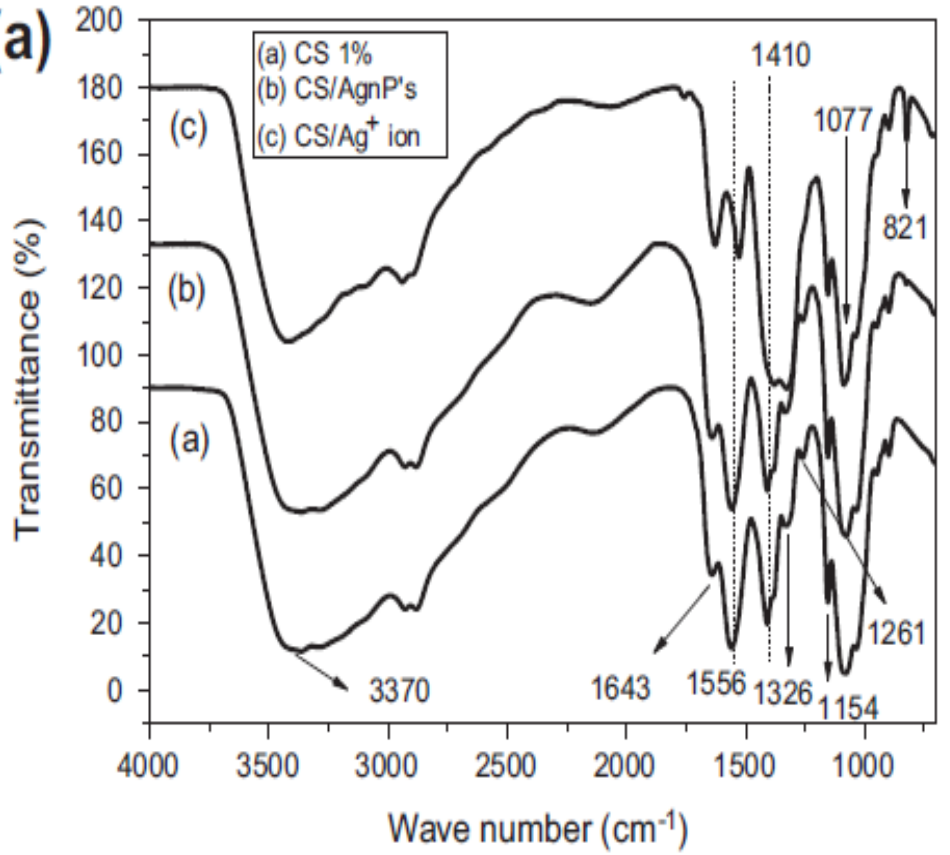
The analysis was performed to understand the molecular interactions of AgNP and Ag+ ions with chitosan.

The pure chitosan films exhibits characteristic transmittance band at:

- 3000–3500 cm^{-1} overlapped NaH and OH stretching vibrations
- 1643 cm^{-1} band for amide I (C@O stretching)
- 1556 cm^{-1} for amide II (NaH bending)
- 1410 cm^{-1} for OH bending vibrations
- 1326 cm^{-1} for CH_2 wagging vibration
- 1261 cm^{-1} for amide III due to combination of NaH deformation and CAN stretching
- 1154 cm^{-1} for anti-symmetrical stretching of CAOAC bridge.

In the FTIR spectra of CS/AgNP nanocomposite film the bands at

- 3370 cm^{-1} (amine and hydroxyl groups)
- 1556 cm^{-1} (bending vibrations of NH_3) decrease in intensity and slightly shift to lower wave number evidencing the interaction of primary amino groups in chitosan with AgNP surface.
- 1643 cm^{-1} (amide I group), 1410 cm^{-1} (bending vibration of AOH group) and 1326 cm^{-1} (CH_2 wagging vibration) were not changed, suggesting that these transmittance bands are not sensitive to the metal nanoparticle surface.



In contrast to the CS/AgNP composite, the CS/Ag+ ions films showed a significant decrease in transmittance at

- 3370 cm^{-1}, it also shifts to 3430 cm^{-1}.
- The prominent NAH bending vibration bands around 1556 cm^{-1} shifted to 1539 cm^{-1} along with a decreasing in intensity, suggesting that the NaH vibration is strongly affected by the interaction with Ag+ ions.
- 1410 cm^{-1} (that corresponds to OH bending vibration), the bands near 1077 cm^{-1} (that are usually attributed to the CAO and CAN stretching vibrations) and the bands at 1326 cm^{-1} corresponded to CH_2 wagging vibrations, all showed a remarkable intensity reduction. These changes are due to the interaction of hydroxyl groups with Ag+ ions through oxygen.
- CS/Ag+ ion composite film shows a new band about 821 cm^{-1} assigned to NO_3 absorption, which confirms the existence of NO_3 as a residual ion from silver salt.
- Such band is not observed in CS/AgNP films, likely due to thermal decomposition of NO_3 to NO and O_2.