Characterization of sewage sludge for thermochemical conversion

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Interest in obtain energy or chemical products from biomass or wastes has risen with the objective of decreasing the dependence on fossil fuel. Biomass uses the CO_2 in the atmosphere to live by photosynthesis, so biomass does not contribute to the increase in CO_2 in the atmosphere, it is environmental friendly. Biomass can also be generated locally and make any country less dependent on foreign petroleum resources. Sewage sludge gasification is a promising method to obtain sustainable energy as well as being a waste management option, due to its large quantities and harmful impact on the environment and its restrictive legislation.

Mathematical modelling to predict the product gas qualities during gasification and pyrolysis requires the knowledge of reaction kinetics of the devolatization of biomass and subsequent reactions. Thermogravimetric analysis is very useful in determining reaction kinetics of gasification and pyrolysis (Arenales Rivera *et al.*, 2016).

The objective of this research is to study the chemical properties related to thermochemical conversion of sewage sludge. The sewage sludge used is a digested dry sewage sludge from a waste-water treatment station. Chemical and physical characterizations were done. This information allows predicting the behaviour of these biomasses in the next stage of the research, gasification process in a 100 kw_{th} bubling fluidised bed reactor.

Thermogravimetric analysis was performed in a Mettler-Toledo Star^{e}SW9.20 thermobalance in air and in nitrogen atmosphere of 99.9% purity, in an operation range from 30 ºC to 1000ºC. Thermogravimetric and derivative thermogravimetric curves were recorded simultaneously and can be used to determine the reaction kinetics.

Sewage sludge stands out among other biomass due to its low heating value, high ash content and high content of metals such as Fe, Mg, P and Si, which can be responsible of the low temperature of agglomeration (Wang *et al.*, 2012). In the thermogravimetric analysis the weight losses were found to occur in three stages. The first stage is the dehydration stage and it may correspond to the loss of water and light volatile compounds in the biomass. The second stage of weight loss is due to the decomposition of its substances. The last stage is consequence of the degradation of the wastes produced in the previous stages.

References

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