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Discussion

Comment on “Adsorption of Supranol Yellow 4 GL from aqueous solution by surfactant-treated aluminum/chromium-intercalated bentonite”

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Recently, Bouberka et al. [1] published the paper entitled “Adsorption of Supranol Yellow 4 GL from aqueous solution by surfactant-treated aluminum/chromium-intercalated bentonite”, which studied the adsorption of the acid dye Supranol Yellow 4 GL onto an inorgano-organo clay. Their study is undoubtedly informative and useful to researchers who are interested in this field. However, it has come to our attention that some problematic equations have been used in their article.

First, the linear form of pseudo-second-order equation in Section 3.2, i.e. Eq. (3) in their paper, was wrongly expressed as

$$\frac{t}{q_t} = \frac{1}{(k_2 {q_e}^2)} \left(\frac{1}{q_e}\right) t \tag{1}$$

This equation should be written as follows instead,

$$\frac{t}{q_t} = \frac{1}{k_2 {q_e}^2} + \frac{1}{q_e} t \tag{2}$$

The pseudo-second-order equation proposed by Blanchard [2], developed by Ho [3], and derived theoretically by Azizian [4] is written as

$$\frac{dq_t}{dt} = k_2 (q_e - q_t)^2 \tag{3}$$

After integration by using the boundary conditions $q_t = 0$ at $t = 0$ and $q_t = q_t$ at $t = t$, Eq. (3) may be rearranged to Eq. (2) above, or other linear forms of pseudo-second-order equation:

$$\frac{1}{q_e - q_t} = \frac{1}{q_e} + k_2 t \tag{4}$$

$$\frac{1}{q_t} = \frac{1}{q_e} + \frac{1}{k_2 {q_e}^2} \frac{1}{t} \tag{5}$$

$$q_t = q_e - \frac{1}{k_2 q_e} \frac{q_t}{t} \tag{6}$$

$$\frac{q_t}{t} = k_2 {q_e}^2 - k_2 q_e q_t \tag{7}$$

Second, the authors wrongly expressed the Elovich equation in Section 3.2. The equation first proposed by Roginsky and Zeldovich but now generally known as the Elovich equation [5] has been extensively applied to chemisorption data, which should be written as

$$\frac{dq_t}{dt} = \alpha \exp(-\beta q_t) \tag{8}$$

In addition, the authors reported that they computed graphically the Elovich coefficients from the plots of q_t vs $\ln t$ of the linear form of Elovich equation. However, the linear form of Elovich equation was not provided in the paper. We would like to point out that the coefficients may be different from different linear forms of Elovich equation. Given that at $t = 0$, there already exists an adsorbed amount $q_t = q_o$, the integration of Eq. (8) yields

$$q_t = \frac{1}{\beta} \ln(\alpha\beta) + \frac{1}{\beta} \ln\left[t + \frac{1}{\alpha\beta} e^{\beta q_o}\right] \tag{9}$$

Integral data for adsorption kinetics are often presented as q_t vs $\ln(t + t_o)$, where $t_o = 1/\alpha\beta \exp(\beta q_o)$ to make the plot linear. Such

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linear plots are called Elovich integral plots [6]. Provided that $q_t = 0$ at $t = 0$, the integrated form of Eq. (8) becomes

$$q_t = \frac{1}{\beta} \ln \left[t + \frac{1}{\alpha\beta} \right] - \frac{1}{\beta} \ln \frac{1}{\alpha\beta} \tag{10}$$

If $t \gg 1/\alpha\beta$, Eq. (9) is simplified as

$$q_t = \frac{1}{\beta} \ln(\alpha\beta) + \frac{1}{\beta} \ln t \tag{11}$$

While the authors cited a paper published by Ho and McKay [7] for the Elovich equation expression, in which the linear form of Elovich equation was written as

$$q_t = \beta \ln(\alpha\beta) + \ln t \tag{12}$$

As presented above, different coefficients may be obtained if we use these different linear forms of Elovich equations. Thus, we suggest that the authors provide the linear Elovich equation used to make the linear plot in Fig. 5 in their article.

Third, the authors wrongly expressed the standard deviation equation in Section 3.3. The correct form should be written as

$$\Delta q(\%) = 100 \times \sqrt{\frac{\sum [(q_{t,\exp} - q_{t,\mathrm{cal}})/q_{t,\exp}]^2}{n-1}} \tag{13}$$

Besides the above-mentioned points, other possible errors in the paper are not discussed in this comment. We suggest that the authors check back the whole of their article and rectify any possible errors caused by the problematic equations.

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