ABSTRACT

Green route was employed for the fabrication of stable silver nanoparticles (Ag-NPs) using *Setaria verticillata*, *Cenchrus ciliaris* and *Azadirachta indica* seeds exudates as both reducing and capping agents. The physio-chemical properties of the resulting Ag-NPs were investigated by employing variety of characterization techniques as UV–visible spectrophotometery; X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and fourier transform infrared (FTIR) spectrometry. In this study, NPs were synthesized from silver nitrate and various concentrations of the seed extract by a green method. However, all the synthesized Ag-NPs showed quasi spherical morphology under transmission electron microscope (TEM).

SV Ag-NPs are prepared by using *S. Verticillata* seeds exudates, their *in-vitro* toxicity was studied on adult earth worms (Lumbricina) resulting in statistically significant ($P < 0.05$) inhibition, in addition; 3-(4, 5 dimethylthiazol-2-yl) 2, 5-diphenyltetrazolium bromide (MTT) assay with Baby hamster kidney cells (BHK-21), revealing dose dependent cytotoxic effect of -NPs. The anti-microbial activities of the 0.75µg/ml Ag-NPs were tested against various gram-positive (*Bacillus anthracis*, *Bacillus amyloliquefaciens, Staphylococcus aureus* and *Staphylococcus warneri*) and gram-negative (*Escherichia coli* and *Acinetobacter baumannii*) bacteria, demonstrating efficient inhibition of pathogen growth. The sample 40SV were loaded with hydrophilic anticancer drugs (ACD) doxorubicin (DOX) and daunorubicin (DNR) for developing novel drug delivery carrier having significant adsorption capacity and efficiency in order to expurgate the side effects of the medicine, effective for leukemia chemotherapy.

A. indica Ag-NPs were rapidly synthesized using an aqueous seed extract with $AgNO_3$ solution within 30 minutes and their size ranged between 10 – 30 nm. However, the synthesized NPs showed spherical morphology with an average diameter of 13 nm when observed under transmission electron microscope (TEM). *A. indica* Ag-NPs showed enhanced bactericidal action against gram-positive (*Bacillus anthracis*, *Bacillus amyloliquefaciens, Staphylococcus aureus* and *Staphylococcus warneri*) and Gram-negative (*Escherichia coli* and *Acinetobacter baumannii*) strains compared to raw *A. indica* seed extract. However, Ag-NPs interacted with the

bacterial membrane, caused cellular leakage and ultimately cell death as evident from TEM images. Moreover, Ag-NPs reduced congo red (CR) and methylene blue (MB) that suggests their catalytic potential in the removal of industrial organic dyes.

C. ciliaris Ag-NPs are prepared by using *Cenchrus ciliaris* seeds exudates. Increasing *C. ciliaris* concentration leads to a reduction in the particle size and the agglomeration between the NPs. The results showed that synthesized Ag-NPs (1-3CC) are less agglomerated and exhibited significant antimicrobial potential against various bacterial strains compared to 4-5CC This report highlights the effect of nanocatalyst on the degradation rate of toxic contaminants, methylene blue (MB) and congo red (CR) by $NaBH_4$ in an eco-friendly manner. In addition, Ag-NPs were loaded with anticancer drugs (ACD) [doxorubicin (Dox) hydrochloride, and daunorubicin (Dono)] to develop novel drug carrier with high loading capacity and rapid drug adsorption rate to hampered the side effects of ACD. The loading capacity of ACD was investigated as a function of contact time and adsorption dosages had a maximum adsorption capacity of 404.19 and 253.85 mg/g for Dox and Dono respectively. Moreover, kinetic models were conducted to evaluate the adsorption kinetics

The anti-microbial activities of the Ag-NPs were tested against various bacterial strains, thick wall of peptidoglycan (PG) in Gram positive strains made them less vulnerable to Ag-NPs penetration. Cell wall of Gram negative strains facilitate the entry of NPs makes difference in the bactericidal activity of Ag-NPs. However, Ag-NPs interacted with the bacterial membrane, caused cellular leakage and ultimately cell death as evident from TEM images. This work also highlights the effect of nano catalyst on the degradation rate of toxic contaminants, methylene blue (MB) and congo red (CR) by $NaBH_4$ in an ecofriendly manner. Moreover, Ag-NPs reduced CR and MB that suggests their catalytic potential in the removal of industrial organic dyes. The current findings will provide an insight for the preparation of green bactericidal, anticancer, anthelmintic and catalytic agents that can be used in biomedical applications.