

## Characteristics of a solid carbonaceous product of microwave pyrolysis/torrefaction of sewage sludge for the use in agriculture and blue-green infrastructure

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### ABSTRACT

The aim of this work is to present results of preparation and characterization of the dried municipal sewage sludge and so called solid carbonaceous product, the outcome of its further processing by slow microwave pyrolysis/torrefaction. Characterization intends to determine the use of these products for combustion with energy production, agriculture, and blue-green infrastructure. The tests included several variables influencing pyrolysis such as mixing sewage sludge with additives, pelletization process, pyrolysis residence time, process temperature and parameters such as yield of solid carbonaceous product, yield of pyrolysis oil, yield of pyrolysis gas, content of heavy metals, calorific value, organic carbon, pH, electrical conductivity, and surface area. The results showed that mixing and pelletizing processes improved the feedstock qualitative parameters necessary for the certification as a solid alternative fuel and the subsequent certification as biochar or the soil amendment. For certification of biochar or soil amendment substance, it is necessary to prepare a mixture of raw dried sewage sludge with additives to improve the feedstock qualitative parameters to increase organic matter and to improve other properties such as organic carbon, surface area etc. The results indicate that slow microwave pyrolysis/torrefaction transforms sewage sludge into solid carbonaceous product and represents an eco-friendly way of sewage sludge disposal which belongs to the important strategies of circular economy.

*Keywords:* Sewage sludge management; Blue-green infrastructure; Microwave pyrolysis/torrefaction; Solid carbonaceous product; Biochar

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