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Comments on using of "pseudo-first-order model" in adsorption [Int. J. Biol. Macromol., vol. 81]

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In *Int. J. Biol. Macromol.*, volume 81, three articles present the idea of a "pseudo-first-order-model". These are: "Surface ion-imprinted amino-functionalized cellulosic cotton fibers for selective extraction of Cu(II) ions" [1], "Adsorption of methyl orange (MO) by Zr(IV)-immobilized cross-linked chitosan/bentonite composite" [2], and "A new porous magnetic chitosan modified by melamine for fast and efficient adsorption of Cu(II) ions" [3]. In the first [1] and second [2] articles, the authors do not cite any appropriate references. In the third article [3] the authors cited Zhou et al. [4] as a secondary reference. However, there is a mistake included in Ref. [4]. In these two articles [3,4], the authors presented the term "pseudo-first-order model" as the same equation:

$$\frac{1}{q_t} = \frac{k_1}{q_e t} + \frac{1}{q_e} \quad (1)$$

where k_1 is the pseudo-first order rate constant (min^{-1}) for adsorption and q_e and q_t ($mg\,g^{-1}$) are the amounts of adsorbate adsorbed at equilibrium and at time t (min), respectively." In fact, Eq. (1) is not correct. Units of parameters in Eq. (1) cannot agree each other. Thus the results in these particular papers might not be correct. The same mistake can be also found in several other articles that include Monier among the authors [5–22].

In 1898, Lagergren first presented the first order rate equation for the adsorption of oxalic acid and malonic acid on to charcoal [23]. In order to distinguish this kinetics equation – based on concentration of solution and adsorption capacity of solids – Lagergren's first order rate equation has been called pseudo-first order since 1998 [24]. Details of Lagergren's rate equation for adsorption reactions were published in 2004 [25]. The most popular form used is:

$$\log(q_e - q_t) = \log(q_e) - \frac{k}{2.303}t$$

q_e and q_t ($mg\,g^{-1}$) are the adsorption capacities at equilibrium and at time t respectively. k (min^{-1}) is the rate constant of pseudo-first order adsorption.

In recent years, use of the wrong "pseudo-first-order model" in adsorption can be found in number of journals [26,27]. However, only a few related comments have been published in relevant journals, for example *Journal of Environmental Sciences—China* [26] and *Food Chemistry* [28]. This type of error could be avoided if authors paid more attention to details in the original paper. In addition, when the authors of a scientific publication duplicate previously published ideas, texts, or figures in the scientific literature without any citations, this can be counted as plagiarism [29]. Citing the original papers respects the work of the authors who present novel research ideas. In my view, Monier et al. [1], Zhang et al. [2], and Wu et al. [3] should have cited the original paper for the pseudo-first order kinetic model and thereby provided greater accuracy and information about the kinetic expression they employed.

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