

ABSTRACT

The Chitosan is a natural biopolymer possessing antibacterial activity; however, its application is still limited due to its relatively low solubility and biological activity. Chitosan modification through Schiff base formation, substitution of the hydroxyl group at the C-6 position with L-lysine, and composite formation with silver nanoparticles (AgNPs) is expected to enhance its antibacterial activity. This study aimed to synthesize 6-deoxy-6-L-lysine chitosan benzaldehyde Schiff base/Ag composite and 6-deoxy-6-L-lysine chitosan-ortho vanillin Schiff base/Ag composite, as well as to evaluate their antibacterial activities. The synthesis was carried out through several stages, namely Schiff base formation, tosylation of the hydroxyl group at the C-6 position, substitution with L-lysine, and composite formation with silver nanoparticles. The synthesized products were characterized using UV–Vis and FTIR spectrophotometry, while the composites were further characterized using SEM–EDX. Antibacterial activity was evaluated in vivo using fresh chicken meat by the Total Plate Count (TPC) method. The results showed that the synthesis of 6-deoxy-6-L-lysine chitosan benzaldehyde Schiff base yielded a product with a yield of 56.19% and a degree of substitution of 10.92%, whereas the corresponding 6-deoxy-6-L-lysine chitosan benzaldehyde Schiff base/Ag composite exhibited a yield of 31.56%. The synthesis of 6-deoxy-6-L-lysine chitosan-ortho-vanillin Schiff base resulted in a yield of 89.62% with a degree of substitution of 19.55%, while the corresponding 6-deoxy 6-L-lysine chitosan-ortho-vanillin Schiff base/Ag composite showed a yield of 64.11%. UV–Vis characterization of the 6-deoxy-6-L-lysine chitosan-ortho vanillin Schiff base/Ag composite confirmed the formation of silver nanoparticles, as indicated by the appearance of an absorption band at 415.6 nm. FTIR spectra confirmed the successful modification of chitosan through the presence of characteristic functional groups. Antibacterial activity tests revealed that both the 6-deoxy-6-L-lysine chitosan-benzaldehyde Schiff base/Ag composite and the 6 deoxy-6-L-lysine chitosan-ortho-vanillin Schiff base/Ag composite at a concentration of 2500 ppm exhibited the highest antibacterial activities, with inhibition percentages of 71% and 97%, respectively, on the seventh day. These findings indicate that chitosan modification and composite formation with silver nanoparticles successfully enhanced antibacterial activity.

Keywords: chitosan, Schiff base, benzaldehyde, ortho-vanillin, L-lysine, silver nanoparticles, antibacterial activity