

### Recovery of Ru from industrial wastewater by using biosorption followed by incineration

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Biosorption has been recognized as an alternative to conventional processes for the recovery of precious metals from aqueous and wastewater. Conventionally, metal recovery methods can be divided in two broad categories: hydrometallurgical and pyrometallurgical processes. In this study, we carry out the incineration as a pyrometallurgical process after biosorption as a hydrometallurgical process. The waste biomass of *Corynebacterium glutamicum*, generated from lysine fermentation industry, was used as a raw material. The raw biomass was modified with poly-ethylenimine (PEIB) to enhance the Ru sorption capacity and then the carboxyl groups of the PEIB were esterified by anhydrous methanol under acidic condition to more develop the metal binding amine sites and to remove the interfering carboxylic sites. The resulting decarboxylated PEI-coated biosorbent (DC-PEIB) showed 2.1 times enhanced uptake capacity than the raw biomass. The XRD analysis indicated that the Ru was able to be purified during incineration. It was therefore noted that the combined method of biosorption and incineration could be effective for concentration and recovery of Ru from the industrial wastewater.