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Evaluation of Thermal Decomposition Kinetics of Borax Pentahydrate Using Genetic Algorithm Method by Isothermal Analysis

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Abstract: The thermal calcination of borax pentahydrate was investigated for both dehydration and decomposition steps at temperatures between 392 and 573 K in a controlled fluidized bed drier. The best kinetic parameters (reaction rate constants, reaction order and equilibrium values) of both steps were determined by the genetic algorithm (GA) method for each calcination temperature in respect of relative standard deviation. The values of the kinetic parameters showed that the dehydration step of borax pentahydrate was controlled by a homogeneous reaction of the order of about 2/3 whereas the decomposition step was controlled by a reaction order of about 1. These kinetic parameters determined by GA were also utilized to compare the experimental results with theoretical calculations. Activation energy was calculated to be 92.88 kJ/mole and 15.94 kJ/mole for the dehydration and decomposition steps, respectively.

Key Words: Borax pentahydrate, dehydration kinetics, decomposition kinetics, genetic algorithm, fluidized bed drier, activation energy

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