

Letter to the Editor

Comment on 'Biosorption of Cadmium Using the Fungus *Aspergillus niger*.' by Barros, L.M., Macedo, G.R., Duarte, M.M.L., Silva, E.P. and Lobato, A.K.C.L.

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In a recent publication Macedo et al. (2003), the section Results and Discussions, authors mentioned a pseudo-second-order Lagergren equation in Eq. (3). In fact, it is Ho (1995) who first developed a pseudo-second order kinetic expression for the adsorption systems of divalent metal ions using sphagnum moss peat. 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. (1996).

The pseudo-second order rate expression of Ho has also been applied to the sorption of metal ions, dyes, and organic substances from aqueous solutions

(Table 1). In addition, discussion of the reaction order has been reported such as the comparison of chemisorption kinetic models (Ho and McKay, 1998a) and pseudo-second order model (Ho and McKay, 1999a). Furthermore, Ho's kinetic expression has also been applied to a multi-stage batch sorption design (Ho and McKay, 1999b) and a two-stage batch sorption optimized design (Ho and McKay, 1998b). 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.

I suggest that Macedo et al. cite Ho's original pseudo-second order kinetic expression paper.

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

Sorbent	Sorbate	References
2-Mercaptobenzimidazole-clay	Hg(II)	Manohar et al., 2002
Activated carbon	Hg(II)	Krishnan and Anirudhan, 2002a
Activated carbon	Pb(II), Hg(II), Cd(II), Co(II)	Krishnan and Anirudhan, 2002b
Activated carbon	Cd(II)	Krishnan and Anirudhan, 2003
Activated carbon	Pb(II)	Krishnan et al., 2003
Activated carbon	Cd(II), Ni(II)	Basso et al., 2002
Activated clay	Basic Red 18, Acid Blue 9	Ho et al., 2001
<i>Aspergillus niger</i>	Pb(II), Cd(II), Cu(II), Ni(II)	Kapoor et al., 1999
<i>Aspergillus niger</i>	Basic Blue 9	Fu and Viraraghavan, 2000
<i>Aspergillus niger</i>	Acid Blue 29	Fu and Viraraghavan, 2001
<i>Aspergillus niger</i>	Congo Red	Fu and Viraraghavan, 2002
Baker's yeast	Cd(II)	Vasudevan et al., 2003
Banana stalk <i>Musa paradisiaca</i>	Hg(II)	Shibi and Anirudhan, 2002
Calcined alunite	Phosphorus	Özacar, 2003
Chitin, Chitosan, <i>Rhizopus arrhizus</i>	Cr(VI), Cu(II)	Sag and Aktay, 2002
Coir	Cu(II), Pb(II)	Quek et al., 1998a
Coir pith carbon	Congo Red	Namasivayam and Kavitha, 2002

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Continuation Table 1

Fly ash	Omega Chrome Red ME, o-cresol, p-nitrophenol	Ho and McKay, 1999c
Grafted silica	Pb(II), Cu(II)	Chiron et al., 2003
Microcystis	Ni(II), Cr(VI)	Singh et al., 2001
Microporous titanosilicate ETS-10	Pb(II)	Zhao et al., 2003
Mixed clay/carbon	Acid Blue 9	Ho and Chiang, 2001
Peat	Basic Blue 69, Acid Blue 25	Ho and McKay, 1998c
Peat-resin particle	Basic Magenta, Basic Brilliant Green	Sun and Yang, 2003
Perlite	Cd(II)	Mathialagan and Viraraghavan, 2002
Pith	Basic Red 22, Acid Red 114	Ho and McKay, 1999d
Sugar beet pulp	Pb(II), Cu(II), Zn(II), Cd(II), Ni(II)	Reddad et al., 2002
Sago	Cu(II), Pb(II)	Quek et al., 1998b
Spent grain	Pb(II), Cd(II)	Low et al., 2000
Sphagnum moss peat	Cu(II), Ni(II)	Ho et al., 1996
Sphagnum moss peat	Chrysoidine (BO2), Astrazon Blue (BB3), Astrazone Blue (BB69)	Ho and McKay, 1998d
Sphagnum moss peat	Cu(II), Ni(II), Pb(II)	Ho and McKay, 2000
Tree fern	Cu(II)	Ho, 2003
Vermiculite	Cd(II)	Mathialagan and Viraraghavan, 2003
Waste tyres, Sawdust	Cr(VI)	Hamadi et al., 2001
Wood	Basic Blue 69, Acid Blue 25	Ho and McKay, 1998e

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