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Utilization of Industrial by-products in Environmental Protection

NEWSLETTER 5

Hydrothermal Carbonization of Sewage Sludge for the Production of Soil Conditioner

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In recent years, the utilization possibilities of sewage sludge have been frequently discussed, in particular, the production of biochars from human faecal- and municipal sewage sludge [1]. The aim of the joint project Carbowert is to develop an integrated process of hydrothermal carbonisation (HTC) for fraction of the urban water respectively the sanitation sector and to implement the resultant products in the sense of a Biochar concept. The focus of this project is to optimise the HTC process in the utilization of sewage sludge. One goal of the process optimization is to minimize the concentration of heavy metals in biochars and to convert this concentration to the process water by the normal running process parameters. The determination of each concentration of heavy metals is carried out using the x-ray fluorescence analysis. The recycling of sewage sludge by HTC offers the advantage that a steady availability of appropriate wet starting material exists, which is not used in any other form of exploitation types [2]. This procedure ensures a complete sanitation, stabilization and conditioning from the created materials. Furthermore, there is the possibility to integrate the hydrothermal carbonization into existing wastewater technologies.

An additional work package evaluated the effects of hydrochar from sewage sludge from Goiânia wastewater treatment plant in Brazil as a potential fertilizer on growth of rice, beans and radish. The hydrochar was produced in Goiânia/Brazil by the hydrothermal carbonization process. The pot experiment was lead in a nursery and had 5 doses (0 ton ha^{-1}; 10 ton ha^{-1}; 20 ton ha^{-1}; 40 ton ha^{-1} and 60 ton ha^{-1}) of hydrochar distributed in random a manner. Each treatment had 4 replications. Fresh and dry plant biomass of shoot were assessed. The dry biomass data were converted to percentage as a function of hydrochar dose 0 g kg^{-1} of soil. Analysis of variance demonstrated that the use of hydrochar had a positive effect on plant biomass yield of radish (Pr>F 0.0002) and of rice (Pr> F 0.0350). However, the addition of hydrochar had no significant effect on biomass of bean (Pr>F 0.11577). The linear polynomial adjustments indicated an increase in biomass of rice (Y = 17.674 +100) and a decrease in biomass of radish (-230,54x + Y = 100). Although not significant, there was a decrease tendency of biomass of bean (Y = -46,642x+100). The seedling emergence and seedling growth experiment was efficient to evaluate the initial potential of hydrochar from sewage sludge as fertilizer in crop plants. The application of hydrochar from sewage sludge had different plant growth response depending on the crop and on the concentration of hydrochar. The hydrochar from sewage sludge had better effect for rice cultivation.

Literature

[1] Lehmann, J. and S. Joseph. eds. Biochar for Environment Management Science and Technology. 2009 Earthscan: London

[2] WHO/UNICEF, Progress on Sanitation and Drinking-Water. 2010 Update, 2010: Geneva

WP 1 Hydrogen and synthesis gas production from waste
University of Poitiers

WP 2 Valorisation of wastes from olive and argan production
University of Chouaib Doukkali

WP 3 Production of valuable chemicals from CO_2 and organic gases
University of Oulu

WP 4 R&D on the HTC technology to valorize industrial by-products and wastes,
Federal University of Applied Sciences, Goiania

WP 5 Utilisation of methane originating from coal mining
Dalian Institute of Chemical Physics

WP 6 Research on the HTC process: Product design
Trier University of Applied Science

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Environmental pollution is a global problem. Unsustainable production of goods, improper treatment of waste, emissions to air and water, and inadequate legislation cause growing problems to human beings and nature. The urgent need for reducing environmental load coming from industry, agriculture and communities demands for novel ways of thinking. NO-WASTE collaboration will attack to this current problem by developing environmentally sound and sustainable possibilities to utilize and valorize different wastes and emissions. **The aim is to create valuable new products and renewable energy to minimize the waste as well as emissions to air and water.** The frame of operation of NO-WASTE allows a great number of green chemistry related possibilities to create networks of knowledge between the scientists of different fields (science, engineering, economy, health) in different countries.