

Fast Pyrolysis and Kinetics of Sugarcane Bagasse in Energy Recovery

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Abstract

The trend for material and energy recovery from biomass-waste along with the need to reduce green house gases has led to an increased interest in the thermal processes applied to biomass. The thermal process applied to biomass produces either liquid fuel (bio-oil) or gaseous fuel. Liquid fuel is more preferred because it is easier to transport from one point to another and also it can be used for production of chemicals. One of the biomass obtained in Tanzania is sugarcane bagasse. The sugarcane bagasse is the fibrous materials that remain after sugarcane is crushed to extract juice. Currently, it is burnt directly in the boilers for production of steam, but it can be used for production of bio-oil. The bio-oil can be optimally obtained by fast pyrolysis, which is a fast thermal decomposition of biomass material at temperature range 523–800 K in the absence of an oxidizing agent. In order to undertake a parametric study on the fast pyrolysis of sugarcane bagasse, it is imperative to establish its thermal characteristics. The paper reports the proximate and ultimate analysis, and thermal degradation of sugarcane bagasse in nitrogen as heating agent. The thermal degradation was conducted in a thermo-gravimetric analyzer from room temperature to 1,000 K at different heating rates of 5, 10, 20 and 40 K min⁻¹. The thermo-gravimetric analyzer was used to study the effect of heating rate on the thermal degradation characteristics and to determine mass loss kinetics. The sugarcane bagasse was observed to be suitable for use in pyrolysis since it contains high volatile level of 80.5 % and fixed carbon of 8.2 %. The peak temperature was observed at 573 K at 10 K min⁻¹ and corresponding activation energy was 387.457 kJ/mol.

Keywords

Sugarcane bagasse bio-oil Fast pyrolysis Activation energy Thermo-gravimetric analyzer