Abstract
Recently, the use of silver nanoparticles (AgNPs) has increased many folds in the industrial, biomedical, and other sectors. Due to its reported biocidal properties, the environment becomes vulnerable to its toxic effects. Mitigating its toxicity might be a good approach in the current scenario. The current study has been designed to perform surface functionalization of the AgNPs using biomolecules, such as amino acids. For this purpose, silver nanoconjugates (AgNCs) were developed using amino acids, such as L-glycine, L- tyrosine, L- tryptophan, N-acetyl cysteine, L- lysine, and L- arginine and tested for their biomimetic and catalytic activity. Characterization of these AgNCs were performed using UV-Vis spectroscopy and Fourier transform infrared spectroscopy (FTIR). In-vitro studies were done to assess their antioxidant potential by performing tests, such as 2,2- diphenyl-1picrylhydrazyl (DPPH), H_2O_2 scavenging assay, and Ferric reducing power (FRP) assay. We found a significant increase (p<0.05) in the concentration of pure amino acids, such as L-Tryptophan, NAC, L- Tyrosine, and L- Glycine as well as conjugated amino acids, such as Lys-AgNCs and Tyr-AgNCs resulted in the significant increase (p<0.05) of DPPH values. In case of H_2O_2 scavenging assay, L- Tyrosine, and NAC showed non-significantly higher (p>0.05) activity while L- glycine showed the least activity in all pure amino acids. In conjugated amino acids, NAC-AgNPs and Gly-AgNPs showed significantly higher (p<0.05) while Lys-AgNCs showed the least activity. In the ferric reducing power (FRP) assay pure amino acids, L-Tryptophan, and L-Tyrosine showed significantly higher (p<0.05) absorbance than the other amino acids. In Conjugated amino acids Lys-AgNPs, Arg-AgNPs, Tryp-AgNPs, Tyr-AgNPs, and Gly-AgNPs showed significantly higher (p<0.05) absorbance than C-AgNPs and NAC-AgNPs at 700nm. In-vitro biomimetic analysis was done to assess their antioxidant enzymes by performing tests, such as superoxide dismutase (SOD)- like activity, Catalase (CAT)- like activity, and Glutathione-S-transferase (GST)-like activity. Arg-AgNPs showed a significantly increased (p<0.05) level of SOD-like activity, C-AgNPs and AgNCs showed a significantly decreased (p<0.05) level of CAT-like activity, and Arg-AgNPs showed a significant higher (p<0.05) level of GST-like activity. The catalytic activity of pure and capped AgNPs was studied against Methylene blue and Congo red. Tyr-AgNCs showed methylene blue dye degradation and NAC-AgNCs showed congo-red dye degradation. It is concluded that surface functionalization enhanced the stability of chemically-synthesized NMs, mainly facilitated by functional groups present in the amino acids. Biomolecules-based synthesis and surface functionalization of NMs might yield eco-friendly and less toxic NMs for future applications. **Keywords**: Silver nanoparticles, surface functionalization, amino acids, biomimetic activity, SOD, CAT, GST, catalytic activity, congo red, methylene blue.