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Letter to the Editor

Abstract

This paper provides reinterpretation of the data reported in an article [1]. The rate constants using a first order kinetic mechanism are evaluated for the untreated and treated Rakata paper. The data allows for the calculation of the activation energy and the frequency factor.

Keywords: Reaction rate; Arrhenius; Rakata paper

Comments on the article "Mechanical properties of the paper sheets treated with different polymers" by S. Kamel, M. El-Sakhawy, A.M.A. Nada, Thermochem. Acta (2004) 421 (1–2) 81–85.

In an article, Kamel et al. [1] have incorrectly stated the Arrhenius equation on page 84 as

$$\ln k = -E/RT \tag{1}$$

According to the above equation, a plot of $\ln k$ versus $1/T$ should result in a straight line with a negative slope that passes through the origin. However, Figs. 7 and 8 in the article [1] show that the line does not pass through the origin. In addition, the line drawn has a positive slope.

The Arrhenius equation as stated in a text by Levenspiel [2] is given by the following:

$$k = k_0 \exp(-E/RT) \tag{2a}$$

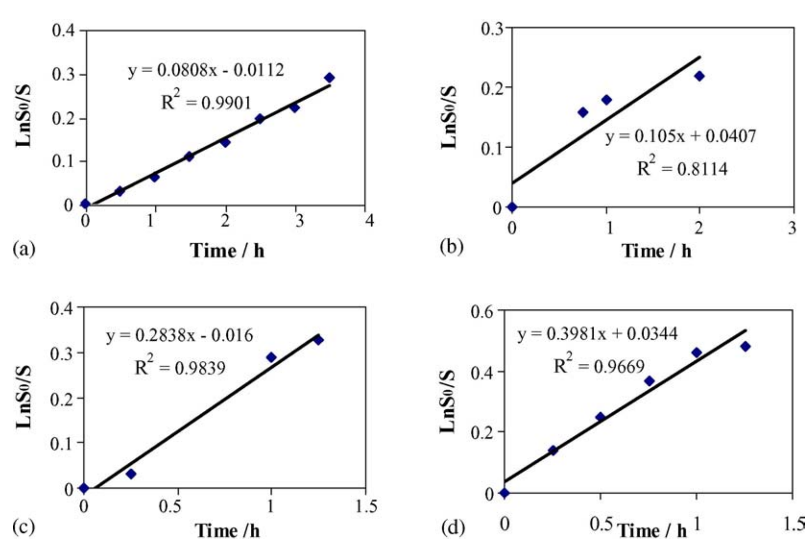

Fig. 1. First order reaction plots for untreated Rakta paper: (a) 170 °C, (b) 180 °C, (c) 190 °C and (d) 220 °C.

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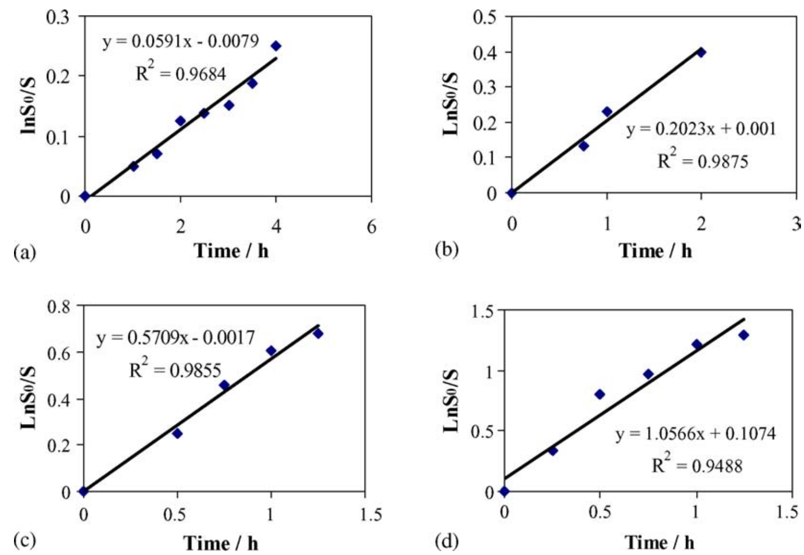

Fig. 2. First order reaction plots for treated Rakta paper: (a) 170 °C, (b) 180 °C, (c) 210 °C and (d) 220 °C.

which can be rewritten as

$$\ln k = \ln k_0 - E/RT \tag{2b}$$

The raw data of breaking length versus time at various temperatures was obtained from Figs. 3 and 4 of the article [1]. A first-order kinetic equation was fitted to the data to estimate the rate constants at four temperatures as shown in Figs. 1 and 2 of this note. The slope of the line is used to determine the rate constant, k for each temperature. The natural log of the rate constant versus the reciprocal of the temperature (Eq. (2b)) is plotted in Figs. 3 and 4 for the untreated and the treated Rakata paper. The slope of the line allows for estimation of the activation energy and the intercept is a measure of the frequency factor. The activation energy of 59.6 and 94 KJ/mol, and the frequency factor of 9.5×10^5 and $9.4 \times 10^9\ h^{-1}$ are obtained for the untreated and treated Rakata paper, respectively.

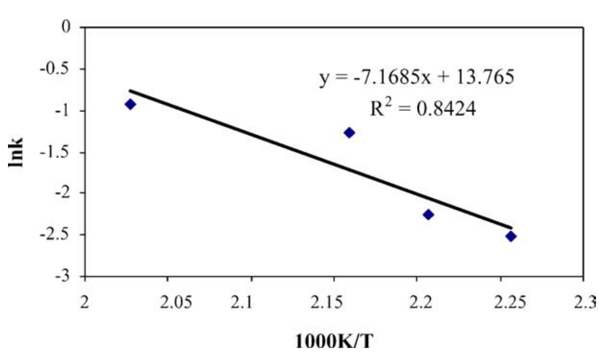

Fig. 3. Arrhenius plot for untreated Rakta paper.

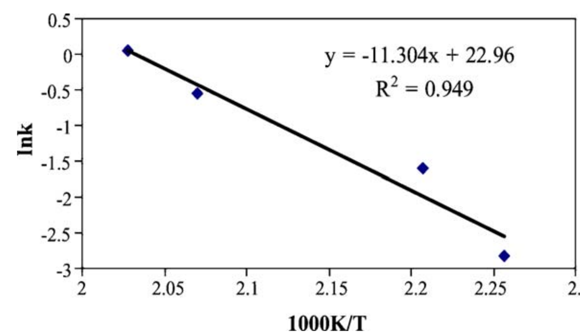

Fig. 4. Arrhenius plot for treated Rakta paper.

References

[1] S. Kamel, M. El-Sakhawy, A.M.A. Nada, Thermochem. Acta (2004) 81–85.

[2] O. Levenspiel, Chemical Reaction Engineering, 3rd ed., John Wiley and Sons, 1999, p. 27.

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