Characterization and biocompatibility properties of silver nanoparticles produced using short chain polyethylene glycol

ABSTRACT

Silver nanoparticles are of interest due to their unique physicochemical and antimicrobial properties. The nanoparticles were produced by chemical reduction using short chain polyethylene glycol (PEG) as reducing agent, solvent and stabilizer in absence of other chemicals. Silver nanoparticles were separated from colloidal dispersion by ultra centrifuge at 14000 rpm. The reduction of silver ion (Ag+) to silver nanoparticles (Ag^o) was monitored by pH measurement and UV-visible spectroscopy of colloidal dispersion at fixed intervals. Silver nanoparticles were characterized by X-ray diffraction (XRD) and transmission electron microscopy (TEM) and diphenyl-picrylhydrazyl (DPPH) radical scavenging method. Antimicrobial activity of silver nanoparticles was investigated against Escherichia coli, Staphylococcus aureus and Vibrio parahaemolyticus by agar plate test. Results indicated 51.5% conversion efficiency of silver ions to silver nanoparticles. Colloidal dispersion containing 4.12 mg/ml silver nanoparticles showed uniform size of 5.5 ± 1.1 nm with a typical visible spectra band at 447 nm. Silver nanoparticles showed significant ($p < 0.05$) antimicrobial efficiency and with concentration of 100 ppm resulted in 46.22%, 66.51% and 69.06% inhibition against S. aureus, E. coli and V. parahaemolyticus, respectively. The nanoparticles were also found to reduce DPPH free radical up to 88.9%. Results of this study proved that the silver nanoparticles produced by polyethylene glycol possess antimicrobial and antioxidant activity.

Keyword: Antimicrobial; Antioxidant; Polyethylene glycol; Silver nanoparticle