Cadmium biosorption by *Stenotrophomonas humi* and *Micrococcus luteus*: kinetics, equilibrium and thermodynamic studies

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**ABSTRACT**

In the present study, the biosorption capacity of *Stenotrophomonas humi* and *Micrococcus luteus* has been assessed for removal of cadmium from the synthetic solution under varying Cd$^{2+}$ concentrations (50–250 ppm), pH (2–8), and contact time (10–270 min). The maximum biosorption capacity ($q_m$) of *S. humi* and *M. luteus* were 97.08 and 42.55 mg/g at 30°C, respectively. The experimental isotherm data were analyzed using the Langmuir, Freundlich and Dubinin–Radushkevich (D–R) equations. The equilibrium data fit well in the Freundlich isotherm for *S. humi* and *M. luteus*. The $R_L$ values ranged between 0 and 1, and rate constant value of Cd$^{2+}$ uptake demonstrated its efficient removal from the solution. Kinetic study showed that pseudo-second-order model describes the biosorption process better than the Lagergren pseudo-first-order and intraparticle diffusion model. The thermodynamic parameters such as free energy, entropy, and enthalpy change for the adsorption of Cd$^{2+}$ have also been computed and discussed. Based on D–R isotherm value, physiosorption appears to be one of the major mechanisms for adsorption of Cd$^{2+}$ by the bacteria. The interactions between heavy metals and functional groups on the cell wall surface of bacterial biomass were confirmed by Fourier transform infrared spectroscopy (FTIR) analysis, which indicate the possible removal of Cd$^{2+}$ ions from the environment by *S. humi* and *M. luteus*.

**Keywords:** Physiosorption; Biosorption; Cd$^{2+}$ uptake; FTIR

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