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Effective removal of anionic contaminants in aqueous solutions by metal-alginate immobilized fungal materials

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The contamination of drinking water resources with toxic anions such as fluoride, arsenate and chromate presents severe threats to both human and environment. Conventional water treatment techniques have drawbacks such as inefficiency in anion removal, high capital and operational costs. Biosorption and bioremediation can offer efficient and affordable alternatives for the removal of anions. *Mucor rouxii* (MR), a filamentous fungus, was examined as a potential biosorbent for the removal of anions in aqueous phase. This fungal biomass was further immobilized in alginate beads and used for the removal of fluoride, arsenate and chromate. We investigated the effects of different cross-linking metal ion centers such as Ca(II), Ce(III), Ce(IV), Sn(IV) and Zr(IV), and doping amino-functionalized silica on the anion removal efficiency of metal-alginate immobilized MR. Among the different metal-alginate immobilized MR, the Zr(IV)-alginate immobilized MR (Zr-AIM) exhibited the most efficient adsorption towards fluoride and arsenate, whereas silica doped Zr-AIM (SZr-AIM) demonstrated the most efficient chromate adsorption. Batch adsorption experiments were conducted to determine the influences of operating conditions including contact time, solution pH, initial anion concentrations and biosorbent dosage on the anion adsorption efficiency of Zr-AIM and SZr-AIM. The integrated results from SEM-EDX, FTIR and XPS analyses and adsorption studies revealed that the Cr(VI) removal mechanisms by SZr-AIM mainly involved: (i) adsorption of Cr(VI) onto the Zr(IV) that crosslinked the alginate polymers through electrostatic interactions, and (ii) partial reduction of the adsorbed Cr(VI) to Cr(III) on the biomass surface. Overall, the Zr-AIM and SZr-AIM are efficient biosorbents for the removal of fluoride, arsenate and chromate from contaminated water and wastewater.

Biography

Wai-Hung Lo is Associate Professor in the Department of Applied Biology and Chemical Technology at the Hong Kong Polytechnic University. He received his B.Sc. and M.Sc. in Chemical Engineering from Massachusetts Institute of Technology, Ph.D. from Purdue University and postdoctoral training at Cornell University, USA. His research interests include pollution control, waste conversion, anti-cancer drug development and adsorption. He was recognized for his research achievements by receiving international Gold Medal Awards for the inventions of potent anti-cancer drugs, and Technology Transfer Awards, President's Award, and High Impact Achievement Award for Research Achievement from the Hong Kong Polytechnic University.

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