



## Assessing the removal of heavy metals in industrial wastewater by means of chemical exergy

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### ABSTRACT

Industrial processes may frequently produce wastewater with high concentrations of heavy metal ions. Heavy metals can be harmful both for the environment and for the human health even in small concentrations. This study has the scope to assess the efficiency of four different sorbent-assisted ultrafiltration methods that were applied for enhancing the treatment of industrial wastewater. Each treatment has different levels of removal success for each heavy metal ion. In the framework of this manuscript chemical exergy is utilized as an evaluating parameter of mass fluxes. The total efficiency of each treatment method is assessed by calculating the total chemical exergy dissipation of each mass flux. All the treatment methods successfully removed more than 96% of copper and lead ions while the performances with respect to nickel and zinc ions removal were more erratic. The ultrafiltration/bentonite absorption had the best overall performance with a total chemical exergy dissipation of 66.82%, and ultrafiltration/vermiculite absorption had the second best overall performance with 64.29%. The method was able to combine different parameters and return meaningful results that can be used for optimization of wastewater plants treatment management.

*Keywords:* Ultrafiltration; Absorption; Exergy dissipation; Zeolite; Bentonite

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