NEXT GEN BIOFUEL

Final Project Report

The focus of the specific research project was to examine the effect pre-treatment methods such as leaching and torrefaction+leaching have in the gasification behaviour of several high alkali and chlorine biomass materials as well as on the properties of the producer gas in order to be used as the feedstock to produce liquid fuels.

High alkali and chlorine biomass has a huge potential around the World and as a result its effective utilization could provide significant assistance towards the development of second generation liquid biofuels. The primary work performed by the Grant recipient during this research project was the pre-treatment of several high alkali and chlorine biomass materials such as wheat straw, olive residue, DDGS, switchgrass, arundo donax, etc. using two different pre-treatment techniques (leaching, torrefaction+leaching) and use them as clean feedstock in fluidized bed gasification lab-scale and pilot-scale tests to produce a syn-gas comprised mainly from H_2 and CO that could be used for the production of liquid fuels through various catalytic processes such as the Fischer Tropsch process, and the catalytic mixed alcohols production process.

Gasification tests were performed with only pre-treated biomass feedstock as well as with the use of mixtures of pre-treated biomass and coal as the gasification feedstock. Gasification tests were performed in atmospheric as well as pressurized gasification reactors.

During the project analysis and characterization of the biomass as well as the ash and liquid samples derived from the pre-treatment process were performed by the research assistants working on the specific project under the direct guidance of the Grant recipient.

The results from the gasification tests showed that the pre-treated biomass could be gasified without ash-related problems and with minimum tar production, ash and sulfur emissions. The produced syn-gas was seen to be of similar quality to that produced from the gasification of coal and the same was observed in the case of the liquid fuels produced from this syn-gas.

These results provide a direct proof that the application of pre-treatment methods in high alkali and chlorine biomass could assist significantly towards its effective utilization for the production of energy and liquid fuels with minimum ash-related and emission problems. In this way vast amounts of low quality secondary biomass such as food and agro wastes, energy crops, etc. could be used for the production of second generation liquid biofuels as well as for the production of clean energy with substantial economic and environmental benefits for the European Union and the World.