



Microwave pyrolysis full-scale application on sewage sludge

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ABSTRACT

This paper reviews microwave pyrolysis (MP) and then presents a full-scale application of this technology to treat sewage sludge. Disposal of sewage sludge is becoming one of the most important issues in wastewater management in European Union. The use of sludge in agriculture is becoming problematic due to the content of heavy metals (HM) in sludge. Sewage sludge contains valuable resources for further use transformed to pyrolysis output products which are: char (also called biochar), pyrolysis oil and pyrolysis gas (syngas). Sludge pre-treatment and following MP outputs can be influenced by catalysts, eventually other admixtures, its mixing ratios in order of optimization of the depolymerization and microwave processes. The examined output samples were produced using a “full-scale” MP technology with the required pelletization. The input mixtures included dried sewage sludge, dried sludge with a catalyst and dried sludge with more admixtures (catalyst, lignin, hay, sawdust). We roughly quantified depolymerization process in terms of performance and temperature monitoring over time. This research includes a number of analyses: the dry solids content, proportion of organic and mineral components of individual materials, weight and bulk density of the output components in dependence of the course of microwave depolymerization and the preparation of input mixtures. The addition of zeolite similar to ZSM-5 (2.0% wt of dry substance) achieves the best temperature increases mainly with lignin or lignocellulosic admixtures. Chemical analyses monitor the HM content of biochar. As regards biochar, the surface and size of pores were evaluated. The aim of this research step is to show that the MP is a good innovative method to treat sewage sludge.

Keywords: Sewage sludge treatment; Sludge disposal; Microwave pyrolysis; Catalytic depolymerization

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