

## **Evaluation of antibacterial properties in calcium enriched mixture cement (CEM cement) mixed with Ag/ZnO/ZSM-5 and TiO<sub>2</sub>/ZnO/ZSM-5 nanoparticles.**

### **Abstract**

**Introduction:** Calcium-enriched cement mixture (CEM cement) is a calcium silicate cement that is used in therapeutic treatments such as vital pulptherapy, apexogenesis, etc. Gram-positive bacteria such as *Enterococcus faecalis* are effective in endodontic infections, therefore; today many efforts are made to create antibacterial properties in dental materials such as CEM cement. In this research, silver-zincoxide (Ag/ZnO) and titanium-zincoxide (Ti/ZnO) nanoparticles on a scaffold of zeolite have been considered to improve the chemophysical and antibacterial properties of calcium silicate cements such as MTA. accordingly this study was conducted with the aim of investigating the antibacterial properties of (Ag/ZnO/ZSM-5) and (TiO<sub>2</sub>/ZnO/ZSM-5) nanoparticles on CEM cement.

**Materials and methods:** In this study, (Ag/ZnO/ZSM-5) and (5-TiO<sub>2</sub>/ZnO/ZSM) nanoparticles were combined with CEM cement and based on the study plan 6 groups (1.CEM cement without nanoparticles, 2.ZSM-5 zeolite, 3,4.CEM cement containing (Ag/ZnO/ZSM-5) with 3 and 6% by weight and 5,6.CEM cement containing (TiO<sub>2</sub>/ZnO/ZSM-5) with 3 and 6% by weight) were investigated. The antibacterial activity of the components was evaluated using the Kent colony method. Each test was separately analyzed by Mann-Whitney, Kruskal-Wallis test using SPSS version 16 software ( $p < 0.05$ ).

**Findings:** CEM cement containing (Ag/ZnO/ZSM-5) with 3 and 6% by weight and CEM cement containing (TiO<sub>2</sub>/ZnO/ZSM-5) with 3 and 6% by weight have clinical reduction in the number of colonies compared with the control group ( $p < 0.05$ ). Also, the number of colonies in CEM cement containing (Ag/ZnO/ZSM-5) was lower than CEM cement containing (TiO<sub>2</sub>/ZnO/ZSM-5) ( $p < 0.05$ ). In addition, with increasing in the weight percentage of nanoparticles, the antibacterial property of CEM cement containing nanoparticles increased ( $p < 0.05$ ).

**Conclusion:** Adding silver-zincoxide and titanium dioxide-zincoxide in the ZSM-5 zeolite scaffold increases antimicrobial properties of CEM cement.

**Key words:** antibacterial, zeolite, calcium enriched cement, nanoparticle