Pyrolysis of Food Waste – Solid Carbonaceous Product/Biochar for Material Use

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Food waste (FW) is a biodegradable waste from kitchens, restaurants, and public canteens, which represents a complicated group of wastes, especially from the point of view of microbiological and leaches pollutions and greenhouse gases emission. According to the new legislation in the Czech Republic, it is no more acceptable to use the FW for animal livestock and there are also other restriction related with FW as a biological degradable waste. In the Czech Republic. FW also cannot be crushed and drained into sewage system. Thus, it is necessary to find a new way for material transformation of such waste into new usable product which would meet the principles of circular economy. The thermal treatment of FW, which represents one of suitable way of its processing, can be performed by pyrolysis technology with following outputs: solid carbonaceous product/biochar (SCP), pyrolysis oil and pyrolysis gas (syngas).

The current applied research conducted with the support of project No. TJ02000262 "Gastro-processing waste into a solid carbon product for material use" is solved as cooperation of the AdMaS Research Centre Brno University of Technology (AdMaS BUT), the Faculty of Chemistry (FCh BUT), Mendel University in Brno, and industrial partner - ASIO NEW. This project solves FW drying, pretreatment included mixing with additives, pelletizing process, and pyrolysis process. The thermal pyrolysis (TP) tests revealed several variables influencing pyrolysis such as pelletization process, pyrolysis residence time, process temperature, yields and parameters such as calorific value, C_{org}, pH, EC.

TP research explores the potential to produce SCP/biochar according to the IBI [1] (International Biochar Initiative) and EBC [2] (The European Biochar Certificate) certification regulations. These regulations define the methods and limits of selected parameters for certification of biochar, namely the assessment of toxic substances (PAH, PCDD/Fs, PCB, heavy metals, etc.) which are hazardous for application into agriculture, as well as other parameters (humidity, C_{org}, H:C_{org}, ash, N, pH, electrical conductivity, O:C_{org}, P, K, S_{BET} and many others) which indicate the potential improvement of soil conditions.

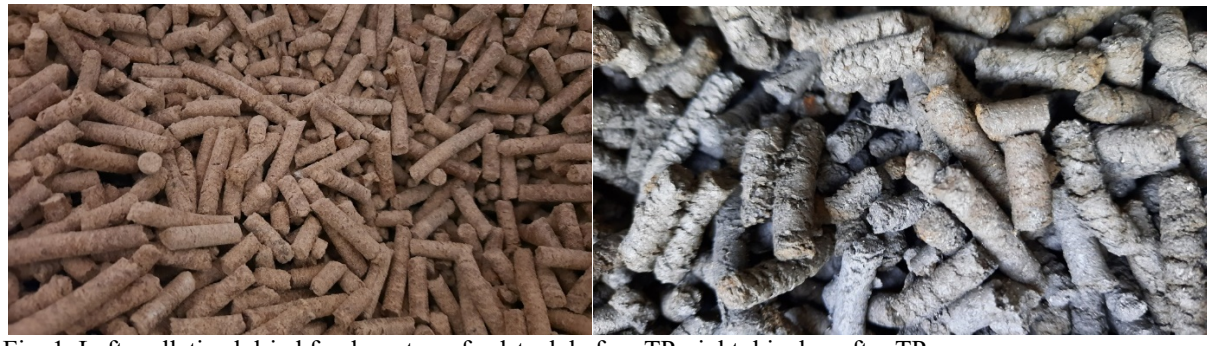

Fig. 1. Left: pelletized dried food waste as feedstock before TP, right: biochar after TP.

The aim of this work is to present TP of FW. The data were compared with the biochar certification guidelines. The TP tests were carried out by using full-scale units, which correspond to real conditions. The aim of this pilot study is to present a full-scale reactor for TP of FW. In addition, we focused on pelletization process, pyrolysis residence time, process temperature and parameters such as yields, calorific value, C_{org}, pH, EC. SCP seems to be attractive solution for energy, agriculture use, and glue-green infrastructure - as a substrate for green roofs, walls, and parking lots. SCP/biochar can retain water and capture pollution. TP represents an eco-friendly way of FW disposal, which belongs among the important strategies of circular economy.

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