Abstract of Ph.D. Thesis (Botany) of Ms. Aiswariya K S entitled

GREEN SYNTHESIS OF SILVER NANOPARTICLES USING CURCUMA RHIZOMES: CHARACTERIZATION AND APPLICATION

Nanotechnology refers to the wide range of technologies and applications that involve the use of particles ranging from a few nanometers to hundreds of nanometers in diameter. Nanoparticles (NPs) have revolutionized the fields of environmental remediation, medicine, material science, chemistry and engineering. The main goal of this research is to produce silver nanoparticles (AgNPs) using aqueous extracts of *Curcuma zanthorrhiza* Roxb (CZ). and *Curcuma aromatica* Salisb.(CA), as well as to evaluate its diverse catalytic, antimicrobial, antioxidant, *in vitro* and *in vivo* anticancer properties. The toxicity of the silver nanoparticles produced was also investigated.

To establish the synthesis of silver nanoparticles, UV-Visible spectroscopy experiments, FTIR investigations, X-ray diffraction techniques, HR-TEM, FESEM, Energy dispersive X-ray (EDX) analysis, DLS, and BET analysis was carried out. HR-LCMS analysis of nanoparticles demonstrated the chemical nature of biomolecules capped over the AgNPs.

The catalytic efficiency of synthesized nanoparticles (CZAgNPs and CAAgNPs) in the degradation of ionic dyes (malachite green and coomassie brilliant blue), by photons (sunlight and UV light irradiation) was investigated. The catalytic property of nanoparticles were further validated by analyzing the degradation of azo dyes (Orange G, Methyl Orange, Eriochrome Black T, and Congo Red) using sodium borohydride as a reductant. UV-Visible spectral analysis has been used to investigate the reduction patterns of various dyes. HR LCMS was further used for quantitative and qualitative analysis of the degradation products that revealed their non –toxic nature.

The antibacterial properties of synthesized CZAgNPs and CAAgNPs were examined using the disc diffusion method and the broth microdilution assay, in light of the potential applications of silver nanoparticles in many biomedical domains. The antifungal property of nanoparticles was investigated by the poisoned food technique. *In silico* molecular docking

ST. THOMAS' COLLEGE (AUTONOMOUS), THRISSUR-1

Dr. Martin K. A.
Principal-in-Charge
St. Thomas College (Autonomous)
Thrissur - 680 001

experiments were done using the tool Auto Dock 4.2. Here rigid protein flexible ligand docking was employed to study the interactions.

The safety evaluation of the synthesized nanoparticles has been conducted *in vivo* in Swiss albino male and female mice. In the present investigations, the antioxidant potentials of plant extracts and AgNP synthesized from them have been assessed using an *in vitro* DPPH assay. The protective impact of green synthesized silver nanoparticles on Swiss albino mice intoxicated with sodium fluoride was investigated. The trypan blue exclusion method in DLA and EAC cell lines, as well as the MTT assay in MCF -7 cell lines, was used to assess the short-term *in vitro* cytotoxicity of plant extracts and the as synthesized silver nanoparticles. To further substantiate the cytotoxic properties of silver nanoparticles, *in silico* molecular docking investigations were conducted. The potential of silver nanoparticles in inhibiting the rapid growth and proliferation of both DLA and EAC tumour models was investigated in this study.

Based on the findings, it was concluded that *C. zanthorrhiza* and *C. aromatica* rhizome extracts could be used to synthesize silver nanoparticles. This study also provided instrumental evidence for the biophysical properties of AgNPs generated from aqueous rhizome extracts of *C. zanthorrhiza* and *C. aromatica* by the different characterization methods. The biosynthesized AgNPs exhibited strong catalytic, antimicrobial, antioxidant, and anticancer properties, implying that they could be used in environmental clean-up and pharmaceutical purposes. These findings add to the growing importance of biogenic AgNPs for prospective nanomedicine and nanocatalytic applications.

ST. THOMAS' COLLEGE (AUTONOMOUS), THRISSUR-1

Dr. Martin K. A.
Principal-in-Charge
St. Thomas College (Autonomous)
Thrissur - 680 001