SINTESIS KOLOID DAN FILM NANOKOMPOSIT PERAK-KITOSAN (Ag-Kit) DENGAN REDUKTOR SUKROSA DAN AKSELERATOR NATRIUM HIDROKSIDA SERTA AKTIVITASNYA SEBAGAI ANTIBAKTERI

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INTISARI

Telah dilakukan penelitian sintesis koloid dan film nanokomposit perak-kitosan (Ag-Kit) dengan reduktor sukrosa dan akselerator natrium hidroksida serta aktivitasnya sebagai antibakteri. Sintesis nanokomposit Ag-Kit dilakukan dengan cara mereduksi Ag^+ menjadi Ag^0 pada suhu ruang dengan akselerator NaOH dan reduktor sukrosa dengan variasi jumlah NaOH, perbandingan molar $AgNO_3$/sukrosa, waktu reaksi, dan jumlah prekursor $AgNO_3$. Hasil koloid Ag-Kit pada kondisi optimum dikarakterisasi menggunakan spektrofotometer UV-Vis untuk menganalisis gejala *localized surface plasmon resonance* (LSPR), spektroskopi FTIR untuk mengetahui gugus fungsi yang menstabilkan nanopartikel, dan TEM untuk mengetahui ukuran dan bentuk Ag-Kit yang terbentuk. Ag-Kit yang berhasil disintesis digunakan untuk pembuatan film nanokomposit Ag-Kit dengan ditambahkan gliserol dan diuji sifat mekanik (kuat tarik dan elongasi) dari variasi penambahan jumlah gliserol. Film nanokomposit dengan sifat mekanik terbaik juga dikarakterisasi dengan SEM-EDX, XRD, dan spektroskopi FTIR.

Hasil penelitian ini diperoleh kondisi optimum sintesis Ag-Kit dengan jumlah NaOH 1 mmol dan perbandingan molar $AgNO_3$/sukrosa 1:4. Karakterisasi Ag-Kit dengan TEM menunjukkan bahwa ukuran nanopartikel sebesar 8,6 ± 0,25 nm dan berbentuk bulat. Variasi terbaik film nanokomposit Ag-Kit adalah dengan jumlah gliserol 100% ($b_{gliserol}/b_{kitosan}$) dengan nilai kuat tarik dan elongasi masing-masing sebesar 1,56 ± 0,32 Mpa dan 138,18 ± 24,54. Ag-Kit dalam bentuk koloid dan film nanokomposit berpotensi sebagai antibakteri yang ditunjukkan dengan adanya zona hambat pada bakteri gram-negatif *E. coli* dan bakteri gram-positif *B. subtilis* dengan kategori sedang hingga sangat kuat.

Kata kunci: antibakteri, film nanokomposit, perak-kitosan, reduktor, sukrosa.

SYNTHESIS OF COLLOID AND NANOCOMPOSITE FILM OF SILVER-CHITOSAN (Ag-Chit) WITH SUCROSE AS A REDUCING AGENT AND SODIUM HYDROXIDE AS AN ACCELERATOR AND THEIR ACTIVITY AS ANTIBACTERIAL

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ABSTRACT

Synthesis of colloid and nanocomposite film of silver-chitosan (Ag-Chit) with sucrose as a reducing agent and sodium hydroxide as an accelerator and their activity as antibacterial were conducted. Synthesis of nanocomposite Ag-Chit was carried out by reducing Ag^+ to Ag^0 at room temperature using NaOH as accelerator and sucrose as reducing agent with varying amount of NaOH, molar ratio of $AgNO_3$/sucrose, reaction time, and amount of $AgNO_3$ as precursor. The Ag-Chit colloid synthesized at optimal conditions was characterized using UV-Vis spectrophotometer to analyze a phenomenon of localized surface plasmon resonance (LSPR), FTIR spectroscopy to determine the functional groups which stabilize nanoparticles, and TEM to determine the size and shape of the formed nanoparticles. The synthesized Ag-Chit was used for the preparation of Ag-Chit nanocomposite films by adding glycerol at various amounts and their mechanical properties (tensile strength and elongation) were then determined. The nanocomposite films with the best mechanical properties were also characterized by SEM-EDX, XRD, and FTIR spectroscopy.

This study found that optimum condition for the synthesis of Ag-Chit colloid occurred at the use of 1 mmol of NaOH and 1:4 molar ratio of $AgNO_3$/sucrose. Characterization of Ag-Chit using TEM yielded the size of the nanoparticle 8.6 ± 0.25 nm and round-shape. Addition of glycerol with composition of $W_{glycerol}/W_{chitosan}$ 100% generated the best Ag-Chit nanocomposite film tensile strength and elongation values 1.56 ± 0.32 MPa and 138.18 ± 24.54, respectively. Ag-Chit in colloidal form and nanocomposite film have a potency as antibacterial as indicated by the presence of an inhibitory zone for gram-negative bacteria, *E. coli* and gram-positive bacteria, *B. subtilis* which can be categorized as moderate to very strong antibacterial.

Keywords: antibacterial, nanocomposite film, reduction agent, silver-chitosan, sucrose.