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Ruthenium recovery from acetic acid waste water through sorption with bacterial biosorbent fibers

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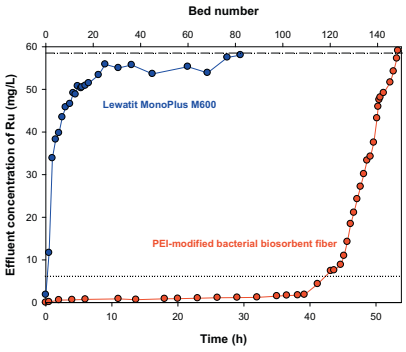
HIGHLIGHTS

- A fibrous type of bacterial biosorbent was evaluated on its Ru sorption capacity.
- The maximum Ru uptake of PBBF was 16.5 times higher than that of commercial resin.
- The PBBF showed a highly effective removal of Ru in a column system.
- The PBBF has potential as a biosorbent for Ru removal from acetic acid wastewaters.

GRAPHICAL ABSTRACT



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ABSTRACT

A fibrous bacterial biosorbent was developed to bind precious metal–organic complexes in batch and column processes. Polyethylenimine (PEI)-modified bacterial biosorbent fiber (PBBF) was prepared by spinning *Corynebacterium glutamicum* biomass-chitosan blends, coating them with PEI and cross-linking with glutaraldehyde. When an acetic acid waste solution containing 1822.9 mg/L Ru was used as a model waste solution, Ru uptake by the PBBF was 16.5 times higher than that of the commercial ion exchange resin, Lewatit MonoPlus M600. The maximum amounts of Ru uptake were 110.5, 16.0 and 6.7 mg/g for PBBF, raw biomass, and Lewatit MonoPlus M600, respectively. In a flow-through packed bed, PBBF exhibited the breakthrough time of 42.32 h. Therefore, PBBF can be considered as an alternative sorbent for recovery of anionic metal–organic complexes from waste solutions.

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1. Introduction

Precious metals are used in various industries as catalysts. Increasing demand, limited availability and the generation of potentially toxic effluents (Wiseman and Zereini, 2009) make the recovery and removal of precious metals from wastewaters a worthwhile endeavor.

Conventional treatment methods for metals-bearing effluents include ion exchange, precipitation, membrane separation and solvent extraction. These methods have significant drawbacks such as incomplete metal removal, high capital costs, high chemical and/or energy requirements, and generation of toxic sludge or other waste products that require disposal. (Mack et al., 2007; Göksungur et al., 2005). Microbial biomasses have been studied as sorbents for

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