Pb(II) biosorption by compound bioflocculant: performance and mechanism

Lili Wang, Zhonglin Chen, Jixian Yang, Fang Ma*

State Key Laboratory of Urban Water Resource and Environment, School of Municipal and Environmental Engineering, Harbin Institute of Technology, Harbin 150090, China
Tel. +86 0451 86282107; email: mafang@hit.edu.cn

Received 30 April 2013; Accepted 25 August 2013

ABSTRACT

Biosorption behavior of compound bioflocculant (CBF), produced by a mixed culture of *Rhizobium radiobacter* F2 and *Bacillus sphaeicus* F6, was investigated for Pb(II) removal under various parameters (pH, initial Pb(II) concentration, temperature, and stirring rate). Biosorption kinetics, isotherm, thermodynamics, and Fourier transform infrared (FTIR) spectra were studied to explore the biosorption mechanism. Additionally, principal factor analysis was also performed with a statistical method to identify the main influencing factor. Optimum pH was determined as 7.0 and biosorption equilibrium was attained within 60 min. The order of effects caused by the four operational parameters was pH > initial Pb(II) concentration > stirring rate > temperature. The experimental data obeyed the pseudo-first-order kinetic model well. Langmuir model fitted the equilibrium data best among Langmuir, Freundlich and Redlich–Peterson models. Negative $\Delta G^\circ$ and positive $\Delta H^\circ$ indicated that the biosorption process was spontaneous and endothermic in nature. FTIR analysis showed that $-\text{OH}$, $-\text{NH}$, and $-\text{C}=\text{O}$ groups were involved in the biosorption. These results demonstrate that CBF could be a promising alternative for Pb(II) removal from aqueous solution.

Keywords: Biosorption; Compound bioflocculant; Pb(II); Kinetics; Principal factor analysis

*Corresponding author.