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The potentiality of *Arthrospira platensis* microalgal species for mining wastewater bioremediation by biosorption removal of heavy metals (Zn^{2+}, Cu^{2+}, Pb^{2+}, Fe^{2+})

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ABSTRACT

Arthrospira platensis has very high absorption by photosynthesis processes of CO_2 fixation and release of oxygen. It was becoming significant microalgae for biological wastewater treatment because of their bodies' accumulation of nutrients, heavy metals, organic and inorganic compounds used as the main source of their life production in wastewater. The objective of this study was to determine the ability of *Arthrospira platensis* for bioremediation by biosorption of heavy metals present in mining wastewater. Microalgae culture condition parameters were: temperature fixed at 30°C–35°C; the light was 1,000–2,000 lux set for 12 h d^{-1} and 12 h $night^{-1}$; pH; turbidity was 25–40 NTU. Biosorption was influenced by sorbent concentration (5–60 g L^{-1}), pH 2.0–9.0, and contact time (60 min) for heavy metals removal. It was related to nutrients consumption from wastewater with microalgae growth production by biosorption and takes place with separation of micronutrients (Zn, Cu, and Fe) and toxic metal such (Pb) from microalgae samples in a solution using centrifugation. The photosynthesis process was very suitable, that why chlorophyll productivity was very high. At low light intensity (1,000–1,400 lux), *Arthrospira platensis* consumed a high amount of nutrients (COD, TP, TN, ammonium) for growth. At high light intensity (2,000 lux), cell productivity, biomass productivity, growth rate, protein content, and energy value were very high. The effect of biosorbent on heavy metals removal from wastewater provides the following results: zinc adsorbed decreased from 4.08 to 2.1216 mg g^{-1}; iron from 6.03 to 0.6 mg g^{-1}; copper from 5.02 to 0.75 mg g^{-1}; and lead decreased from 7.04 to 0.98 mg g^{-1}. The effect of pH on metals biosorption was: sulfates (SO4) 93%, iron Fe 99%, lead Pb 95%, zinc Zn 52%, copper Cu 94%) removal efficiency with pH above 7.1. Heavy metals biosorption from wastewater was depended on sorbent concentration, pH, and contact time. The presence of multi-metal in culture systems decreases zinc adsorption, compared to the single metal one. The previous study was *Arthrospira platensis* biomass removed 50% of zinc from wastewater, which means that higher concentrations of other metal ions present in the wastewater don't affect the removal of zinc ions from the wastewater. The removal of zinc ions from the mining wastewater was about 52% in the current study.

Keywords: Absorption; Heavy metals; Mining wastewater; Micronutrients; Bioremediation

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