

SINTESIS NANOPARTIKEL TEMBAGA (CuNPs) MENGGUNAKAN REDUKTOR ASAM L-ASKORBAT DAN BANTUAN GELOMBANG MIKRO SERTA UJI AKTIVITASNYA SEBAGAI ANTIBAKTERI

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INTISARI

Sintesis nanopartikel tembaga (CuNPs) menggunakan reduktor asam L-askorbat dan bantuan gelombang mikro serta uji aktivitasnya sebagai antibakteri telah dilakukan. Pengaruh daya gelombang mikro, pH, konsentrasi asam L-askorbat dan waktu reaksi diamati dalam rangka menentukan kondisi optimum sintesis CuNPs. Nanopartikel tembaga hasil sintesis pada dalam kondisi optimum dikarakterisasi dengan spektrofotometer UV-Vis, FTIR, XRD, SEM-EDX, dan TEM. Aktivitas antibakteri CuNPs dilakukan terhadap bakteri gram positif *Staphylococcus aureus* dan bakteri gram negatif *Escherichia coli*.

Hasil penelitian ini menunjukkan bahwa asam L-askorbat dapat digunakan sebagai agen pereduksi dalam sintesis CuNPs yang ditandai dengan terjadinya perubahan warna dari biru menjadi coklat tua. Kondisi optimum sintesis CuNPs diperoleh pada daya gelombang mikro sebesar 800 W, pH larutan 10, konsentrasi asam L-askorbat 3 mM untuk tembaga(II) sulfat pentahidrat ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) 1 mM. dan waktu reaksi selama 10 menit. Nanopartikel tembaga yang dihasilkan masih mengandung pengotor CuO dan Cu_2O dengan ukuran partikel rata-rata sebesar $22,48 \pm 0,63$ nm serta berbentuk heksagonal yang relatif kurang seragam. Nanopartikel tembaga menunjukkan zona hambat bakteri $6,62 \pm 0,18$ mm terhadap bakteri gram positif *Staphylococcus aureus* dan $6,22 \pm 0,17$ mm terhadap bakteri gram negatif *Escherichia coli*.

Kata kunci: antibakteri, asam L-askorbat, gelombang mikro, nanopartikel tembaga

SYNTHESIS OF COPPER NANOPARTICLES (CuNPs) USING L-ASCORBIC ACID AS A REDUCTOR AGENT AND MIROWAVE ASSISTANCE AND THEIR APPLICATION AS ANTIBACTERIAL

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ABSTRACT

The synthesis of copper nanoparticles (CuNPs) using L-ascorbic acid as a reducing agent and microwave assistance as well as their application as antibacterial have been carried out. Effects of microwave power, pH, concentration of L-ascorbic acid, and reaction time have been examined to determine the optimum condition of CuNPs synthesis. The synthesized CuNPs at optimum conditions were characterized by UV-Vis spectrophotometer, FTIR, XRD, SEM-EDX, and TEM. The antibacterial activity of CuNPs was carried out against gram-positive *Staphylococcus aureus* and gram-negative *Escherichia coli* bacteria.

The results of this experiment showed that L-ascorbic acid could act as a reducing in the synthesis of CuNPs, as characterized by the change of colloid color from blue to dark brown. The optimal conditions for the synthesis of CuNPs were 800 W microwave power, pH of solution 10, 3 mM L-ascorbic acid for 1 mM copper(II) sulfate pentahydrate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$), and a reaction time of 10 minutes. The obtained copper nanoparticles still contained CuO and Cu_2O impurities with the average particle size was 22.48 ± 0.63 nm and relatively less uniform hexagonal shape. Copper nanoparticles showed bacterial inhibition zone of 6.62 ± 0.18 mm in gram positive bacteria, *Staphylococcus aureus* and 6.22 ± 0.17 mm in gram negative bacteria, *Escherichia coli*.

Keywords: antibacterial, L-ascorbic acid, microwave, copper nanoparticles