“Influence of the Volatile Organic products of torrefaction on the reactivity of the torrefied residual biomass and initiation of gasification process”

Torrefaction is a process of thermal treatment of a solid fuel, which transforms biomass into biocoal, thus changing it from worthless by-product into a high quality solid fuel, useful both for power plants as well as for the “average Smith”, for his boiler, which he uses to heat up his household in winter. Gasification is a process transforming solid fuel into gas, which could be subsequently used in a power generator, instead of expensive gasoline.

During the course of the project, certain mechanisms will be determined, which are responsible for the creation of volatile organic compounds on the surface of biocoal, produced in the processes of dry and wet torrefaction and adsorbed on the surface of torrefied material.

Volatile Organic Compounds (VOC) is a group of organic compounds, with following properties: they easily evaporate and become gases, with relatively high vapour pressure, that can be characterised by low miscibility with water. The boiling point of these compounds ranges between 50-250 °C (for normal pressure - 101,3 kPa). Influence of these compounds, adsorbed on the surface of biocoals, made out of different types of residual biomass, on the change of reactivity of the torrefied biomass and initiation of the subsequent gasification process, will be within the scope of this project.

Project is based on the following hypothesis: volatile organic compounds, that are by-products of dry and wet torrefaction process, are being adsorbed to some extent on the surface of the torrefied biomass and have an influence on ignition as well as initiation and sustaining of the gasification of the fuel valorised in this manner. The aim of the project is speciation and quantitative determination of the organic compounds, adsorbed at the surface of the torrefied biomass. It means that all volatile compounds that are “sticking” to the surface of biocoal can be precisely identified. The research will result in developing a model of creation and sorption of the volatile organic by-products of torrefaction as a function of the process parameters. Such a mathematical model will allow calculation of the quantity of each of these compounds adsorbed at the surface. Another result will be a model, that will allow estimating a minimum temperature, for the initiation and sustainment of the gasification process, depending on the volatile organic by-products of torrefaction, adsorbed on the surface of the torrefied biomass. This will allow estimating if the deposition of these substances on the surface helps in case of an “ignition” and sustaining of gasification.

Performed research will also allow obtaining the answer for the question, if biocoal is more suitable for gasification, in comparison to raw biomass and if the use of biocoal will allow obtaining a good quality gas, even with a low load of the generator, during the time when not so much electricity is needed. The project will allow answering the question about the role of the volatile organic compounds in the initiation and sustainment of the gasification process.