Potential of living Rhodotorula sp. for cadmium ions removal from aqueous solutions

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1. Introduction – The presence of heavy metals in water sources and soil can cause serious damages to the entire food chain, the most affected being the species at the top. Cadmium is one of the most toxic heavy metal that can produce bone damage, renal dysfunction, cancer or metabolic dysfunctions in human body and must be eliminated from the food chain and water bodies [1]. The conventional methods for Cd^{2+} ion removal are considered expensive and unfriendly for the environment, thus now is paying a particular attention to the biological processes, which involve the use of microorganisms or plants in achieving the desired goal [2]. The aims of this paper is the study of living *Rhodotorula* sp. potential for Cd^{2+} removal from aqueous effluents and identification of mechanisms involved in this process based on biomass analysis performed with SEM-EDX (Scanning Electron Microscopy-Energy Dispersive X-ray Spectroscopy) and FTIR (Fourier Transform Infrared Spectroscopy) before and after its use in Cd^{2+} elimination.

2. Experimental – The experiments were carried out in duplicate, using an incubator IKA KS 4000i control type at 28^0C and 130 rpm, during 72 hours. The studies concerning the influence of pH were performed in 250 mL Erlenmeyer flasks with 100mL Sabouraud growth medium and 50 mg/L Cd^{-2+} ions concentration. Inductively Coupled Plasma Spectrometer (Optima 8000 ICP-OES model) was used for determination of Cd^{2+} concentration in solution, while the determination of functional groups on cell wall surfaces was performed by a FTIR spectrometer (BOMEN MB 104) and the structural changes were identified by a JEOL JSM-7001F Scanning Electron Microscope.

3. Results and Discussion -. Based on the experimental result, we found that the highest effectiveness of Cd^{2+} removal by *Rhodotorula* sp. was achieved at pH = 5 (Image 1) with removal efficiencies around 25% for Cd^{2+} ion concentrations lower than 50 mg/L. Also, comparing the results of SEM and EDX analysis of biomass with and without cadmium, we found that the biomass suffers structural changes and cadmium is adsorbed on cell wall (around 1% of the yeast weight). Therefore, biosorption can be considered the prevalent mechanism during Cd^{2+} elimination from aqueous solution.

4. Conclusions - The experimental results on the removal of Cd^{2+} ions from aqueous effluents using *Rhodotorula* sp. living biomass as biosorbent have shown that the yeast has a good potential to remove the heavy metal ions and, according to SEM, EDX and FTIR analyses the principal mechanism is the biosorption of ions on cell surface.

5. References

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