**Fabrication of highly stable silver nanoparticles with shape-dependent electrochemical efficacy**

Design of effective and efficient nanoscale sensor for the selective monitoring of hydrogen peroxide (H2O2) in environmental samples is of great requirement to avoid several diseases; not only but also include diabetes, cancer, cardiovascular disorders, aging and Alzheimer. Herein, we report the fabrication of highly stable silver nanoparticles (Ag NPs) with three different phases (i.e spherical (Sp), star (St) and pyramidal (Py)) via simple wet chemical approach. Among all the three phases, St Ag-NPs with more exposed catalytic active sites, poor dipolar non-radiative plasmons multipoles and large number of surface defects which in turn enhance ion(s) diffusion between electrode-electrolyte interfaces; shows highest performance in terms of linear range, limit of detection and sensitivity. We observe no interference between electro-active organic compounds (ascorbic acid (AA), uric acid (UA), dopamine (DA) and glucose) and inorganic (NaCl, KCl, Na2SO4 and K2SO4) species on the as-fabricated St-Ag-NPs based electrode. Furthermore, We were able to account for the amount of H2O2 generated in the discharged water (effluent) from a poultry firm using the designed St-Ag-NPs based electrode over a wide linear range (~5 mM) in the presence of co-existing electro-active species. These results show reliability of our designed electrode as useful sensing materials for the detection and monitoring of H2O2 mismanagement in an immediate environment.