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ORIGINAL PAPER

Biological removal of heavy metal zinc from industrial effluent by *Zinc sequestering bacterium VMSDCM*

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Abstract The present investigation reports the biosorption capacity of *Zinc sequestering bacterium VMSDCM* in batch studies. In this work, an isotherm model has been proposed for the data obtained at equilibrium conditions. The results indicated that the validations of Langmuir, Freundlich, Temkin, and Dubinin-Radushkevich isotherm models were not satisfactory to describe proficiently the sorption of the zinc ion on the surface of the bacterium cells. The proposed model was found suitable to interpret the sorption of zinc ion on the surface of bacterium cells at boundary conditions. The biochemical characterization of the bacterium cells showed that the isolated cells were rod-shaped with gram-negative type of cell wall structure. The experimental uptake capacity reported at the attainment of the equilibrium was 431.5×10^3 mg of per unit (grams) biomass.

Keywords Biosorption · Isotherm model · Zn(II) · *Zinc sequestering bacterium VMSDCM* · Sum of square error · χ^2

Abbreviation
SSE Sum of square errors

List of symbols

χ^2	Chi square
q_e	Uptake capacity at equilibrium (mg g^{-1})
q_{max}	Maximum uptake capacity (mg g^{-1})
C_e	Equilibrium concentration of Zn(II) ion (mg l^{-1})
D_{vM}	Modified model constant
K_L	Langmuir model constant
K_f	Freundlich model constant (mg g^{-1})
B_t	Temkin model constant
K_t	Temkin model constant
R	Gas constant (8.314 J/mol K)
T	Temperature (K)
β	Dubinin-Radushkevich model constant
ε	Polayni potential
V_m	Constant of point function in proposed model
C_{bm}	Adsorbate species concentration in liquid phase (mg l^{-1})
q_e (Th)	Theoretical uptake capacities (mg l^{-1})
q_e (Exp)	Experimental capacities (mg l^{-1})
$1/n$	Affinity constant

Introduction

Tremendous industrialization and urbanization have provided thrust to the environmental pollution due to the enormous discharge of heavy metals (Ghodbane et al. 2008) in various water bodies. The main industrial sectors that significantly contribute to the heavy metal pollution are paint and pigment industries, steel and metallurgical plants, alloy and galvanization industries, electroplating units (Abdelwahab 2007; Iqbal and Edyvean 2004; Memon et al. 2007), etc. The heavy metal series consists of various

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