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Comment

Comment on “Sorption of basic dyes from aqueous solution by activated sludge” [J. Hazard. Mater. 108 (2004) 183–188]☆

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Recently, Gulnaz et al. [1] published the paper entitled as above. In Section 3.5 – Adsorption kinetics, authors mentioned that “Adsorption kinetics can be modeled by the pseudo-first-order Lagergren equation [2], second-order equation [3] and pseudo-second-order rate equation [4] given below as (1) (2) and (3), respectively.

$$\log(q_1 - q_t) = \log(q_1) - \frac{k_1}{2.303}t \tag{1}$$

$$\frac{1}{q_e - q_t} = \frac{1}{q_e^2} + kt \tag{2}$$

$$\frac{t}{q_t} = \frac{1}{kq_e^2} + \frac{1}{q_e}t \tag{3}$$

In fact, it is Lagergren [5] who first presented the first-order rate equation for the adsorption of ocalic acid and malonic acid onto charcoal. Lagergren’s kinetics equation has been most widely used for the adsorption of an adsorbate from an aqueous solution. In order to distinguish kinetics equation based on adsorption capacity of solid from concentration of solution, Lagergren’s first-order rate equation has been called pseudo-first-order since 1998 [6–9]. In addition, citation review of Lagergren kinetic rate equation on adsorption reactions has also been presented [10].

For second-order equation, authors cited Raji and Anirudhan [3], in which there is nothing about second-order equation discussion and Eq. (2). Furthermore, the Eq. (2) is not correct by checking the terms of units. If so, Eq. (2) should be as follows:

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

However, Eq. (4) is the same as second-order equation as Eq. (3). Authors cited Zhang et al. [4] for the pseudo-second-order equation and Eq. (3). In fact, Zhang et al. [4] reported “Removal of lead from aqueous solution by non-living *Rhizopus nigricans*” where they did not mention any thing about pseudo-second-order kinetic and the equation. Similar comments have also been published in *Adsorption Science & Technology* [11], *Journal of Colloid and Interface Science* [12,13], *Journal of Chemical Technology and Biotechnology* [14], *Biochemical Engineering Journal* [15], and *Bioresource Technology* [16].

In fact, the second-order kinetic expression for the adsorption systems of divalent metal ions using sphagnum moss peat has been reported by Ho [17]. In order to distinguish kinetics equation based on adsorption capacity of solid from concentration of solution, Ho’s second-order rate expression has been named pseudo-second-order [6–33]. The earlier application of the pseudo-second-order equation to the kinetic studies of competitive heavy metal adsorption by sphagnum moss peat was undertaken by Ho et al. [34]. In addition, a modified pseudo-second-order kinetic expression has been reported since 1997 [33]. The model has also been presented in following years [6–16,18–33]. The most frequently cited papers were published in *Environmental Technology* [34], *Process Safety and Environmental Protection* [6,7], *Chemical Engineering Journal* [8], *Journal of Environmental Science and Health Part A–Toxic/Hazardous Substances & Environmental Engineering* [18], *Resources, Conservation and*

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Table 1
Pseudo-second-order kinetic model of various related systems from the literature

Sorbent	Sorbate	References
2-Mercaptobenzimidazole–clay	Hg(II)	[35]
Activated carbon	Hg(II)	[36]
Activated carbon	Pb(II), Hg(II), Cd(II), Co(II)	[37]
Activated carbon	Cd(II)	[38]
Activated carbon	Pb(II)	[39]
Activated carbon	Methylene blue	[40]
Activated carbon	Cd(II)	[41]
Activated carbon	Phenol	[42]
Activated carbon	Cd(II), Ni(II)	[43]
Activated carbon	2,4-dichlorophenoxy-acetic acid (2,4-D)	[44]
Activated clay	Basic red 18, Acid blue 9	[29]
Aspergillus niger	Pb(II), Cd(II), Cu(II), Ni(II)	[45]
Aspergillus niger	Basic blue 9	[46]
Aspergillus niger	Acid blue 29	[47]
Aspergillus niger	Congo red	[48]
Baker's yeast	Cd(II)	[49]
Banana stalk [*Musa paradisiaca*]	Hg(II)	[50]
Base-treated juniper fiber	Cd(II)	[51]
Beech leaves	Cd(II)	[20]
Bi_2O_3	Cr(VI)	[20]
Blast furnace slag, dust, Sludge, carbon slurry	Phenols	[52]
Bottom ash	Cu(II) and Pb(II)	[20]
Calcined alunite	Phosphorus	[53]
Calcined Mg-Al-CO_3 hydrotalcite	Cr(VI)	[54]
Chitin, chitosan, *Rhizopus arrhizus*	Cr(VI), Cu(II)	[55]
Coir	Cu(II), Pb(II)	[56]
Coir pith carbon	Congo red	[57]
Cypress leaves	Pb(II)	[20]
Date pits	Methylene blue	[58]
Diatomaceous earth	Methylene blue	[59]
Fly ash	Omega chrome red ME, *o*-cresol, *p*-nitrophenol	[18]
Fly ash	Victoria blue, OCL, PNP, OCRME	[20]
Grafted silica	Pb(II), Cu(II)	[60]
Iron oxide-coated sand	As(V), As(III)	[61]
Microcystis	Ni(II), Cr(VI)	[62]
Microporous titanosilicate ETS-10	Pb(II)	[63]
Mixed clay/carbon	Acid blue 9	[30]
Mucor rouxii	Pb(II), Cd(II), Ni(II), Zn(II)	[64]
Myriophyllum spicatum	Pb(II), Zn(II), Cd(II)	[65]
Na-bentonite	Oil	[66]
Peat	Basic blue 69, Acid blue 25	[20]
Peat	Cu(II)	[67]
Peat	Cu(II)	[68]
Peat	Cu(II)	[20]
Peat-resin particle	Basic magenta, Basic brilliant Green	[69]
Perlite	Cd(II)	[70]
Phosphate	Aluminum-impregnated mesoporous	[71]
Pith	Basic red 22, Acid red 114	[19]
Reed leaves	Cd(II)	[20]
Rhizopus oligosporus	Cu(II)	[72]
Sago	Cu(II), Pb(II)	[73]
Sawdust	Cd(II), Pb(II)	[74]
Sawdust	Phenol	[75]
Schizomeris leibleinii	Pb(II)	[76]
Spent grain	Pb(II), Cd(II)	[77]
Sphagnum moss peat	Cu(II), Ni(II)	[34]
Sphagnum moss peat	Chrysoidine (BO2), Astrazon blue (BB3), Astrazone blue (BB69)	[9]
Sphagnum moss peat	Cu(II), Ni(II), Pb(II)	[21]
Sugar beet pulp	Pb(II), Cu(II), Zn(II), Cd(II), Ni(II)	[78]
Sugar beet pulp	Pb(II)	[79]
TNSAC	Phosphate	[20]
Tree fern	Cd(II)	[24]
Tree fern	Cu(II)	[28]

Table 1 (*Continued*)

Sorbent	Sorbate	References
Tree fern	Pb(II)	[32]
Vermiculite	Cd(II)	[80]
Waste tyres, sawdust	Cr(VI)	[81]
Wollastonite	Ni(II)	[20]
Wood	Basic blue 69, Acid blue 25	[7]

Recycling [19], *Process Biochemistry* [20] and *Water Research* [21].

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 (Table 1). Moreover, discussion of the reaction order has been reported, for example, the comparison of chemisorption kinetic models [6], and pseudo-second-order model [20]. Furthermore, Ho's kinetic expression has also been applied to a multi-stage batch sorption design [22,23] and pseudo-isotherm studies [24].

Research papers conventionally include an introduction, a description of the objectives and procedures of the study, an account of the results and a discussion of the results and their implications. However, a paper's contribution existed not only in its originality and creativity, but also in its continuity and development for the following researches. The reference section can play a key role to researchers that were interested in the paper's statement and would like to follow the study or find useful information from the paper [10]. Calne and Calne suggested that authors should cite relevant work of others, as well as their own [82]. Authors could merely be instructed to include key citations in their introduction and to verify, in writing, that they have fully reviewed published work [81]. I suggest that Gulnaz et al. cite Ho's original pseudo-second-order kinetic expression paper or relevant works.

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