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# Removal of Pb(II) from wastewaters by *Fontinalis antipyretica* biomass: Experimental study and modelling

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**ABSTRACT**

Aquatic bryophytes are frequently used as biomonitors for trace metals in aquatic ecosystems. Nevertheless, their special characteristics also allow using them as biosorbents to clean industrial wastewaters. As biosorption is a low-cost and effective method for treating metal-bearing wastewaters, understanding the process kinetics is relevant for design purposes. In this study, the ability of the aquatic bryophyte *Fontinalis antipyretica* to remove lead from simulated wastewaters was evaluated. Previously, the effect on biosorption of parameters such as the initial solution pH, contact time and initial metal ion concentration was investigated. The biosorption process is highly pH-dependent, and the favorable pH for maximum $Pb^{2+}$ adsorption on the aquatic moss was found to have an optimum value in the range 4.0–6.0. The equilibrium sorption capacity of lead by *Fontinalis antipyretica* increased with the initial metal concentration. For an initial metal concentration of 10 mg $L^{-1}$, the uptake capacity at equilibrium was 4.8 mg $g^{-1}$. Nevertheless, when the initial concentration increased up to 100 mg $L^{-1}$, the uptake of lead was 10 times higher. Maximum adsorption rates were achieved almost in the first 10–20 min of contact, and a further increase in the contact time had a negligible effect on the $Pb^{2+}$ sorption. Three kinetic models (pseudo-first order, pseudo-second order and Elovich) were fitted to the experimental data and compared by the F-test. The pseudo-second order biosorption kinetic model provided the better correlation with the experimental data ($R^2 = 1.00$). Probably the chemisorption is the rate-limiting step and the biosorption mechanism follows a pseudo-second order reaction model. The applicability of the Langmuir and Freundlich adsorption isotherms to the present system was also assessed. The equilibrium experimental data of lead sorption was very well described by the Langmuir model with $R^2$ values exceeding 0.993. The maximum lead sorption capacity by *Fontinalis antipyretica* attained a value of 68 mg of lead ions per gram of aquatic moss.

*Keywords: Fontinalis antipyretica*; Aquatic mosses; Lead; Biosorption; Removal; Kinetics

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