

SINTESIS NANOPARTIKEL TEMBAGA OKSIDA (CuONPs) DENGAN BANTUAN GELOMBANG MIKRO MENGGUNAKAN ASAM SITRAT SEBAGAI REDUKTOR DAN UJI AKTIVITAS ANTIBAKTERINYA

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INTISARI

Penelitian tentang sintesis nanopartikel tembaga oksida (CuONPs) dengan bantuan gelombang mikro menggunakan asam sitrat sebagai reduktor dan uji aktivitas antibakterinya telah dilakukan. Nanopartikel tembaga oksida disintesis menggunakan metode reduksi kimia dengan terlebih dahulu menentukan kondisi optimum pH, konsentrasi asam sitrat, daya *microwave*, dan waktu radiasi gelombang mikro kemudian dilanjutkan dengan karakterisasi menggunakan Spektrofotometer UV-Vis, *Fourier-Transform Infrared Spectrophotometer* (FTIR), *X-Ray Diffraction* (XRD), *Transmission Electron Microscope* (TEM), dan *Scanning Electron Microscope-Energy Dispersive X-Ray Spectrometer* (SEM-EDX). Aktivitas antibakteri diuji pada bakteri Gram positif *Staphylococcus aureus* dan bakteri Gram negatif *Escherichia coli*.

Hasil penelitian menunjukkan bahwa sintesis CuONPs berhasil dilakukan pada kondisi optimum pH 12 dengan konsentrasi asam sitrat 1 mM dengan $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ 1 mM. Daya *microwave* optimum pada 800 W dengan waktu radiasi gelombang mikro selama 10 menit. Pola XRD mengkonfirmasi pembentukan CuONPs fase monoklinik. Karakterisasi TEM menunjukkan CuONPs berbentuk bulat dengan rata-rata ukuran partikel sebesar 78 nm. Karakterisasi SEM memberikan gambaran bahwa CuONPs berbentuk seperti serpihan bola dengan permukaan kasar. Nanopartikel tembaga oksida menunjukkan zona hambat 8,3 mm pada bakteri Gram positif *Staphylococcus aureus* dan 6 mm pada bakteri Gram negatif *Escherichia coli*.

Kata kunci: antibakteri, asam sitrat, CuONPs, gelombang mikro.

***SYNTHESIS OF MICROWAVE-ASSISTED COPPER OXIDE
NANOPARTICLES (CuONPs) USING CITRIC ACID AS A
REDUCTOR AND ITS ANTIBACTERIAL
ACTIVITY TEST***

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ABSTRACT

Synthesis of copper oxide nanoparticles (CuONPs) with the assistance of microwave and citric acid as a reducing agent as well as the test of their antibacterial activity has been carried out. Copper oxide nanoparticles were synthesized using a chemical reduction method after examining the optimum conditions of pH, concentration of citric acid, microwave power, and time of microwave radiation and then followed by characterization using a UV-Vis Spectrophotometer, Fourier-Transform Infrared Spectrophotometer (FTIR), X-Ray Diffraction (XRD), Transmission Electron Microscope (TEM), and Scanning Electron Microscope-Energy Dispersive X-Ray Spectrometer (SEM-EDX). Antibacterial activity was tested on Gram-positive bacteria *Staphylococcus aureus* and Gram-negative bacteria *Escherichia coli*.

The results showed that the synthesis of CuONPs was successfully carried out at optimum conditions of pH 12 with a concentration of 1 mM citric acid for 1 mM $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$. The optimum microwave power was at 800 W with a microwave radiation time of 10 minutes. The XRD pattern confirmed the formation of monoclinic phase of CuONPs. Characterization with TEM showed that CuONPs was speric with an average particle size of 78 nm. SEM characterization gave an image that CuONPs were in the form of spherical flake-like with rough surfaces. Copper oxide nanoparticles showed an inhibition zone of 8.3 mm in Gram-positive *Staphylococcus aureus* and 6 mm in Gram-negative bacteria *Escherichia coli*.

Keywords: antibacterial, citric acid, CuONPs, microwave.