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Influence of clinoptilolite on the efficiency of heavy metal removal from wastewater by *Chlorella vulgaris*

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ABSTRACT

Heavy metals are the main pollutants in electroplating wastewater. Currently, mainly chemical methods, which generate huge amounts of toxic sludge, are used in industrial wastewater treatment. To achieve environmental sustainability, there is a need to introduce an eco-friendly treatment of such contaminated wastewater. The present study was carried out in order to: (i) examine the hypothesis that a mixture of clinoptilolite and *Chlorella vulgaris* would enhance the efficiency of the removal of heavy metals, (ii) evaluate the potential application of sediments containing *C. vulgaris* and clinoptilolite after N-NH_4 assimilation for heavy metal removal, (iii) assess the selectivity of *C. vulgaris* and clinoptilolite for heavy metal removal and (iv) verify if there was potential applicability of *C. vulgaris* and clinoptilolite as effective and eco-friendly biomaterial for developing the Fe(III), Zn(II) and Pb(II) removal procedure. The influence of Pb(II) on Fe(III) and Zn(II) uptake was also studied. The study was conducted in a multimetallic system. The results demonstrated that all the sorbents were sufficient to remove >97.5% of Fe(III) and Pb(II) and 75% of Zn(II) from the investigated wastewater. The maximum uptake of lead and iron (99.9%) was more efficient than the uptake of zinc (94.8%). The mixture of unicellular algae and zeolites enhanced the efficiency of the removal of heavy metals since ion-exchange resins, such as zeolites, have mono-functional sites, whereas the algal cell walls have multi-functional sites, thereby complementing each other.

Keywords: Microalgae; Clinoptilolite; Bioremoval; Fe(III), Zn(II) and Pb(II); Industrial wastewater

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