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Silk functionalization by caffeic acid assisted *in-situ* generation of silver nanoparticle

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Abstract

This paper reports a simple one-step process for the *in situ* synthesis and deposition of silver nanoparticles (AgNPs) on silk fabric by employing caffeic acid as an eco-friendly reductant. The formation of silver nanoparticles was confirmed by visible colour changes and UV–visible spectra. The SPR band of AgNPs was observed at $\lambda_{\text{max}} \sim 414\text{-}420$ nm indicating spherical or roughly spherical AgNPs, which was further confirmed by TEM and SEM measurements. Surface of AgNPs treated fabrics showed roughness due to deposition of silver particles and uniform distribution of roughly spherical AgNPs on the silk surface was observed in SEM images. EDS analysis also confirmed the presence silver in treated fabrics. An increase in the amount of caffeic acid and silver nitrate resulted in more silver being deposited on silk fabric. The caffeic acid assisted *in situ* generation of AgNPs imparted golden yellow colour and good multi-functional properties to the treated silk fabrics. The treated fabrics showed excellent fastness towards washing, rubbing and light. The antibacterial effect was highly durable as more than 90% bacterial reduction was observed even after 10 washing cycles.

Keywords: Silver nanoparticles; Caffeic acid; Silk; Antibacterial; UV-protective

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