EDIBLE NANOCOATING BERBASIS BIOPOLIMER KITOSAN DENGAN ZAT AKTIF NANOPARTIKEL PERAK (AgNPs) UNTUK PERLINDUNGAN BUAH PISANG

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INTISARI

Sintesis nanopartikel perak (AgNPs) telah dilakukan dengan metode *bottom-top* reduksi kimia. Sintesis AgNPs dalam larutan membutuhkan prekursor logam perak nitrat ($AgNO_3$) dengan penambahan asam askorbat ($C_6H_8O_6$) dan natrium sitrat ($Na_3C_6H_5O_7$), pada dengan variasi rasio volume (dalam mL) prekursor Ag:asam askorbat:natrium sitrat 1,5:10:10; 1,5:20:20; 1,5:30:30; dan 1,5:40:40. Hasil sintesis AgNPs dikarakterisasi dengan spektroskopi UV-Vis dan TEM (*Transmission Electron Microscopy*). AgNPs yang telah disintesis dilakukan variasi volume yaitu 2%, 4%, 6%, dan 8% untuk ditambahkan pada kitosan sebagai bahan *edible nanocoating* yang diaplikasikan pada buah pisang. Nanokomposit kitosan-AgNPs dikarakterisasi dengan spektroskopi FT-IR, XRD (*X-ray diffraction*), dan SEM (*Scanning Electron Microscope*) serta dilakukan pengujian aktivitas antibakteri pada bakteri *Escherichia coli* sebagai bakteri Gram negatif dan *Staphylococcus aureus* sebagai bakteri Gram positif. Nanokomposit kitosan-AgNPs selanjutnya diaplikasikan pada buah pisang.

Hasil penelitian menunjukkan bahwa AgNPs telah berhasil disintesis dengan variasi terbaik yaitu 1,5:30:30 yang memiliki morfologi berbentuk bulat (*spherical*) yang seragam dan memiliki ukuran diameter partikel sebesar 10,46 ± 2,35 nm. Nanokomposit kitosan-AgNPs yang telah diperoleh memiliki aktivitas antibakteri pada bakteri *Escherichia coli* dengan diameter daya hambat sebesar 0,34-2,90 mm dan *Staphylococcus aureus* dengan diameter daya hambat 1,60- 4,41 mm. Aplikasi pada buah pisang menunjukkan bahwa *edible nanocoating* kitosan-AgNPs dengan variasi terbaik 6% berhasil mempertahankan kesegaran pisang dan berat bobot pisang hingga hari ke-10.

Kata kunci: *Escherichia coli*, kitosan, nanopartikel perak (AgNPs), *Staphylococcus aureus*

EDIBLE NANOCOATING BASED ON BIOPOLYMER CHITOSAN WITH SILVER NANOPARTICLES (AgNPs) FOR PROTECTION OF BANANA FRUIT

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ABSTRACT

Synthesis of silver nanoparticles (AgNPs) has been carried out by bottom-top chemical reduction method. The chemical synthesis of AgNPs in solution requires silver nitrate metal precursor ($AgNO_3$) with the addition of ascorbic acid ($C_6H_8O_6$) and sodium citrate ($Na_3C_6H_5O_7$), with a volume ratio (in mL) of 1.5:10:10; 1.5:20:20; 1.5:30:30; and 1.5:40:40. Synthesis of AgNPs was characterized by UV-Vis spectroscopy and TEM (Transmission Electron Microscopy). The synthesized AgNPs were varied in volume, namely 2%, 4%, 6%, and 8% to be added to chitosan as an edible nanocoating material that was applied to bananas. Chitosan nanocomposites-AgNPs were characterized by FTIR spectroscopy, XRD (X-ray diffraction), and SEM (Scanning Electron Microscope) and were tested on the antibacterial activity of *Escherichia coli* as a Gram negative and *Staphylococcus aureus* as Gram positive bacteria. Chitosan nanocomposites-AgNPs were then applied to bananas.

The results showed that AgNPs had been successfully synthesized with the best variation of 1.5:30:30 which had a uniform spherical morphology and had a particle diameter of 10.46 ± 2.35 nm. The chitosan-AgNPs nanocomposite that has been obtained has antibacterial activity on *Escherichia coli* bacteria with an inhibitory diameter of 0.34-2.89 mm and *Staphylococcus aureus* with an inhibitory diameter of 1.6-4.41 mm. Application to bananas showed that edible nanocoating chitosan-AgNPs with the best variation of 6% succeeded in maintaining banana freshness and banana weight until the 10^{th} day.

Keywords: Chitosan, *Escherichia coli*, silver nanoparticles (AgNPs), *Staphylococcus aureus*.