

Kinetic parameter estimation for oil shale and its extracted kerogen from El Lajjun oil shale

Omar Al-Ayed

Al-Balqa Applied University, Jordan

The present work compares the estimated activation energy values during pyrolysis of kerogen obtained after acid treatment of Ellajjun oil shale samples with kinetic parameters estimated for oil shale pyrolysis at the same heating rate conditions. The extracted kerogen and oil shale samples are subjected to pyrolysis using a thermogravimetric analyser.

The procedure of Kissinger-Akahira-Sunose, and Flynn-Wall-Ozawa are used to determine the activation energy and frequency factor values. The kinetic parameters are estimated at heating rates of 1, 3, 5, 10, 30, and 50 °C min⁻¹ in a pyrolyzing atmosphere.

Iso-conversional points selected in this research are 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, and 0.9. At these pre-selected points, the rate of transformation of kerogen to products are re-calculated according to the models studied and compared with the experimental values.

The results show that a decrease-increase behaviour of activation energy is observed for kerogen and oil shale pyrolysis within same estimation procedure. Oil shale activation energy is lower than that necessary for kerogen pyrolysis at same iso-conversional points. Depending upon the estimation method. For low oil shale conversion, the activation energies of 200 kJ/mol decreased to approximately 165 kJ/mol at intermediate conversion then increased to 210kJ/mol at higher conversion values, whereas, 220 kJ/mole is estimated for low conversion of kerogen, decreased to 150 kJ/mol and then increased to 225 kJ/mol at higher conversion points.

Finally the rates of transformation are re-calculated according to the models studied and compared with the experimental values.