Comment on "Arsenic Removal Using Mesoporous Alumina Prepared via a Templating Method"

In a recent publication of Kim et al. (*1*), the Results and Discussion cited Quek et al. (*2*) for a recently introduced pseudo-second-order equation for describing the adsorption of arsenic to MA:

$$\frac{t}{q_t} = \frac{1}{k_{ad}q_e^2} + \frac{1}{q_e}t \qquad (9)$$

where k_{ad} is the rate constant of adsorption (in g mg^{-1} min^{-1}). The initial sorption rate, h (mg g^{-1} min^{-1}), as $t \rightarrow 0$ can be defined as

$$h = k_{ad}q_e^2 \qquad (10)$$

These equations that Kim et al. (*1*) presented are not the same as referenced since Quek et al. (*2*) cited Ho's original pseudo-second-order model (*3*). The second-order kinetic expression for the adsorption systems of divalent metal ions using sphagnum moss peat has been reported by Ho (*4*). To distinguish kinetics equation based on adsorption capacity of solid from concentration of solution, Ho's second-order rate equation has been called pseudo-second-order (*3*−*14*). The earlier application of the pseudo-second-order equation to the kinetic studies of competitive heavy metal adsorption

TABLE 1. Pseudo-Second-Order Kinetic Model of Various Related Systems from the Literature

sorbent	sorbate	ref
2-mercaptobenzimidazole-clay	Hg(II)	*17*
activated carbon	Hg(II)	*18*
activated carbon	Pb(II), Hg(II), Cd(II), Co(II)	*19*
activated carbon	Cd(II)	*20*
activated carbon	Pb(II)	*21*
activated carbon	methylene blue	*22*
activated carbon	Cd(II)	*23*
activated clay	Basic Red 18, Acid Blue 9	*24*
activated carbon	phenol	*25*
Arundo canes	Cd(II), Ni(II)	*26*
Aspergillus niger	Pb(II), Cd(II), Cu(II), Ni(II)	*27*
Aspergillus niger	Basic Blue 9	*28*
Aspergillus niger	Acid Blue 29	*29*
Aspergillus niger	congo red	*30*
Baker's yeast	Cd(II)	*31*
banana stalk (*Musa paradisiaca*)	Hg(II)	*32*
base-treated juniper fiber	Cd(II)	*33*
calcined alunite	phosphorus	*34*
calcined Mg−Al−CO_3 hydrotalcite	Cr(VI)	*35*
chitin, chitosan (*Rhizopus arrhizus*)	Cr(VI), Cu(II)	*36*
coir	Cu(II), Pb(II)	*37*
coir pith carbon	congo red	*38*
date pits	methylene blue	*39*
diatomaceous earth	methylene blue	*40*
fly ash	Omega Chrome Red ME, *o*-cresol, p-nitrophenol	*41*
grafted silica	Pb(II), Cu(II)	*42*
microcystis	Ni(II), Cr(VI)	*43*
microporous titanosilicate ETS-10	Pb(II)	*44*
mixed clay/carbon	Acid Blue 9	*45*
Mucor rouxii	Pb(II), Cd(II), Ni(II), Zn(II)	*46*
Myriophyllum spicatum	Pb(II), Zn(II), Cd(II)	*47*
Na-bentonite	oil	*48*
peat	Basic Blue 69, Acid Blue 25	*5*
peat	Cu(II)	*49*
peat-resin particle	basic magenta, basic brilliant green	*50*
perlite	Cd(II)	*51*
phosphate	aluminum-impregnated mesoporous	*52*
pith	Basic Red 22, Acid Red 114	*53*
sugar beet pulp	Pb(II), Cu(II), Zn(II), Cd(II), Ni(II)	*54*
sago	Cu(II), Pb(II)	*2*
sawdust	Cd(II), Pb(II)	*55*
Schizomeris leibleinii	Pb(II)	*56*
spent grain	Pb(II), Cd(II)	*57*
sphagnum moss peat	Cu(II), Ni(II)	*3*
sphagnum moss peat	Chrysoidine (BO2), Astrazon Blue (BB3), Astrazone Blue (BB69)	*58*
sphagnum moss peat	Cu(II), Ni(II), Pb(II)	*7*
tree fern	Cu(II)	*59*
tree fern	Pb(II)	*60*
vermiculite	Cd(II)	*61*
waste tyres, sawdust	Cr(VI)	*62*
wood	Basic Blue 69, Acid Blue 25	*63*

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by Sphagnum moss peat was undertaken by Ho et al. (*3*). The modified model has also been reported in following years (*5*−*16*). The most cited related papers were published in *Chemical Engineering Journal* (*5*), *Process Biochemistry* (*6*), and *Water Research* (*7*). In addition, similar comments have also been published in *Adsorption Science & Technology* (*8*), *Journal of Colloid and Interface Science* (*9*, *10*), *Journal of Chemical Technology and Biotechnology* (*11*), and *Biochemical Engineering Journal* (*12*). The equations Kim et al. used are Ho's modified pseudo-second-order model (*5*−*16*).

The pseudo-second-order rate expression of Ho has been applied to the adsorption of metal ions, dyes, organic substances, and oil from aqueous solutions (Table 1). Moreover, discussion of the reaction order has been reported such as the comparison of chemisorption kinetic models (*13*) and pseudo-second-order model (*6*). Furthermore, Ho's kinetic expression has also been applied to a multi-stage batch adsorption design (*14*, *15*) and pseudo-isotherm studies (*16*). Numerous applications of Ho's kinetic expression have been reported in recent years. A list of pseudo-second-order systems is given in Table 1.

A research paper's contribution exists not only in its originality and creativity but also in its continuity and development for research that follows. The reference section can play a key role to researchers who are interested in a paper's statement or who would like to follow the study or find useful information from the paper (*64*). I suggest that Ho's original pseudo-second-order kinetic expression paper should be cited by Kim et al. (*1*).

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