

SINTESIS NANOPARTIKEL PERAK MENGGUNAKAN TIROSIN SEBAGAI REDUKTOR DAN AGEN PENGKAPING SERTA PEMANFAATANNYA UNTUK ANTIBAKTERI PADA NANOKOMPOSIT FILM KITOSAN-AgNPs

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INTISARI

Telah dilakukan sintesis nanopartikel perak (AgNPs) menggunakan tirosin sebagai reduktor dan agen pengkaping serta pemanfaatannya untuk antibakteri pada nanokomposit film kitosan-AgNPs. Sintesis nanopartikel perak dilakukan dengan metode reduksi menggunakan tirosin untuk menentukan kondisi pH, konsentrasi, dan waktu reaksi optimum dengan cara pemanasan kemudian dikarakterisasi menggunakan *UV-Visible Spectrophotometer*, *Atomic Absorption Spectrophotometer (AAS)*, *Transmission Electron Microscope (TEM)*, *Particle Size Analyzer (PSA)*, dan *Fourier-transform infrared spectrophotometer (FTIR)*. Sintesis AgNPs dibuat dalam bentuk nanokomposit pada film kitosan-AgNPs (CS-AgNPs) yang kemudian digunakan untuk uji antibakteri. Karakterisasi dilakukan dengan *Universal Testing Machine*, *Fourier-transform infrared spectrophotometer (FTIR)*, *X-Ray Diffractometer (XRD)*, dan *Scanning Electron Microscope with Energy Dispersive X-Ray Spectrophotometer (SEM-EDX)*. Uji aktivitas antibakteri dilakukan dengan bakteri *Bacillus subtilis* dan *Escherichia coli* menggunakan metode difusi cakram pada nanokomposit film.

Hasil penelitian menunjukkan bahwa asam amino tirosin dapat digunakan sebagai reduktor dan agen pengkaping dalam sintesis AgNPs yang ditandai dengan perubahan warna yaitu dari tidak berwarna menjadi kuning. Kondisi optimum proses sintesis AgNPs diperoleh pada pH 11. Konsentrasi optimum tirosin adalah 3 mM dan konsentrasi AgNO₃ adalah 0,5 mM, sehingga didapatkan perbandingan konsentrasi asam amino tirosin dan AgNO₃ adalah 6:1. Waktu reaksi optimum selama 45 menit pada suhu 90 °C. Karakterisasi AgNPs menggunakan TEM dan PSA menunjukkan bahwa AgNPs berbentuk bulat dengan ukuran partikel sebesar 29,5 nm. Nanokomposit film kitosan-AgNPs (CS-AgNPs) memperoleh nilai kuat tarik dan elongasi masing-masing sebesar 8,40 Mpa dan 21,36 %. Film kitosan-AgNPs (CS-AgNPs) dapat berpotensi sebagai antibakteri yang ditunjukkan adanya zona hambat. Hasil penelitian menunjukkan bahwa diameter zona hambat pada bakteri *Bacillus subtilis* adalah 10,5 mm dan *Escherichia coli* adalah 9 mm. Aktivitas antibakteri *Bacillus subtilis* (gram-positif) lebih kuat dibandingkan dengan *Escherichia coli* (gram-negatif).

Kata kunci: antibakteri, nanokomposit film, nanopartikel perak, tirosin

SYNTHESIS OF SILVER NANOPARTICLES USING TYROSINE AS A REDUCTOR AND CAPPING AGENT AND ITS UTILIZATION AS ANTIBACTERIAL OF CHITOSAN-AgNPs NANOCOMPOSITES FILM

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ABSTRACT

Synthesis of silver nanoparticles using tyrosine as a reductor and capping agent and its utilization as antibacterial of nanocomposites film chitosan-AgNPs has been done. The synthesis of silver nanoparticles was carried out by the reduction method using tyrosine to determine the conditions of pH, concentration, and optimum reaction time by heating. The characterization was conducted using *UV-Visible Spectrophotometer*, *Atomic Absorption Spectrophotometer (AAS)*, *Transmission Electron Microscope (TEM)*, *Particle Size Analyzer (PSA)*, dan *Fourier-transform infrared spectrophotometer (FTIR)*. Synthesize of AgNPs were provided form at nanocomposites film Chitosan-AgNPs (CS-AgNPs) then used as an antibacterial. The characterization was carried out by using *Universal Testing Machine*, *Fourier-transform infrared spectrophotometer (FTIR)*, *X-Ray Diffractometer (XRD)*, and *Scanning Electron Microscope with Energy Dispersive X-Ray Spectrophotometer (SEM-EDX)*. Antibacterial activity tests were carried out with the bacteria *Bacillus subtilis* and *Escherichia coli* using disc diffusion method on nanocomposites films.

The experimental results showed that amino acid tyrosine can be used as a reductor and capping agent in the synthesis of AgNPs which were observed by a color from colorless to yellow. The synthesis process was obtained in alkaline condition at optimum pH 11. The optimum concentrations of tyrosine and AgNO₃ respectively were 3 mM and 0.5 mM, so it was obtained the ratio of tyrosine and AgNO₃ was 6:1. The optimum reaction time was 45 minutes at 90 °C. The characterization of AgNPs using TEM and PSA showed a round shape with the particle size of 29,5 nm. Chitosan-AgNPs (CS-AgNPs) nanocomposites film was obtained that tensile strength and elongation values were 8.40 MPa and 21.36 % respectively. Chitosan-AgNPs (CS-AgNPs) film possessed antibacterial activity indicated by inhibition zone test. The result showed that diameter of inhibition zone in *Bacillus subtilis* bacteria was 10.5 mm and *Escherichia coli* bacteria was 9 mm. Antibacterial activity have a stronger effect against *Bacillus subtilis* (gram-positive) than *Escherichia coli* (gram-negative).

Keywords: antibacterial, nanocomposites film, silver nanoparticles, tyrosine