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Letter to the Editor

Comment on "Adsorption of naphthalene on zeolite from aqueous solution" by C.F. Chang, C.Y. Chang, K.H. Chen, W.T. Tsai, J.L. Shie, Y.H. Chen

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Abstract

A paper contributes not only by its originality and creativity, but also by its continuity and development toward subsequent research. Referencing and quotation accuracy are an important part of a scientific article. This study presents a literature review concerning the precision of 50 first authors' publications, which originally cited Ho's pseudo-second-order kinetic expression paper in kinetics model for solute sorption on various sorbents. This model applies to a range of solid–liquid systems such as metal ions, dyestuffs, herbicides, oil, and organic substances in aqueous systems onto various sorbents. In addition, citations of Lagergren and Elovich rate equations are also discussed. This comment offers information for citing the original idea of Ho's pseudo-second-order kinetic expression and Lagergren's pseudo-first-order kinetic equation. It is also suggested that the cited paper should be accurately quoted.

Keywords: Sorption; Kinetics; Pseudo-second-order; Pseudo-first-order; Citation

Recently, Chang et al. published a paper entitled "Adsorption of naphthalene on zeolite from aqueous solution" [1]. In Section 3.2.1, "Pseudo-first-order process," the authors mentioned Eqs. (8) and (9) and cited Cheung et al. [2] as a secondary reference. A citation review of the Lagergren rate equation for adsorption reactions has been presented [3]. Ho and McKay first presented the correct reference citing the original Lagergren paper in 1998. That is "Lagergren, S. (1898), Zur theorie der sogenannten adsorption gelöster stoffe. Kungliga Svenska Vetenskapsakademiens Handlingar, Band **24**, No. 4, 1–39" ["Lagergren, S. (1898), About the theory of so-called adsorption of soluble substances. Kungliga Svenska Vetenskapsakademiens Handlingar, Band **24**, No. 4, 1–39"], and the abbreviated style is "Lagergren, S. (1898), Zur theorie der sogenannten adsorption gelöster stoffe. K. Sven. Vetenskapsakad. Handl., Band **24**, No. 4, 1–39." In order to distinguish a kinetic equation based on the adsorption capacity of a solid from one based on the concentration of a solution, Lagergren's first-order rate equation has been called pseudo-first-order [4–7]. Ho pointed that Lagergren's equation has been widely cited, but there are far more mistakes made in the reference sections of papers than anywhere else, including the authors' name, journal title, year, volume, and page number [3]. It is clear that most of the papers citing Lagergren's original paper published in 1898 are incorrect. However, numerous researchers use secondary references without knowing that mistakes have already been made in their sources of references, such as taking references straight from secondary references.

In Section 3.2.2, "Pseudo-second-order process," the authors cited Cheung et al. [2] for a pseudo-second-order model to describe adsorption of naphthalene onto zeolite from aqueous solution using Eqs. (10) and (11). In fact, Cheung et al. [2] did not mention a pseudo-second-order model in their paper. The second-order kinetic expression for the adsorption systems of divalent metal ions using

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Table 1
Numerous authors have cited pseudo-second-order kinetic models from the literature

Authors	Sorbent	Sorbate
Abdulkarim and Abu Al-Rub [34]	Activated carbon	Pb(II)
Abu Al-Rub [35]	Phosphate	Pb(II)
Acemioğlu [36]	Fly ash	Congo Red
Aksu et al. [37]	Activated carbon	2,4-Dichlorophenoxy-acetic acid (2,4-D)
Al-Asheh et al. [38]	Pyrolyzed, oil shale residue	4-Nitrophenol
Banat et al. [39]	Activated carbon	Phenol
Basso et al. [40]	Activated carbon	Cd(II), Ni(II)
Bektas and Soysal [41]	Clinoptilolite	Phosphate
Benaissa and Benguella [42]	Chitin	Cd(II)
Beolchini et al. [43]	Rice hull	Cr(VI), Cu(II)
Chiron et al. [44]	Grafted silica	Pb(II), Cu(II)
Cho et al. [45]	*Rhodotorula aurantiaca*	Pb(II)
Demirbas [46]	Hazelnut shells	Co(II)
Doğan et al. [47]	Perlite	Methylene Blue
Fiol et al. [48]	Grape stalks	Cr(VI)
Fu and Viraraghavan [49]	*Aspergillus niger*	Congo Red
Gündoğan et al. [50]	Peat	Cu(II)
Hamadi et al. [51]	Waste tires, sawdust	Cr(VI)
Jadhav and Vanjara [52]	Sawdust	Phenol
Jain et al. [53]	Blast furnace slag, dust, sludge, carbon slurry	Phenols
Kapoor et al. [54]	*Aspergillus niger*	Pb(II), Cd(II), Cu(II), Ni(II)
Keskinkan et al. [55]	*Myriophyllum spicatum*	Pb(II), Zn(II), Cd(II)
Krishnan et al. [56]	Activated carbon	Pb(II), Hg(II), Cd(II), Co(II)
Lazaridis and Asouhidou [57]	Calcined Mg–Al–CO_3 hydrotalcite	Cr(VI)
Low et al. [58]	Spent grain	Pb(II), Cd(II)
Manohar et al. [59]	2-Mercaptobenzimidazole–clay	Hg(II)
Mathialagan and Viraraghavan [60]	Phosphate	Aluminum-impregnated mesoporous
Min et al. [61]	Base-treated juniper fiber	Cd(II)
Namasivayam and Kavitha [62]	Coir pith carbon	Congo Red
Loukidou et al. [63]	*Aeromonas caviae*	Cr(VI)
Onyango et al. [64]	Zeolite	As(V)
Özacar [65]	Calcined alunite	Phosphorus
Özer [66]	*Schizomeris leibleinii*	Pb(II)
Petroni et al. [67]	Peat	Cu(II)
Quek et al. [68]	Coir	Cu(II), Pb(II)
Reddad et al. [69]	Sugar beet pulp	Pb(II), Cu(II), Zn(II), Cd(II), Ni(II)
Sağ and Aktay [70]	Chitin, chitosan, *Rhizopus arrhizus*	Cr(VI), Cu(II)
Shawabkeh and Tutunji [71]	Diatomaceous earth	Methylene Blue
Shibi and Anirudhan [72]	Banana stalk [*Musa paradisiaca*]	Hg(II)
Shin et al. [73]	*Rhizopus oligosporus*	Cu(II)
Singh et al. [74]	Microcystis	Ni(II), Cr(VI)
Sun and Yang [75]	Peat–resin particle	Basic Magenta, Basic Brilliant Green
Tang et al. [76]	Perlite	Cd(II)
Taty-Costodes et al. [77]	Sawdust	Cd(II), Pb(II)
Thirunavukkarasu et al. [78]	Iron oxide-coated sand	As(V), As(III)
Unnithan et al. [79]	Coconut coir pith	Cr(VI)
Vasudevan et al. [80]	Baker's yeast	Cd(II)
Viraraghavan and Moazed [81]	Na-bentonite	Oil
Yan and Viraraghavan [82]	*Mucor rouxii*	Pb(II), Cd(II), Ni(II), Zn(II)
Zhao et al. [83]	Microporous titanosilicate ETS-10	Pb(II)

sphagnum moss peat has been reported by Ho [8]. In order to distinguish a kinetic equation based on the adsorption capacity of solids from one based on the concentration of solutions, Ho's second-order rate expression has been called pseudo-second-order [4–84]. The earlier application of the pseudo-second-order equation to the kinetic studies of competitive heavy metal adsorption by sphagnum peat moss was undertaken by Ho et al. [30]. In addition, a modified pseudo-second-order kinetic expression has been reported since 1997 [31]. The modified model was also reported in subsequent years [4–7,9–29,31–84]. Azizian presented a theoretical analysis of pseudo-second-order equations [84]. The most frequently cited pseudo-second-order kinetic expression papers were published in *Adsorption—Journal of the International Adsorption Society* [32], *Environmental Technology* [30], *Process Safety and Environmental Protection* [4,5], *Journal of Environmental Science and Health, Part A—Toxic/Hazardous Substances and Envi-*

ronmental Engineering [18], *Chemical Engineering Journal* [6], *Resources, Conservation and Recycling* [19], *Process Biochemistry* [10], and *Water Research* [11]. In addition, similar comments have also been published in *Adsorption Science and Technology* [20], *Journal of Colloid and Interface Science* [21,22], *Journal of Chemical Technology and Biotechnology* [23], *Biochemical Engineering Journal* [24], *Bioresource Technology* [25], and *Fresenius Environmental Bulletin* [26].

In Section 3.2.3, "Elovich rate equation," the authors mentioned Eqs. (4)–(6) and cited Cheung et al. [2] as a secondary reference again. In this reference, the authors made mistake in citing of the Elovich rate equation.

The pseudo-second-order rate expression of Ho has been widely applied to the sorption of metal ions, dyes, herbicides, oil, and organic substances from aqueous solutions. Numerous authors have cited Ho's pseudo-second-order rate expression in sorption systems (Table 1). Moreover, discussion of the reaction order has been reported such as the comparison of chemisorption kinetic models [4] and pseudo-second-order model [10]. Furthermore, Ho's kinetic expression has also been applied to a multistage batch adsorption design [15,16] and pseudo-isotherm studies [17,33].

A paper contributes not only by its originality and creativity, but also by its continuity and development toward subsequent research. Readers of published scientific articles may wish to retrieve cited references to further their follow-up researches and knowledge or to confirm claims made by the researchers [85]. The reference section can play a key role for researchers who are interested in the paper's statement and would like to follow the study or find useful information from the paper [3]. I suggest that Chang et al. cite Lagergren's pseudo-first-order kinetic model paper, Ho's original pseudo-second-order kinetic expression paper, and the original Elovich rate equation paper or relevant work which should be correct.

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