

## **Leaching and antimicrobial properties of silver nanoparticles loaded onto natural zeolite clinoptilolite by ion exchange and wet impregnation**

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### **Abstract**

This study aimed to compare the leaching and antimicrobial properties of silver that was loaded onto the natural zeolite clinoptilolite by ion exchange and wet impregnation. Silver ions were reduced using sodium borohydride (NaBH<sub>4</sub>). The leaching of silver from the prepared silver-clinoptilolite (Ag-EHC) nanocomposite samples and their antimicrobial activity on *Escherichia coli* Epi 300 were investigated. It was observed that the percentage of silver loaded onto EHC depended on the loading procedure and the concentration of silver precursor used. Up to 87% of silver was loaded onto EHC by wet impregnation. The size of synthesized silver nanoparticles varied between 8.71\_72.67 nm and 7.93\_73.91 nm when silver was loaded by ion exchange and wet impregnation, respectively. The antimicrobial activity of the prepared nanocomposite samples was related to the concentration of silver precursor used, the leaching rate and the size of silver nanoparticles obtained after reduction. However, only in the case of the nanocomposite sample (Ag-WEHC) obtained after loading 43.80 ± 1.90 mg of Ag per gram zeolite through wet impregnation was the leaching rate lower than 0.1 mg L<sup>-1</sup> limit recommended by WHO, with an acceptable microbial killing effect.