Pyrolysis of Biomass to Carbon through Self-Activation: Theory and Applications

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Abstract

Self-activation takes the advantages of the gases emitted from the pyrolysis process of biomass to activate the converted carbon, so that a high-performance activated carbon is obtained. The presentation summarizes the theory of self-activation process of biomass. The BET surface area as a function of the self-activation process is discussed. The productions of gases during the carbonization and activation are used to predict the pyrolysis process. A gas model was developed using the Gaussian function to describe the gas productions in real time for biomass pyrolysis. The gas production readings were recorded using an external gas sensor array and the gas concentrations readings were measured and compared to the results obtained from GC-MS, FTIR, and surface area analysis. The effects of dwelling temperature and temperature ramping rate on the gas production were investigated. Different biomass types were used in the experiments for the self-activation processes. A linear relationship is shown between the BET surface area (SABET) and the yield (ln(SABET) and yield) is established for the self-activation process so that an optimized yield as a function of surface area is estimated. The applications of the resulted activated carbon for water filtration, composites, and battery cathode are discussed in this presentation.

Key Words: Pyrolysis, self-activation, activated carbon