

## **PENGARUH PENAMBAHAN NANOPARTIKEL ZnO DAN MgO PADA SIFAT FISIK DAN ANTIBAKTERI MINERAL TRIOKSIDA AGREGAT PUTIH**

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### **INTISARI**

Dalam penelitian ini telah dikaji pengaruh penambahan nanopartikel ZnO (ZnONP) dan MgO (MgONP) pada sifat fisik dan antibakteri mineral trioksida agregat putih (*white mineral trioxide aggregate, WMTA*). Penelitian ini meliputi sintesis ZnONP dan MgONP, mempelajari pengaruh penambahan ZnONP dan MgONP terhadap sifat mekanik dan sifat antibakteri WMTA terhadap bakteri Gram positif *Staphylococcus aureus*.

Sintesis ZnONP dan MgONP masing-masing dilakukan dengan metode kopresipitasi menggunakan prekursor  $Zn(NO_3)_2 \cdot 4H_2O$  dan  $Mg(NO_3)_2 \cdot 6H_2O$ , *capping agent Polyvinylpyrrolidone* dan basa kuat NaOH. Kristalinitas ZnONP dan MgONP diidentifikasi dengan XRD. Modifikasi dilakukan dengan mencampur WMTA dan nanopartikel dengan perbandingan berat tertentu sebelum dihidrasi menggunakan air. Kristalinitas dan morfologi WMTA termodifikasi dipelajari dengan karakterisasi XRD, SEM dan SEM-EDX. Kajian pengaruh penambahan ZnONP dan MgONP pada WMTA dilakukan dengan pengujian sifat mekanik kuat tekan dan pengujian antibakteri terhadap bakteri Gram positif *Staphylococcus aureus* setelah waktu pendiaman pelet selama 14 hari.

Hasil penelitian menunjukkan bahwa ZnONP dan MgONP telah berhasil disintesis berupa kristal serbuk halus masing-masing berwarna putih tulang dan putih bersih. Hasil karakterisasi menggunakan XRD menunjukkan rata-rata ukuran kristal ZnONP dan MgONP masing-masing 24,17 nm dan 25,23 nm. Pengujian sifat mekanik memberikan hasil bahwa WMTA-ZnO1-MgO1 memberikan kuat tekan tertinggi yaitu  $7,70 \pm 0,36$  MPa. Pengujian terhadap bakteri Gram positif *Staphylococcus aureus* diperoleh aktivitas antibakteri tertinggi pada WMTA-ZnO1-MgO2 dengan diameter zona hambat  $10,43 \pm 0,61$  mm.

Kata kunci: antibakteri, MgO, WMTA, ZnO

***THE EFFECT OF ZnO AND MgO NANOPARTICLE ADDITION  
ON PHYSICAL AND ANTIBACTERIAL PROPERTIES OF  
WHITE MINERAL TRIOXIDE AGGREGATE***

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**ABSTRACT**

In this study, the effect of ZnO and MgO nanoparticles (ZnONP and MgONP) addition on physical and antibacterial properties of white mineral trioxide aggregate (WMTA) has been studied. This research includes the synthesis of ZnONP and MgONP, and studying the effect of the adding of ZnONP and MgONP on the mechanical and antibacterial properties of WMTA against Gram-positive bacteria *Staphylococcus aureus*.

Synthesis of ZnONP and MgONP was done with a coprecipitation method using  $Zn(NO_3)_2 \cdot 4H_2O$  and  $Mg(NO_3)_2 \cdot 6H_2O$  precursors, Polyvinylpyrrolidone as capping agent and strong base NaOH to produce solid nanoparticles. Modification was carried out by mixing WMTA and nanoparticles in a certain of weight ratio before being hydrated using water. The crystallinity of the nanoparticles was identified with XRD and the crystallinity and morphology of the modified WMTA were characterized with XRD, SEM and SEM-EDX. The effect of adding ZnONP and MgONP to WMTA was evaluated by testing the mechanical properties of compressive strength and antibacterial testing against Gram-positive bacteria *Staphylococcus aureus* after pelleting for 14 days.

The results showed that ZnONP and MgONP had been successfully synthesized as crystalline solids with bone white and pure white colors, respectively. Characterization using XRD showed that the average crystal size of ZnONP and MgONP is 24.17 nm and 25.23 nm, respectively. Testing of the mechanical property gives a result the highest compressive strength ( $7.70 \pm 0.36$  MPa) for WMTA-ZnO1-MgO1. Testing against Gram-positive *Staphylococcus aureus* showed that the highest antibacterial activity, with an inhibition zone diameter of  $10.43 \pm 0.61$  mm, occurred on WMTA-ZnO1-MgO2.

Keywords: antibacterial, MgO, WMTA, ZnO