TITLE: Ability of cadmium removal by *Enterobacter clocae* UENF P7 and nutriotional composition

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ABSTRACT:

The bioavailability of cadmium (Cd) has increased in recent years as a result of human activities. This metal is water soluble and highly toxic, even at low concentrations. Mitigation measures are needed and bioremediation is an alternative to recover contaminated environments. Metal-resistant bacteria can help with this process. The objective was to evaluate the resistance to Cd in *Enterobacter cloacae* UENF P7, an isolated strain of aquatic plant. For this, the bacteria were cultivated in LB medium (pH=6) with 22.5 mg L^{-1} Cd or without addition of Cd (control) in Erlenmeyer flasks, at 30 ºC and 140 min^{-1}, evaluating the kinetics growth rate (OD=600nm), CFU.mL^{-1}, pH, live/dead assay, glucose consumption, Cd bioavailability, cell nutritional composition and morphology by optical and scanning electron microscopy. The growth kinetics in control medium and with 22.5 mg L^{-1} of Cd were similar, obtaining final OD ≈ 4.0 (8h) with production of $1.8x10^8$ and $2.0x10^8$ CFU.mL^{-1}, respectively. During growth, the pH of the medium decreased (final pH ≈ 3.5). At the end of growth the cells were viable. In both treatments, all the glucose available in the medium was consumed in 4h, but with 2h of cultivation a higher consumption rate was observed in the condition of Cd. Possibly, the bacterium used other metabolic routes to survive until the stationary phase (8h). Cd was available in the medium during growth and the bacteria was able to remove 22.3% of the metal in 2h and 31.2% in 8h, equivalent to 5 and 7 mg L^{-1} Cd, respectively. Despite the percentage value, the removal efficiency in mg L^{-1} was superior to some strains of the same species. In the nutritional composition of the cells, differences were observed in the concentrations of the elements. In the Cd treatment, a higher level of Mg, K, S, Ca, P, Mo, Mn, Cu and B was observed in the cells compared to the control. The demand for these nutrients may be attributed the ability of the bacteria to overcome Cd-mediated stress, using them in enzymes and metabolic processes. Morphological changes in the cells were not observed, showing that the excess of the referred metal did not cause structural damage. Considering that the concentration of Cd tested is well above the limits foreseen in the environmental legislation, *E. cloacae* UENF P7 is a highly resistant bacteria to Cd, with biotechnological potential for use in the treatment of contaminated industrial effluents.

Keywords: heavy metal; decontamination; environmental contamination

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