In-situ preparation of binary-phase silver nanoparticles at a high Ag+ concentration

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Stable and monodisperse silver nanoparticles (NPs) have been synthesized using high metal salt concentration (up to 0.735 M) through a simple but novel technique. It is based on one-step procedure that uses glycerol for reducing Ag+ in the presence of o-phenylenediamine (o-PDA) resulting the nanoparticles are in two forms (one water-soluble, the other a precipitated). The water-soluble phase contains NPs that have a bimodal size distribution (2–3 and 5–6 nm); the other comprises precipitated NPs, having a unimodal size distribution (2–3 nm). The water-soluble NPs are covalently bonded to the aromatic amine molecules to form isolated units, while the precipitated nanoparticles are embedded in the networks formed by cross-linking between COOH groups of hydroxypyruvic acid (oxidized form of glycerol) and NH2 groups of o-PDA molecules. We used transmission electron microscopy (TEM), UV–Vis spectroscopy, X-ray diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy, X-ray photoelectron spectroscopy (XPS) to characterize the silver products obtained.