declaration
Germination inhibition assay	No inhibition	No inhibition
Phytotoxicity	No phytotoxicity	No phytotoxicity
Agronomic efficiency	Should be proved	Should be proved



The REFERTIL proposed analytical methods for organic pollutants

ORGANIC POLLUTANTS	PROPOSED REFERTIL METHODS
PAH <sub>16</sub>	CEN/TS 16181:2013 * - Determination of polycyclic aromatic hydrocarbons (PAH) by gas chromatography (GC)
PCB <sub>7</sub>	EN 16167:2012 * - Gas chromatography with mass selective detection (GC-MS)
PCDD/F	CEN/TS 16190:2012* - Gas chromatography with high resolution mass selective detection (HR GC-MS)

\* HORIZONTAL Standards (CEN/TC 400) Sludge, treated biowaste, soil and waste.

## BIOCHAR STANDARDIZATION and revision of the Fertiliser Regulation

REFERTIL Policy Support Aims: support for the European Commission (DG Industry & Enterprise and other DGs) in the revision of the Fertiliser Regulation (Reg. (EC) No 2003/2003), and the possible inclusion of biochar - as organic fertilizer (ABC - Animal Bone bioChar) and soil additive (plant biomass byproduct based biochar).

When biochar is irrevocably applied to open and complex soil ecological system, there is also a direct interlink to subsurface water systems, therefore only

qualified and safe biochar must be applied. The aim is to ensure that the proposed biochar quality and safety criteria are fully consistent with EU-wide Directives and Regulations for long term.

The reason for the proposed stricter biochar quality and safety (limit values for toxic substances) standard is the reduction of environmental risks from potential toxic elements and organic compounds for application of safe biochar product in conservation agriculture. The REFERTIL consortium has been

reviewed the respective EU Directives, Regulations and also the relevant MS national legislations. Several workshop meetings have been organized with the EU Commission representatives in 2012-2014 for joint considerations. Furthermore, wide range of European and global biochar S&T groups have been consulted for knowledge and experience exchange in this new and complex biochar case. Detailed policy support report submitted to the Commission on December 20, 2013.



## Biochar technology RTD key drivers

- Safe biochar product characteristics to be determined, validated, field tested and proven demonstrated.
- The biochar technology design performance is key factor for biochar product quality, energy efficiency and emission performance.
- Biochar production yields are low (approx. 30 % for PBC and 50% for ABC), and the rest is oil and non condensable gases, for which economical and environmental friendly utilization strategy is key important.
- As biochar production can be considered as a small scale chemical industrial installation, therefore comprehensive solution is needed.
- Towards “zero emission solution” as combined environmental and economical incentive.
- Economical industrial scale need to be reached under market based conditions.
- Input feed material logistics is key important.
- Energy self sustaining.

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## Rationale for limit values and quality criteria of the safe biochar products:

- I. **SAFETY:** There should be no overall adverse environmental, ecological and human health impact from the use of biochar products in the open soil environment. The limit values set for PAHs, potential toxic elements and pollutants with biochar quality criteria should promote the production of higher quality and safe biochar products under market based economical conditions in conservation agriculture.
- II. **MARKET REGULATION:** The limits and biochar quality standards should exclude the poor quality carbon products from the fertiliser and soil improver market, those are usually missing the environmental and human health measures during its obsolete charcoal production schedules. Biochar products made from biomass by-products and regulated under mandatory EU Regulations are proposed to be mutually MS recognized products. Biochar made from waste material streams under Waste Framework Directive/End-of-Waste criteria, is proposed to be additional law harmonized by the Member States as well.
- III. **AUTHORITY CONTROL:** beyond the availability of the Authority permits for production and use of biochar over one ton per year production capacity (REACH), the Authority permit, control and continuous follow up are important elements. By selection of key performance indicators full and transparent up to date information on biochar production and product quality required, such as
  - **Nutrient content with economical value,** application indicator.
  - **PAHs:** Target pollutants. Product and environmental quality key indicator.
  - **Potential toxic elements:** target pollutants and key indicators.
  - **PCB7:** Contamination indicator also for PCDD/F.
- IV. **BIOCHAR PRODUCTION:** The Refertil ABC/PBC product quality criteria, application and follow up of the new EU/MS industrial, agricultural and environmental regulations encourage the best practice of biochar production and supply of safe biochar. The Refertil ABC/PBC criteria also providing a legal, technical, economical and market platform for sustainable biochar business operations, including an important legal element to support the users and consumers interest, such as producer’s biochar product responsibility, insurance and guarantee, same way as for any other commercial products.
- V. **ECONOMY:** REFERTIL provides rational, realistic and commercial market demanded economical scenario for all biochar stakeholders from sustainable feed material supply, through production and conservation agricultural safe application, while equally importantly the environment, the climate protection and social aspects are also on the win side with equal importance.

