Letter to the Editor

Comments on using of "pseudo-first-order model" [J. Taiwan Inst. Chem. Eng. Vol. 59]

In J. Taiwan Inst. Chem. Eng., volume 59, two papers, entitled "Phosphate adsorption from aqueous solutions by zirconium (IV) loaded cross-linked chitosan particles" [1] and "Comparative study of naphthalene adsorption on activated carbon prepared by microwave-assisted synthesis from different typical coals in Xinjiang" [2], presented the "pseudo-first-order model" as:

$$\frac{1}{q_t} = \frac{1}{q_e} + \frac{k_1}{q_e t} \tag{1}$$

and cited secondary material to be references. Toor and Jin [3] was cited in the paper by Liu et al. [1] and Maldhure and Ekhe [4] in the paper by Liu et al. [2]. However, Eq. (1) could not be found in the cited reference Maldhure and Ekhe [4].

Authors also presented pseudo-second-order kinetic rate equation in both papers [1,2] as:

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

In fact, Eqs. (1) and (2) are the same. From Eqs. (1) and (2), k_1 can be obtained as:

$$k_1 = \frac{1}{k_2 q_e}$$

In addition, the pseudo-first-order model, Eq. (1), is incorrect. Thus results and conclusion in "Phosphate adsorption from aqueous solutions by zirconium (IV) loaded cross-linked chitosan particles" [1] and "Comparative study of naphthalene adsorption on activated carbon prepared by microwave-assisted synthesis from different typical coals in Xinjiang" [2] might not be appropriate.

In 1898, Lagergren firstly proposed the first order rate equation for the adsorption of oxalic acid and malonic acid onto charcoal [5]. In order to distinguish kinetics equation based on concentration of solution and adsorption capacity of solid, Lagergren's first order rate equation has been called pseudo-first order since 1998 [6,7]. In addition, a citation review of Lagergren's kinetic rate equation on adsorption reactions has been published by Ho [8]. The most popular form used is:

$$\log (q_e - q_t) = \log (q_e) - \frac{k}{2.303}t \tag{3}$$

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

In recent years, the same mistake can be found in Desalination and Water Treatment [9], Separation Science and Technology [10], Chemical Engineering Journal [11,12], International Journal of Biological Macromolecules [13], Carbohydrate Polymers [14], Applied Clay Science [15], Journal of Hazardous Materials [16], Journal of Colloid and Interface Science [17], Journal of Industrial and Engineering Chemistry [18], RSC Advances [19], and Water Science and Technology [20]. However less related comments were accepted in some journals, such as Food Chemistry [21], Journal of Molecular Liquids [22], Journal of Environmental Sciences-China [23], Journal of Hazardous Materials [24], Applied Clay Science [25], and International Journal of Biological Macromolecules [26].

Similarly, three papers with the same mistakes were published in the same volume in International Journal of Biological Macromolecules [26]. This type of error could be avoided if authors paid more attention to details in the original paper [24]. Greater emphasis and responsibility must be placed on authors to check the accuracy of cited references in their submitted manuscripts [27]. Reviewers should also take the responsibility for this section of the manuscript. Finally the journal editors have to insist on reference accuracy in article accepted for publication [28]. Citing the original paper not only respects the authors who presented a novel idea in research, but also directs readers to the details of the original work [29]. In my view, Liu et al. should have cited the original paper for the kinetic models and thereby provided greater accuracy and information details about the kinetic expression they employed.

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Yuh-Shan Ho*

Water Research Centre, Asia University, Taichung 41354, Taiwan

* Fax: +886 4 2330 5834.

E-mail address: ysho@asia.edu.tw