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Derivation of hydrous pyrolysis kinetic parameters from open-system pyrolysis

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Kinetic information is essential to predict the temperature, timing or depth of hydrocarbon generation within a hydrocarbon system. The most common experiments for deriving kinetic parameters are mainly by open-system pyrolysis. However, it has been shown that the conditions of open-system pyrolysis are deviant from nature by its low near-ambient pressure and high temperatures. Also, the extrapolation of heating rates in open-system pyrolysis to geological conditions may be questionable. Recent study of Lewan and Ruble shows hydrous-pyrolysis conditions can simulate the natural conditions better and its applications are supported by two case studies with natural thermal-burial histories. Nevertheless, performing hydrous pyrolysis experiment is really tedious and requires large amount of sample, while open-system pyrolysis is rather convenient and efficient. Therefore, the present study aims at the derivation of convincing distributed hydrous pyrolysis E_a with only routine open-system Rock-Eval data.

Our results unveil that there is a good correlation between open-system Rock-Eval parameter T_{max} and the activation energy (E_a) derived from hydrous pyrolysis. The hydrous pyrolysis single E_a can be predicted from T_{max} based on the correlation, while the frequency factor (A_0) is estimated based on the linear relationship between single E_a and log A_0. Because the E_a distribution is more rational than single E_a, we modify the predicted single hydrous pyrolysis E_a into distributed E_a by shifting the pattern of E_a distribution from open-system pyrolysis until the weight mean E_a distribution equals to the single hydrous pyrolysis E_a. Moreover, it has been shown that the shape of the E_a distribution is very much alike the shape of T_{max} curve. Thus, in case of the absence of open-system E_a distribution, we may use the shape of T_{max} curve to get the distributed hydrous pyrolysis E_a. The study offers a new approach as a simple method for obtaining distributed hydrous pyrolysis E_a with only routine open-system Rock-Eval data, which will allow for better estimating hydrocarbon generation.