Study on co-biosorption of Zn (II) and Cu (II) in liquid phase

Vishal Mishra

Division of Biotechnology, Netaji Subhas Institute of Technology, Sector 3, Dwarka, New Delhi-78, India, Tel. +91 9643022909; email: vishal.nsitdit@gmail.com

Received 13 January 2015; Accepted 15 April 2015

**ABSTRACT**

The present investigation has dealt with co-biosorption of zinc and copper on the surface of eggshell powder (ESP) in liquid phase. Various process parameters such as pH, temperature, initial concentration of metal ions, agitation rate, contact time, and ESP dose were optimized to obtain the maximum removal of copper (77.36%) and zinc (44.24%). The optimized values of pH, temperature, initial concentration of metal ions, contact time, agitation rate, and ESP dose were 5, 308 K, 60 mg/L, 50 min, 180 rpm, and 2 mg/L, respectively. Various isotherms such as Langmuir, Freundlich, and Temkin model were evaluated. The results indicated that Langmuir model has better suitability in explaining co-biosorption of copper and zinc in terms of higher linear regression ($R^2$) in range of 0.94–0.99 together with very low values of $\chi^2$ and sum of square errors from 0.007 to 0.01 and from 0.11 to 0.44, respectively. Contrary to this, the range of linear regression coefficient ($R^2$) reported for Freundlich and Temkin was quite low 0.74–0.94 and 0.66–0.91, coupled with very high values statistical error function. The preferential order of metal ion biosorption was Cu > Zn. The superior biosorption of Cu over Zn was due to their difference in the molecular weight, atomic radii, and electronegativity. The surface characterization revealed the presence of macroporous texture with open void spaces rendering ESP as less efficient biosorbent for the removal of heavy metals such as Cu and Zn.

**Keywords:** Co-biosorption; Process parameters; Egg shell powder; Isotherms