

Thermal Pre-Treatment of Sewage Sludge in Fluidized Bed for Enhancing Its Solid Fuel Properties

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Abstract : A lab-scale fluidized bed was used for the study of sewage sludge, a non-lignocellulosic biomass, torrefaction. The influence of torrefaction temperature ranging from 200–350 °C and residence time of 0–50 minutes on the physical and chemical properties of the torrefied product was investigated. Properties of the torrefied product were analyzed on the basis of degree of torrefaction, ultimate and proximate analysis, gas analysis and chemical exergy. The degree of torrefaction and chemical exergy had a positive influence on increasing the torrefaction temperature. Moreover, the effect of torrefaction temperature and residence time on the elemental variation of sewage sludge exhibited an increase in the weight percentage of carbon while the content of H/C and O/C molar ratios decreased. The product gas emitted during torrefaction was analyzed to study the pathway of hydrocarbons and oxygen-containing compounds. The compounds with oxygen were emitted at higher temperatures in contrast to hydrocarbon gases. An attempt was made to obtain the chemical exergy of sewage sludge. In addition, the study of various correlations for predicting the calorific value of torrefied sewage sludge was made.

Keywords : chemical exergy, degree of torrefaction, fluidized bed, higher heating value (HHV), O/C and H/C molar ratios, sewage sludge

Conference Title : ICBECT 2018 : International Conference on Biomass Energy and Conversion Technologies

Conference Location : Sydney, Australia

Conference Dates : January 29-30, 2018