

# The effect of conditioning with NaCl, KCl and HCl on the performance of natural clinoptilolite's removal efficiency of $\text{Cu}^{2+}$ and $\text{Co}^{2+}$ from Co/Cu synthetic solutions

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## Abstract

Southern African clinoptilolite's capability as an ion-exchanger with respect to  $\text{Cu}^{2+}$  and  $\text{Co}^{2+}$  was investigated in order to consider its viability in the removal of metal cations from aqueous solutions. The effect of chemical conditioning was investigated using sodium chloride (NaCl), hydrochloric acid (HCl) and potassium chloride (KCl). The most efficient activating or conditioning reagent was found to be HCl at 0.02 M concentration, followed by KCl at 0.04 M and then NaCl at 0.04 M. The worst performing clinoptilolite was the original form under the conditions described in this study and it thus served as a control. The HCl-conditioned clinoptilolite was the most efficient in metal removal (79%  $\text{Co}^{2+}$  and 73%  $\text{Cu}^{2+}$ ) followed by the NaCl-conditioned form (69%  $\text{Co}^{2+}$  and 54%  $\text{Cu}^{2+}$ ), while the KCl-conditioned form adsorbed 54% and 73% of  $\text{Co}^{2+}$  and  $\text{Cu}^{2+}$ , respectively. The column method was used for the cation-exchange processes with synthetic solutions of 0.0020 M, 0.0698 M and 0.2000 M of  $\text{Co}^{2+}$  and  $\text{Cu}^{2+}$  concentrations which were measured using atomic absorption spectroscopy (AAS).

**Keywords:** clinoptilolite, chemical conditioning, ion-exchange, copper and cobalt