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Book of Abstracts

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Session 3.2: Technologies of biorefineries
Monday, 21 September 2020 3.30 pm – 5.30 pm

Oral Presentation 1

Amendment production from composting wet hydrochar obtained by HTC of digestate from dry anaerobic digestion of OFMSW

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Aim

Hydrothermal Carbonization (HTC) is an emerging technology to produce hydrochar (HC), but there are still few studies for an industrial-scale application of HTC. HC could play a role in nutrient retention capacity in soil, soil aggregation, carbon storage and GHG emissions reduction. C2Land project aims to design and validate a new industrial scaling model to produce a valuable co-compost from OFMSW digestate and a portion of its HC. The integration of HTC and anaerobic digestion (AD) will produce a good quality amendment by applying a biorefinery approach in a circular economy framework. Moreover, a business model and LCA will be carried out.

The use of 'wet' HC in agriculture is challenging, because of the presence of highly phytotoxic compounds, but there are different promising approaches to reduce phytotoxicity, such as the composting process itself, previously tested on dry hydrochar [1]. The purpose of this work is to present the novelty of the C2Land's concept and the preliminary results on the production of wet HC for amendment purposes, as a viable solution to exploit digestate from OFMSW AD treatment.

Methods

The HTC reactions were performed at three different temperatures (180, 200 and 220 °C) for a duration of 3h in quadruplicate in a 2L bench-scale batch reactor. The reactor was filled with around 1.2 L of OFMSW digestate sampled in a dry AD full-scale plant and previously sieved with a 19 mm mesh. The wet HC will be composted with digestate and green waste in lab reactors. Chemical characterization of all the samples obtained after HTC and composting process is in progress. The biological stability will be assessed by measuring the oxygen uptake through dynamic respirometric index. Phytotoxicity will be evaluated based on germination index (GI) on *Cucumis sativus* L., *Lepidium sativum* L. and *Sorghum saccharatum*) and plant growth bioassay (PGB, UNI 11357) on *Brassica rapa* and *Avena sativa* (UNI EN ISO 11269-2). The extracts will also be analyzed with HPLC.

Results

The wet HC obtained after HTC showed a solid yield that ranges from 60 to 90% and decreases as the HTC temperature increases. The preliminary results on feedstock characterization showed pH values of 8.5, 8.8, 8.8 and 8.7, respectively for raw digestate (DIG) and the HCs produced at 180, 200 and 220 °C (HC180, HC200, HC220). The values of electric conductivity are in the range 4300-4800 μS cm^{-1}. The wet HCs showed a different average value of dry matter content on wet basis (25-30%) compared to DIG (~18%). The volatile solids content on dry basis (%db) of HC180 (~58%db) is slightly higher than the value for HC200 and HC220 (~54%db). The first set of GI and PGB of the aforementioned samples are under study.

Conclusion

The experimental activity is temporarily suspended due to the CoVid-19 emergency. The project is supported by the EIT Climate KIC Call 2019 'Earlier stage innovation Partner accelerator'.

References

[1] Daniela Busch; Arne Stark; Claudia I. Kammann; Bruno Glaser, (2013), Genotoxic and phytotoxic risk assessment of fresh and treated hydrochar from hydrothermal carbonization compared to biochar from pyrolysis, Elsevier, Ecotoxicology and Environmental Safety vol. 97, 59-66, https://doi.org/10.1016/j.ecoenv.2013.07.003