ABSTRACT

This research focuses on the development of chitosan-based materials through chemical structure modification to enhance their antibacterial activity. Chitosan was selected due to its biocompatible and biodegradable properties, as well as its ability to function as both a matrix and a stabilizer for metal nanoparticles. The modification was carried out via Schiff base formation using benzaldehyde and veratraldehyde, followed by substitution of a lysine group at the 6-deoxy position and the formation of a composite with silver nanoparticles (AgNPs). This modification strategy aims to enhance the material's capability as a capping agent, thereby improving its antibacterial performance. The synthesis involved several stages, including the formation of chitosan Schiff bases, subsequent modification into 6-deoxy-p-sulfonyl toluene derivatives as intermediates, lysine substitution, and composite formation through the reduction of Ag^{+} *ions to* Ag^{0} *within the polymer matrix. Characterization was performed using UV-Vis spectroscopy, FT-IR, SEM-EDX, and SEM-EDX mapping, while antibacterial activity was evaluated using the Total Plate Count (TPC) method on days 0, 3, and 7. The results showed that the modification was successfully achieved, as indicated by changes in product color, shifts in UV-Vis and FT-IR spectra, and the detection of Ag elements in SEM-EDX analysis. Antibacterial activity increased after modification, with the veratraldehyde-based system exhibiting higher effectiveness compared to the benzaldehyde-based system. The optimum antibacterial activity was obtained for the 6-DL-BSK-V/Ag composite, reaching an inhibition value of 95% on day 7, followed by 6-DL-BSK-B/Ag at 71%. Overall, these findings demonstrate that chitosan modification significantly enhances the antibacterial activity of the resulting materials.*

Keywords: *Chitosan, Schiff base, lysine, silver nanoparticles (AgNPs), antibacterial activity.*