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# Kinetics of the Pyrolysis of Oil Sands Based upon Thermogravimetric Analysis

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**Highlights**

- The pyrolysis kinetics of oil sand was studied by four methods.
- The most probable mechanism function matches General kinetic mechanism functions.
- Distributed activation energy models are used to explore the pyrolysis kinetics.
- The Akaike Information Criteria method are used to determine the optimal model.
- The Weibull model is best fitted with the differential thermogravimetry curve.

**Abstract**
In this work, the pyrolysis kinetics of oil sands were determined based upon the TG-DTG curves. Using the single-step reaction model, the parameters of thermal decomposition kinetics of oil sands, such as the activation energy $E_0$=186.14 kJ/mol, reaction order n=5.21 and pre-exponential factor $A_0$=1.56E13 $s^{-1}$, were obtained. The activation energy values of 185.05 kJ/mol and 162.95 kJ/mol were received by using the Friedman and KAS method, respectively. The result of the most probable mechanism function is not perfectly matched with the common kinetic model, the first order reaction model is not suitable for the study of oil sands' pyrolysis. Using different density probability functions, such as Logistic, Lognormal, Gaussian, Rayleigh and Weibull, the distribution of apparent activation energy of the pyrolysis of oil sands was studied. The Akaike Information Criteria and the calculated kinetic parameters show that the Weibull model is the most suitable model for studying the pyrolysis of oil sands.
Key words: Oil sands; Pyrolysis; Kinetic analysis; DAEM model

## 1. Introduction

Due to depleting fossil reserves in China, oil sands, which are an unconventional energy source, have drawn global attention because of their reserves [1]. Oil sands are usually composed of sand, water and bitumen (heavy oil), and are also known as tar sands, heavy oil sands and