**Title:** Chemical synthesis of silver nanoparticles and chitosan biocompatible polymer nanocomposites applicable in wound coating

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**Introduction**

Chitosan is a linear biomedical [polysaccharide](https://en.wikipedia.org/wiki/Polysaccharide) and it is made by treating the [chitin](https://en.wikipedia.org/wiki/Chitin) shells of crustaceans with an alkaline substance in excess as a reagent and water as a solvent. It can be used in [agriculture](https://en.wikipedia.org/wiki/Agriculture) as a seed treatment, [bio-pesticide](https://en.wikipedia.org/wiki/Biopesticide) that helps plants to fight off fungal infections, [wine making](https://en.wikipedia.org/wiki/Winemaking), self-healing [polyurethane](https://en.wikipedia.org/wiki/Polyurethane) [paint](https://en.wikipedia.org/wiki/Paint) coating, antibacterial [bandages](https://en.wikipedia.org/wiki/Bandage) and deliver drugs through the skin.. Chitosan is [hypoallergenic](https://en.wikipedia.org/wiki/Hypoallergenic) [antibacterial](https://en.wikipedia.org/wiki/Antibacterial) and [biodegradable](https://en.wikipedia.org/wiki/Biodegradable) and its derivatives have been used in nonviral gene delivery, [transfect](https://en.wikipedia.org/wiki/Transfection) breast cancer cells, cytotoxicity; [hemostatic agents](https://en.wikipedia.org/wiki/Antihemorrhagic), pain reducing, transport of polar [drugs](https://en.wikipedia.org/wiki/Medication) and treat burn wounds. Chitosan has a positive charge under acidic conditions that comes from protonation of its free amino groups which leads to an increase in solubility.Silver nanoparticles have been the subject of extensive research in the frame of nanotechnology, mainly owing to their unique optical properties. Indeed, the free electron gas of Ag such nanoparticles features a resonant oscillation upon illumination in the visible part of the spectrum. The spectral properties of this resonance depend on the constitutive material, the shape of the nanoparticles and its environment. This resonant electronic oscillation is called localized surface plasmon (LSP), and the field of research that studies the fundamentals and applications of LSP is known as nanoplasmonics. Plasmonic nanoparticles can behave as efficient nanosources of heat, light or energetic electrons, remotely controllable by light.Nanostructured silver compounds have achieved great attention, due to their potential applications in different areas of technology such as electronic, sensor, solar cells and photo-catalysts. Nano particles with smaller sizes and larger specific surface areas can shorten the diffusion distance of photo generated carriers transferring to the surface of photo catalysts, and increase the surface catalytic active sites. In this work Ag and Chitosan-Ag nanocomposites were made by a fast chemical procedure by three applicable hydrothermal, sonochemical and microwaves methods in water as a green solvent.

**Methods**

XRD patterns were recorded by a Philips, X-ray diffractometer using Ni-filtered CuKα radiation. SEM images were obtained using a KYKY instrument model EM3200. Prior to taking images, the samples were coated by a very thin layer of Pt (using a BAL-TEC SCD 005 sputter coater) to make the sample surface conductor and prevent charge accumulation, and obtaining a better contrast. A multiwave ultrasonic generator (BandelineMS 73), equipped with a converter/transducer and titanium oscillator, operating at 20 kHz with a maximum power output of 150 W. AgNO3, NaBH4, starch, glucose, gelatin, poly vinyl pyrrolidone and acetone were purchased from Merck or Aldrich and all the chemicals were used as received without further purifications.

**Results**

The composition of the Chitosan-Ag nanocomposite was investigated. Presence of face centred cubic phase (JCPDS No.:891010, space group: Fm-3m, strong Bragg reflection peaks can be seen which correspond to the (111), (200), (220) and (311) reflections) was confirmed and is illustrated in The crystalline sizes from Scherrer equation, Dc=Kλ/βCosθ, was estimated, β is the width of the observed diffraction peak at its half maximum intensity, K is the shape factor, which takes a value of about 0.9, and λ is the X-ray wavelength (CuKα radiation, equals to 0.154 nm). The average crystalline size for Ag nanoparticles was found to be about 30 nm respectively.