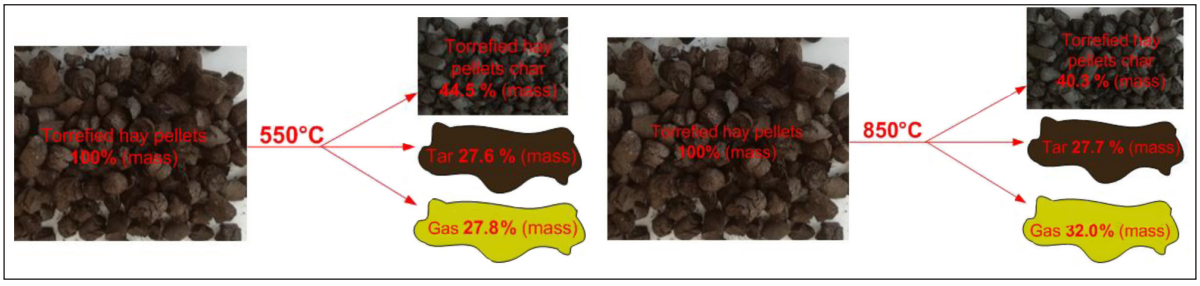
Cooperation between Estonia and Lithuania to investigate characteristics of pyrolysed hay pellets

Mr. Taivo Rooman from Leedi Farm (Estonia) is carrying out a project named "Biosyngas production from torrefied hay" (Project number 616215780006). The project is funded by the Estonian Agricultural Registers and Information Board by Measure Co-operation, art 35, Regulation (EU) No 1305/2013 of the European Parliament and of the Council, Estonian Rural Development Plan (ERDP) for 2014–2020, Sub-measure 16.2 (Support for development of new products, practices, processes and technologies) programmes. The main objectives for the development of projects under this financial instrument for the period 2014–2020 are as follows: to support individual projects which promote cooperation and develop innovation in agriculture, food and forestry sector and solve the production-related challenges faced by the given producer(s) and processor(s). The projects are targeted at finding solutions to the challenges defined by the applicant based on their practical needs. Cooperation with EIP OGs from other member states and other cross-border cooperation aimed at development activities or development of innovation was also eligible.

Therefore, to achieve foreseen project goals, in 2017 project representative *Mr. Taivo Roomann* (Leedi Talu FIE, Leedi, Suurekivi, Rapla county, Estonia) and *Mr. Tommy Biene* and *Mr. Allan Vrager* (Company BRM TB Llc, Estonia) contacted the Laboratory of Combustion Processes at the Lithuanian Energy Institute regarding investigation of torrefied hay pellet pyrolysis process at different temperatures. After the optimal process conditions are determined, a certain amount of char was produced for further studies for agricultural needs. Raw hay pellets were torrefied at Fraunhofer Institute (Germany) before supplying them to LEI. Torrefaction is similar to pyrolysis but occurs at a lower temperature (about 320°C). During torrefaction, biomass is partly devolatilized leading to decrease of its mass, but the initial energy content of the torrefied biomass is mainly preserved in the solid product and the calorific value of torrefied biomass increases by 2–3 MJ/kg. Due to these reasons and due to light weight, the torrefied biomass is more suitable for long-range transportation and management.

Researchers at the Lithuanian Energy Institute (K. Zakarauskas, R. Paulauskas) performed experiments with a small pyrolysis reactor to determine gas composition, tar content, and conditions for char production. the rig consists of pyrolysis reactor, tar condensation, and gas sampling system. The experiments were performed at 550 and 850°C temperature. After pyrolysis, three groups of substances are formed: char, tars, and gases.

Based on the obtained results (in a small pyrolysis reactor), a bigger pyrolysis reactor was designed and manufactured for char production. The char production was performed at the same temperature as the pyrolysis investigation. Thermal analysis (TGA), surface area and pore volume analysis as well as proximate and ultimate



Mass balance of torrefied hay pellet pyrolysis at different temperatures

analysis were performed in order to estimate the characteristics of the obtained char. The taken gas samples were analysed using the Agilent 7890A gas chromatograph with a two-channel thermal conductivity detector (TCD) and a set of valves. Tar concentrations were determined using the CEN BT/TF 14385 method. The taken samples of condensed tars are weighted and analysed using the Varian GC-3800 gas chromatograph with the flame ionisation detector.

It can be concluded that physical properties of char obtained by thermal degradation of biomass are porous and carbon-rich due to these reasons, the biochar might be used for carbon capture and storage, greenhouse gas reduction, catalyst, soil, and water remediation.

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