Abstract

Understanding is on the rise concerning the use of nanomaterials environmental/health management solutions. In the current study, silver and gold nanoparticles (AgNPs and AuNPs respectively) were prepared for this purpose and characterized with UV–visible, transmission electron microscopy (TEM), dynamic light scattering and zeta potential.

First, spherical and prism colloidal AgNPs were capped with poly-L-arginine and tested for their biological activity. Prism shaped AgNPs exhibited stronger growth inhibitory effects against *E.coli*, *P. aeruginosa* and *S. enterica,* where MBC was 0.65 μg/mL), whereas it was 2.7 μg/mL for spherical ones. Maximum mortality percentage of HeLa cell line was 80% for AgNP-prism nanocomposite, capped with poly L arginine and polyvinyl pyrollidone (PLA-PVP) at 11 μg/mL concentration. It was also found that PVP capped AgNP nanoprisms were able to detect mercury (Hg^{2+}) by colorimetric estimation (blue to yellow color); TEM and spectrophotometry revealed the change in morphology of the prismatic to spherical shaped AgNPs; energy dispersive x-ray spectroscopy (EDX) also confirmed the formation of nano-alloy with Hg^{2+}. Linear relationship was found between surface plasmon resonance (SPR) for the position shift of the AgNP nanoprisms and Hg^{2+} (Conc. 0-5 μmol/L conc.; detection limit, 0.5 μmol/L; pH, 7 – 9).

Additionally, AuNP nanoshell conjugates were using for their biosensing capacity for bacteria, such as *E. coli*, *P. aeruginosa, S. enterica* and *S. aureus*, by colorimetric method (color change, yellow to red); bacterial concentrations upto 10 CFU/mL could be detected easily. AuNP-conjugates comprised of cetyl trimethyl ammonium bromide (CTAB) capped AuNP nanoshells , conjugated with the enzyme, β-galactosidase. The bacterial surfaces (bearing electronegative surface functional groups) could electrostatically attract CTAB capped AuNP nanoshells, whereas the enzyme, β-galactosidase was freed meanwhile. Here, chlorophenol-red-β-D-galactopyranoside (CPRG), which is yellow in color, was used as substrate to attract β-galactosidase (freed from the AuNP nanoshell complex), resulting in red chromophore chlorophenol red. With the increased concentration of bacterial cell, more absorption was seen by spectrophotometer, which

clearly proved our hypothesis. Hence our studies suggest the possible antibacterial, biosensing, and anticancer applications of AgNPs and AuNPs.

Key words: **PVP capped AgNP, SEM, TEM, EDX, UV–visible, CTAB-functionalized gold nanoshells, CPRG, β-galactosidase, Chlorophenol red.**