The REFERTIL project is providing advanced solutions to the transformation of the bio-waste streams from EU municipalities, food industries and farms, by improving composting systems and developing new generation zero emission industrial scale biochar and compost technology for safe, economical and ecological nutrient recovery, specially Phosphorus, for sustainable agricultural systems.

High quality Compost and Biochar products are designed, aiming to reduce the intensive use of mineral fertilizers and chemicals in agriculture, enhancing the environmental, ecological and economical sustainability of crops and food production; reducing the negative footprint of the cities and overall contributing to climate change mitigation, while creating new bio-economy.

Moreover, the REFERTIL consortium is providing strong policy support to the European Commission for the revision of the Fertilisers Regulation, that will standardize and harmonize the biochar and compost products use as organic P-fertilisers, organic fertilisers or soil improvers.

The REFERTIL project is co-funded by the European Union, Seventh Framework Programme under Grant Agreement number 289785. 2011-2015.
Regarding the limitation of input materials, purpose of the EoW (End-of-Waste) Technical proposal of December 2013 is to ensure of clean suitable biowaste by means of a scope definition, finally rejecting the idea of a Positive list. Non-sorted M.S.W. and sewage sludge were excluded, as well as deinking, primary and secondary sludge from paper industry. In principle the future Fertilisers Regulation will only accept input materials compliant with EoW criteria for compost production. Materials compliant with national EoW criteria might be used on national territory + possibility for mutual recognition.

### Compost quality criteria

**EoW Technical Proposal for Compost and Digestate, December 2013**

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic Matter</td>
<td>&gt; 15% on dry matter weight</td>
</tr>
<tr>
<td>Pathogens</td>
<td>No <em>Salmonella</em> sp. in 25 g ; &lt;1000 CFU/g for E. Coli</td>
</tr>
<tr>
<td>Minimum stability</td>
<td>15 mmol O2/kg organic matter/h</td>
</tr>
<tr>
<td>Weeds and propagules</td>
<td>&lt;2 viable weed seeds/liter</td>
</tr>
<tr>
<td>Impurities</td>
<td>0.5% &gt; 2mm</td>
</tr>
<tr>
<td>Zn (mg/kg)</td>
<td>600</td>
</tr>
<tr>
<td>Cu (mg/kg)</td>
<td>200</td>
</tr>
<tr>
<td>Ni (mg/kg)</td>
<td>50</td>
</tr>
<tr>
<td>Cd (mg/kg)</td>
<td>1.5</td>
</tr>
<tr>
<td>Pb (mg/kg)</td>
<td>120</td>
</tr>
<tr>
<td>Hg (mg/kg)</td>
<td>1</td>
</tr>
<tr>
<td>Cr (mg/kg)</td>
<td>100</td>
</tr>
<tr>
<td>PAH₁₆ (mg/kg)</td>
<td>6</td>
</tr>
</tbody>
</table>

In line with REFERTIL suggestions, Cu and Zn limit values were risen for its consideration as micro-nutrients. PAH₁₆ is the only organic pollutant set up. As limit has not been included.

### Composting process requirements

3 profiles time-temperature for non ABPs *EoW Final*, not binding:
- 65 °C or more for minimum 5 days
- 60 °C or more for minimum 7 days
- 55 °C or more for minimum 14 days

Hygienization of ABPs containing materials by AD or Composting including domestic and commercial MSW, *Regulation EU 142/2011*:
- Maximum particle size before composing: 12 mm
- Minimum temperature for all material process: 70 °C
- Minimum time in reactor at 70 °C: 60 minutes
- Possible validation of other equivalent process conditions by MS

**REFERTIL Policy integration**


REFERTIL activities are in line with EoW policy, covering the 21 composting plants surveyed across 7 EU countries, the 6 selected compost for evaluation and the Composting BATs demo trials.

The bigger challenges identified for the composting sector are the technological adaptation to the ABPs process requirements set by Regulation EU 142/2011, affecting most of the M.S.W. plants, together with the update of collection systems to reach the “EoW or product quality for compost”. REFERTIL has focused on policy support to the DG Ent & Ind in the revision of Regulation 2003/2003 on Fertilisers.
COMPOSTING BATs trials in Spain (BGUADALQUIVIR)

• 880 t input materials used in 2 years trials in Toledo (Spain) Mediterranean area, with 320 t of output compost from different mixes and formulations.
• Similar technologies as Hungarian BATs trials.
• Input materials and compost produced intensively analyzed and used as control for lab, greenhouse tests and field trials compost evaluation.
• Technical focus of trials on bacterial cocktail’s inoculums effects, N conservation and eco-biological and foodweb profile.

Farmers’ willingness to use compost and biochar is strictly connected to various aspects and agronomical tests are important to evaluate its efficiency and efficacy.

Within the REFERTIL project, different agronomical performance tests were carried out by Agroinnova - University of Turin with six selected composts and biochar during the Compost survey:

• Cress test in petri dishes and pots for evaluating phytotoxicity and germination capacity. Composts showed little phytotoxicity effects, in particular those composts deriving from animal manure and municipal biowaste, with a clear germination promotion effect by some of them.

The activities are carried out at the composting plant of Gödöllő (Hungary), and used two different technologies:
• Negative aeration system with turning.
• Covered heap composting with GORE™ cover system.

PROFIKOMP has used different configurations: heap sizes and different intensive-maturation time profiles towards improved and optimized composting processes.

COMPOST EVALUATION

• Potting trials on zucchini and lettuce to evaluate agronomical effects of compost and biochar. Green waste composts and animal bonechar showed a good fertilization effect on crops.
• Suppressiveness trials on cucumber, to evaluate the capacity to control plant pathogens. 3 of the 6 compost showed suppressiveness activity.
• Microbiological analysis for evaluating the safety of the products. Listeria and Salmonella are not a problem for composts, while E. coli are frequently present but not exceeding the legislative thresholds.

In conclusion, compost and biochar could be a reliable alternative to chemical fertilizers, with both short term (nutrients) and long term effects to crops and soil. Agronomical evaluation should inform on suitable crops and conditions of use.

Eco-toxicological evaluation of selected composts has been performed by dose-response studies targeting sensitive bioindicators represented by ammonia oxidizing soil microorganisms.

Results indicated that compost products caused no inhibitory effects on the soil microbial ecosystems except for one product which caused a transient short-term (2 days) inhibition corresponding to an EC50 value of 9.1% (w/w percent of compost admixture to the soil).
CONCLUSIONS COMPOST POLICY SUPPORTING WORK

- More than **200 biowaste samples** and **34 compost samples** analyzed at WESSLING certified lab, from 21 European composting plants. Obtained results were in line with JRC analytical campaigns (FATE SEES-COMES Programmes). Only two compost samples were over PAHs and PCB limits (due to sludge and treated wood in the mix). In the REFERTIL opinion the proposed POPs limits could be suitable with quality input materials and with EoW compost.

- Regarding Potentially Toxic Elements (PTEs), REFERTIL it would be appropriate to review the initial limit values for Cu, Zn (already adjusted up) and Ni. A good number of bio-waste and green waste composts exceed the Nickel limits (due to a natural concentration of geogenic origin in the vegetables, with special incidence in Italy). Zn and Cu are oligo-elements and are originated in animal manure from diet additions, presenting risks only in repeated slurry applications near animal farms.

- REFERTIL performed an up-to-date review of Legal quality requirements and pollutant limits for compost and biochar across the MS, stressing the need of a harmonised frame for biowaste management and compost quality and use.

- Today, only the Nitrates Directive regulates the compost application to a maximum amount of 170 kg N/ha/year. REFERTIL suggests a maximum rate of 10 t dry matter/ha/year, which corresponds with the national compost use regulations very well.

- REFERTIL fully supports the recent Communication “Towards a circular economy: a zero waste programme for Europe” of July 2014 which intends to promote the circular economy, including a legislative proposal to review recycling and waste-related targets:
  - Phasing out landfilling by 2025 for recyclable waste (including plastics, paper, metals, glass and bio-waste) to a maximum landfilling rate of 25% by 2025.
  - Change in Article 22 Bio-waste of the Waste Framework Directive: all MS are obliged to implement separate collection of bio-waste by 2025

STATUS OF FUTURE EU FERTILISER REGULATION

- The revision of Regulation 2003/2003 EC is in the last phase of its technical preparation. For the first time, organic products are considered: Organic fertilisers (material of biological origin including manure, composts, bio-digestates) Organo-mineral fertilisers, Soil improvers and Growing media (but also Liming materials, Plant biostimulants and Fertiliser Additives).

- The document is goes beyond registering procedure, being conceived as a tool for promoting the closing of the nutrients cycles and recovery of mainly P (facing the scarcity and concentration of P mineral resources) but also other nutrients from secondary sources. For compost it should be carefully considered what should be the minimum required levels for OM, N and nutrients. Another alternative way is to establish a specific category for compost, which is a fertilizing material as well as a soil improver.

REFERTIL COMPOST SURVEY INVITATION

Please help our policy support works:
http://www.refertil.info/refertil-survey-questionnaire

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