Characterization of bio-coal produced from different origins under different conditions for different applications, Luleå tekniska universitet MiMeR, Minerals and Metallurgical Engineering

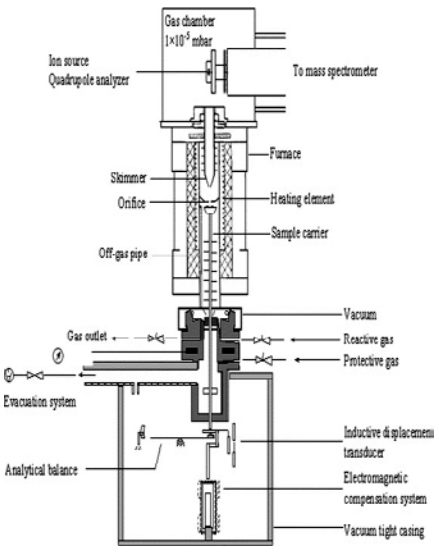
RESEARCH CONTRIBUTION TO THE PROJECT OBJECTIVES

The aim of the project is to identify new users of bio-carbon and help develop process technologies for the production of bio-coal that are adapted for various metallurgical processes. In this way, the project supports the growth of SMEs that will develop process engineering, manufacture bio-coal production equipment and produce bio-coal.

Today, neither metallurgical nor mining industry is using renewable carbon sources, despite the fact that there is a large amount of forest raw materials available in the region. Knowledge of the effects of using bio-coal on mining and metallurgical processes and requirements for different bio-coals for specific processes is lacking. Furthermore, climate change has led to the EU's environmental goals in terms of reduced energy consumption and CO_2 emissions and increased use of renewable energy by 20% to year 2020. The research helps to visualize the possibility that parts or all coal used in metallurgical processes can be replaced by renewable carbon sources and thus to the project's goals such as reducing environmental impact by contributing to reduced fossil CO_2 emissions from metallurgical industries in the region and in Sweden. Bio4Metals will support SMEs growth and contribute to the EU and Sweden's environmental objectives by developing process technologies for the production of bio-coals that are specifically adapted for various metallurgical processes.

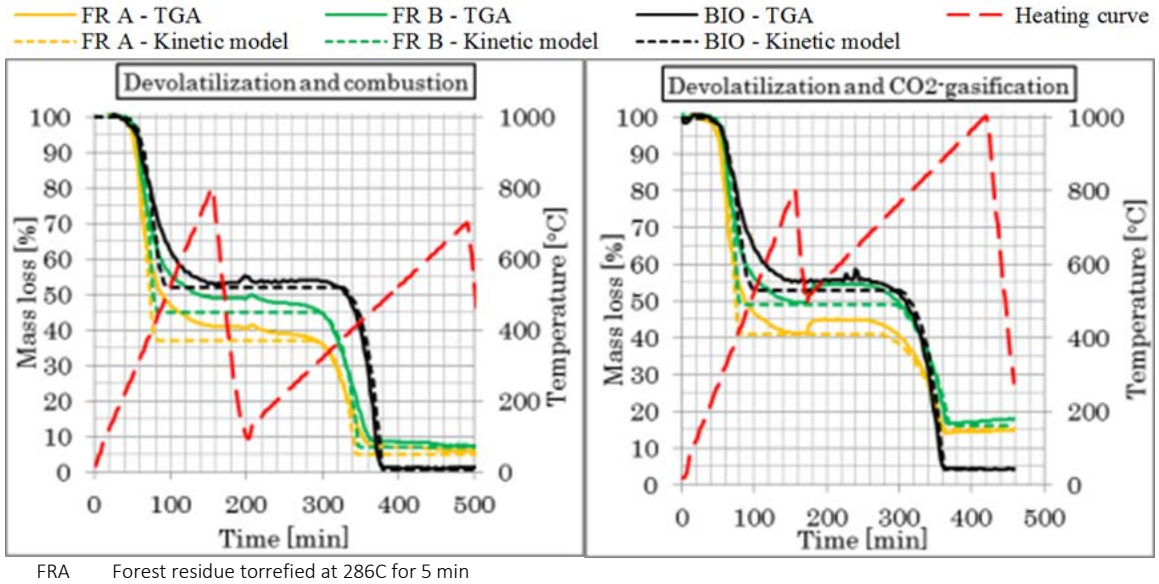
IMPLEMENTED WORK

During the course of the Project, different bio-coals are being produced from different origins under different conditions by means of different processes including pyrolysis, torrefaction, etc… bio-coal produced by BioEndev, Future ECO and Processometri AB are being characterized for their chemical land metallurgical properties. The characterization includes sample preparation, density measurements, particle size distribution, devolatilization, gasification and oxidation. The devolatilization tests were conducted under Argon at a flowrate of 100 ml/min and heating rate of 5 ℃/min while char gasification and oxidation were conducted under CO_2 and synthetic air, respectively, at a flowrate of 200 ml/min and heating rate of 3 ℃ /min. The figure below show some of the tools used for bio-coal characterization.



RESULTS

An example of the theromgravimetric analysis is given in the figure below. the reacctions kinetics are further estimated by means of kinetic models. The reaction behavior, estimated reaction kinteic parameters and other properties are used to evaluate the product toward an application.



FRA Forest residue torrefied at 286C for 5 min
FRB Forest residue torrefied at 325C for 12 min
BIO Saw dust torrefied at 297 for 6 min.

FUTURE WORK

It is intended to continue to characterize the bio-coals developed during the project and establish a defined methodology for evaluating different bio-coals for different applications. Moreover, the estimated kinetic data form the thermogravimetric analysis will be further used as an input to a developed CFD model to simulate the raceway in the blast furnace.

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