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THERMAL DECOMPOSITION UNDER OXIDATIVE ATMOSPHERE OF LIGNOCELLULOSIC WASTES: DIFFERENT KINETIC METHODS APPLICATION

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Abstract:

Combustion of six lignocellulosic wastes was studied using thermogravimetric analysis. Experimental data were analyzed using different kinetic methods: Kissinger, FWO, DAEM linear multiple regression methods and Coast Redfern method. Also, their thermodynamic parameters (ΔG, ΔH, ΔS) were obtained.

The activation energy (E) and the pre-exponential factor (A) values calculated by the DAEM, FWO and Kissinger methods were higher than those obtained by the linear multiple regression and Coast Redfern methods. The E values obtained from the Kissinger method are consistent with the range of values obtained by the FWO and DAEM methods and are very near to their average values (between 52.75 and 116.92 kJ/mol for all studied agro-industrial wastes). DAEM and FWO methods provides E and A distributions, detecting multi-step kinetics. However, Kissinger method provides only one E and A values for all heating rates, similar to obtained values applying DAEM and FWO methods.

The linear multiple regression method provides the knowledge of kinetic triplets for each studied heating rate, presenting a slower fit than the other methods. On the other hand, Coast Redfern method supplies these triplets and the reaction mechanisms. However, using this method, the obtained E values are very different to the calculated values applying isoconversional methods. Using the last mentioned methods, the models of volume contraction and first order describe the devolatilization and char combustion stages, respectively.

The obtained thermodynamic parameters values show that the lignocellulosic wastes combustion has a low reaction favorability.