

**PENGARUH PENAMBAHAN NANOPARTIKEL TEMBAGA
PADA SIFAT FISIK DAN ANTIBAKTERI
WHITE MINERAL TRIOXIDE AGGREGATE**

Muhammad Akram Fakhriza
18/427639/PA/18599

INTISARI

Dalam penelitian ini telah dikaji pengaruh penambahan nanopartikel tembaga (CuNP) pada sifat fisik dan antibakteri *white mineral trioxide aggregate* (WMTA). Tujuan penelitian ini yaitu melakukan sintesis CuNP dan mempelajari pengaruh penambahan CuNP pada sifat fisik serta kemampuan antibakteri dari WMTA terhidrasi. CuNP disintesis dengan mereaksikan prekursor tembaga (II) klorida dihidrat ($\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$), agen pelindung L-asam askorbat ($\text{C}_6\text{H}_8\text{O}_6$), dan reduktor natrium borohidrida (NaBH_4) kemudian dikarakterisasi menggunakan spektrofotometer UV-Visibel serta TEM. Koloid CuNP (3,0; 6,0; 9,0 mM) digunakan untuk hidrasi WMTA dengan perbandingan 1:2 menghasilkan variasi Cu-WMTA yang dikarakterisasi menggunakan XRD dan SEM-EDX lalu diuji kuat tekan, pH, difusi ion Ca^{2+} , solubilitas serta kemampuan antibakteri.

Hasil penelitian menunjukkan bahwa CuNP hasil sintesis memiliki bentuk bola dengan ukuran ~28,08 nm. Penambahan CuNP pada WMTA terhidrasi mempengaruhi sifat fisik WMTA, yaitu menyebabkan kuat tekan; pH; pelepasan ion Ca^{2+} dan solubilitas meningkat dengan masing-masing nilai tertinggi sebesar $4,74 \pm 0,38$ MPa; $9,01 \pm 0,03$; 1718 ± 63 ppm dan $22,48 \pm 0,37\%$. Penambahan CuNP pada WMTA memberikan pengaruh signifikan pada sifat antibakteri terhadap bakteri *S. aureus* dan *P. aeruginosa* dengan Cu-WMTA-9 memberikan zona hambat paling besar secara berturut-turut, yaitu $10,15 \pm 0,47$ mm dan $11,93 \pm 1,16$ mm.

Kata kunci: antibakteri, nanopartikel tembaga, sifat fisik, WMTA

THE EFFECT OF COPPER NANOPARTICLES ADDITION ON PHYSICAL AND ANTIBACTERIAL PROPERTIES OF WHITE MINERAL TRIOXIDE AGGREGATE

Muhammad Akram Fakhriza

18/427639/PA/18599

ABSTRACT

The effect of copper nanoparticles addition on physical and antibacterial properties of white mineral trioxide aggregate has been studied. These research aims are to synthesize CuNP and study the effect of CuNP addition on physical properties and antibacterial activities of hydrated WMTA. CuNP was synthesized by reacting copper (II) chloride dihydrate ($\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$) as the precursor, ascorbic acid ($\text{C}_6\text{H}_8\text{O}_6$) as the capping agent, and sodium borohydride (NaBH_4) as the reducing agent. CuNP colloid was characterized by UV-Vis spectrophotometer and TEM. Variations of Cu-WMTA were synthesized by hydrating WMTA with CuNP colloids (3,0; 6,0; 9,0 mM) by 2:1 ratio. Cu-WMTA was characterized by using XRD and SEM-EDX, and then had compressive strength, pH, Ca^{2+} ion diffusion, solubility, and antibacterial activity test.

The results showed that the synthesized CuNP had a spherical shape measuring ~ 28.08 nm. The addition of CuNP on hydrated WMTA influenced physical properties of WMTA, such as compressive strength; pH; Ca^{2+} ion diffusion and solubility increased with each highest value were 4.78 ± 0.38 MPa; 9.01 ± 0.03 ; 1718 ± 63 ppm and $22.48 \pm 0.37\%$. The addition of CuNP on WMTA had a significant effect on antibacterial activities. Cu-WMTA-9 had the greatest inhibition zone value of 10.15 ± 0.47 mm against *S. aureus* bacteria and 11.93 ± 1.16 mm against *P. aeruginosa* bacteria.

Keywords: antibacterial, copper nanoparticles, physical properties, WMTA