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Optimization of Lead Biosorption Yield by *Streptomyces humidus* DBPb2 Derived from a Public Waste Dump Using the Response Surface Methodology

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Abstract Pollution by heavy metals is one of the risks threating the human health and the environment, and reducing the concentrations of these pollutants constitutes a major challenge, in particular by using alternative bioremediation techniques. Actinobacteria are frequently proposed as an environmental cleaner of several emerging pollutants such as heavy metals. In this study, 24 actinobacteria resistant strains to heavy metals isolated from the Boulimat public landfill in Bejaia, Algeria, were evaluated for their heavy metal removal potential. Two different screenings were conducted, determination of minimum inhibitory concentration of the isolates to metal ions and the percentages of metals biosorption in batch experiment using the Atomic Absorption Spectroscopy. *Streptomyces humidus* DBPb2 strain, was selected as the most efficient isolate, identified based on morphological, physiological and 16S rRNA gene sequencing, by a highest minimum inhibitory concentrations to various metals mainly lead, with a MIC reaching 4000 mg.L^{-1} and has proven its efficiency to reduce the concentration of Pb, Fe and Cu in batch experiments with 66.47%, 33.16% and 27.39% respectively. Rotatable Central Composite Design was used to optimize the lead bisorption yield studying the influence of four operating parameters: pH, stirring speed, incubation time, and inoculum size. The optimal conditions were found for pH= 7, at stirring speed of 84 rpm under incubation time of 3 days, and 3 agar cylinders as inoculum reaching a lead biosorption yield of 100%, for an initial concentration of 100 mg.L^{-1}. The metal-resistance mechanisms were identified in DBPb2 strain, the production of siderophores and cell wall bioaccumulation by the interaction of different functional groups (carboxylic, hydroxyl and amine groups) detected by infrared spectroscopy analysis. Therefore, this present study confirms the possibility of exploiting the DBPb2 strain in the bioremediation of lead from polluted environments such as soils and wastewater.

Keywords *Streptomyces humidus* · Heavy metals · Bio-sorption · Lead · Response Surface Methodology (RSM)

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