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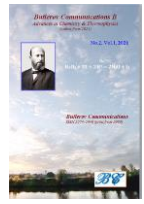

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Features of macrokinetics and kinetic compensation effect in the process of thermolysis of multicomponent hydrocarbon systems

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Abstract

The features of the macrokinetics of high-temperature thermolysis of 450-500 ºC of multicomponent hydrocarbon mixture have been studied (on the example of catalytic cracking gas oil with a boiling point of 280-480 ºC using the example of a fraction of the catalytic cracking process with a boiling point of 340-480 ºC). It was shown by chromatographic analysis that this fraction contains an increased number of aromatic hydrocarbons. The study of kinetics was carried out on a laboratory setup including a thermostated quartz isothermal microreactor. According to the data of experiments carried out in the interval from 30 to 240 min, a two-stage macrokinetics of the thermolysis process was stated. The stages of the process were determined by the nature of the slope of the kinetic curves in the coordinates "product yield – time". The processing of kinetic data was carried out within the framework of the representation of kinetics in heterophase systems using Avraami-Erofeev equation. The results indicate the adequacy of such process description. The kinetic parameters of the thermolysis process have been determined: effective kinetic rate constants, effective activation energies, and Arrhenius pre-exponents. Activation energies are in the ranges of 19.10-113.90 kJ/mol. The value of the rate constant is 1.518-4.430 min^{-1}, which indicates the diffusion limiting stage of the process. In addition, the kinetic compensation effect (KCE) of the thermolysis process was stated, the essence of which is the existence of a linear relationship between the corresponding effective activation energies and Arrhenius pre-exponents. The results obtained confirm earlier investigations in which the KCE phenomena of multicomponent systems were studied. The research results can be used in the optimization of industrial processes of catalytic cracking, delayed coking

and pyrolysis in the oil refining and petrochemical industries, as well as in the mathematical modeling of the corresponding processes.

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