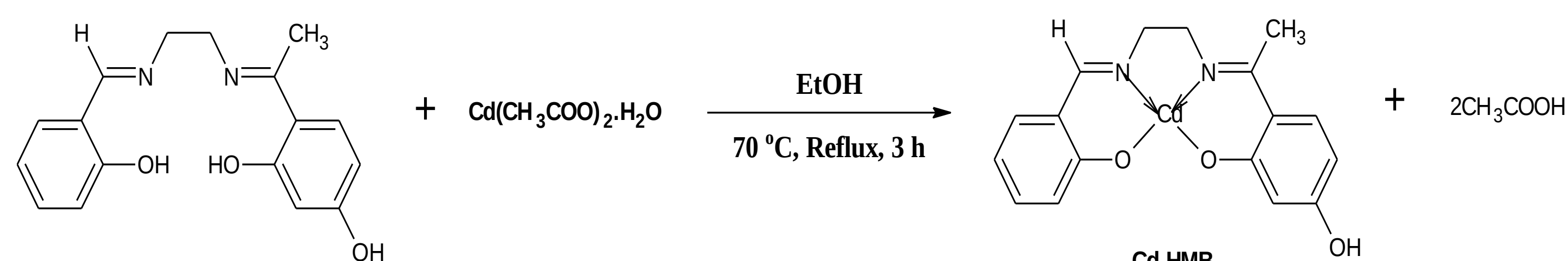


INTRODUCTION

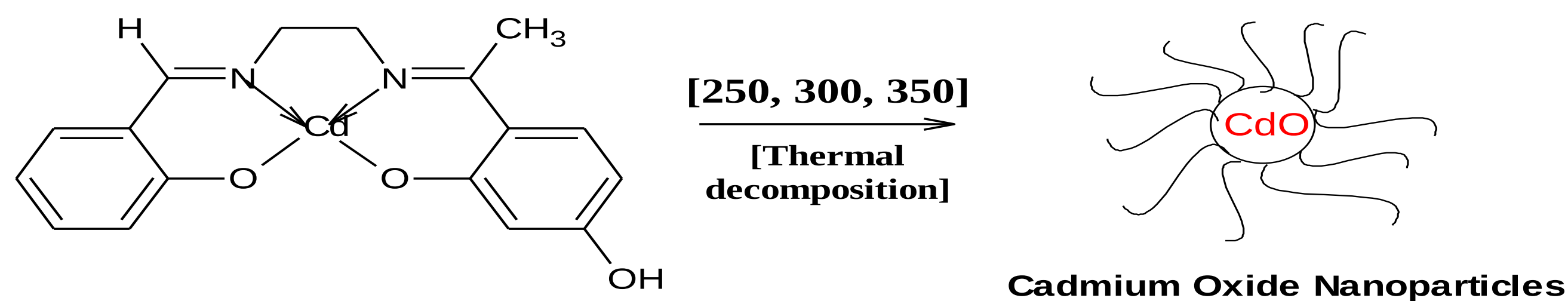
Metal complexes containing Schiff base are of interest because of their electronic properties that can be modified by suitable functionalization with amine and cyclic substituents [1-2]. Also, tetradentate Schiff base complexes have shown high stability when coordinated to metal ion using the N_2O_2 donor atoms [1]. Metal oxide nanoparticles can be obtained by various methods depending on the chemical and physical techniques employed. Metal oxide nanoparticles and composite materials are widely applied in the field of research and development and diverse applications in industries including surface coatings, bioengineering, biodiagnostics, optoelectronics, and agriculture [3]. Cadmium oxide nanoparticles (CdO NPs) have received considerable attention due to their unique antibacterial, antifungal, and UV filtering properties, high catalytic and photochemical activity [4]. Among the metal oxide nanoparticles, cadmium oxide is interesting because it has vast applications in various areas such as optical, piezoelectric, magnetic, and gas sensing. Besides these properties, CdO nanostructure exhibits high catalytic efficiency, strong adsorption ability and are used more and more frequently in the manufacture of sunscreens [3-4], ceramics and rubber processing, wastewater treatment, and as a fungicide [3-4]. Reactive oxygen species (ROS) or free radicals are products of the in vivo physiological and bio-chemical processes in the living cells [1] that could cause lipid peroxidation and may lead to diseases such as cancer, cardiovascular diseases, immunodeficiency, liver injury and other infections [1,5]. In order to safeguard the human body against cell damage by oxidative species, antioxidant is of paramount importance [5]. Due to many biological processes taking place at the nanoscale level, there is the potential that engineered nanomaterials may interact with biomolecules and cellular processes, hence, CdO nanoparticles are believed to be biosafe, nontoxic, and biocompatible. Based on the above facts in the present work, we have reported the synthesis and characterization of Cd(II) Schiff base complexes and its CdO nanoparticles. Also, we have reported the antiradical and antibacterial activities of the synthesized nanomaterials.

MATERIALS AND METHODS

Reaction route for the preparation of the metal complexes



Reaction route for the preparation of the metal oxide nanoparticles



Scavenging prospects of 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical

The antioxidant activity of the metal oxide nanoparticles were determined using a stable 2,2-diphenyl-1-picrylhydrazyl (DPPH) reagent following a previous procedure [1]. The equation below was used to obtain the percentage scavenged DPPH radical:

$$\text{Percentage scavenging activity} = \frac{\text{Absorbance of control} - \text{Absorbance of sample}}{\text{Absorbance of control}} \times 100$$

Characterization Methods: UV/Vis, FT-IR, TGA, XRD, TEM

RESULTS AND DISCUSSION

The metal complex were obtained by reaction the cadmium acetate in methanol with the ligand in a 1:1 mole ratio. The complex analytical data disclose metal: ligand molar ratio (1:1) for the system. The complex were found soluble in DMF, DMSO and insoluble in other organic medium, with molar conductivity measured in DMF solution indicating a non-electrolyte character.

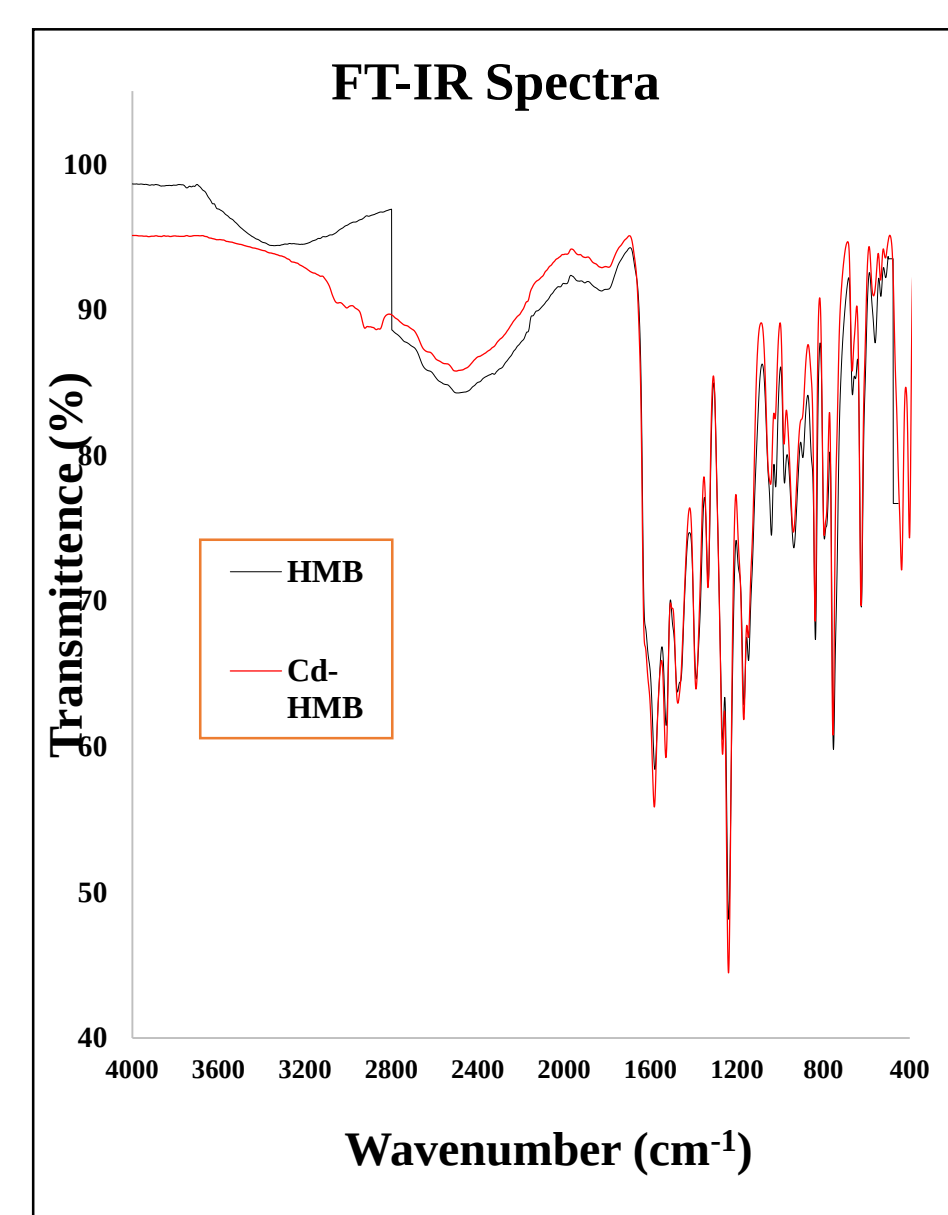


Fig. 1: FT-IR

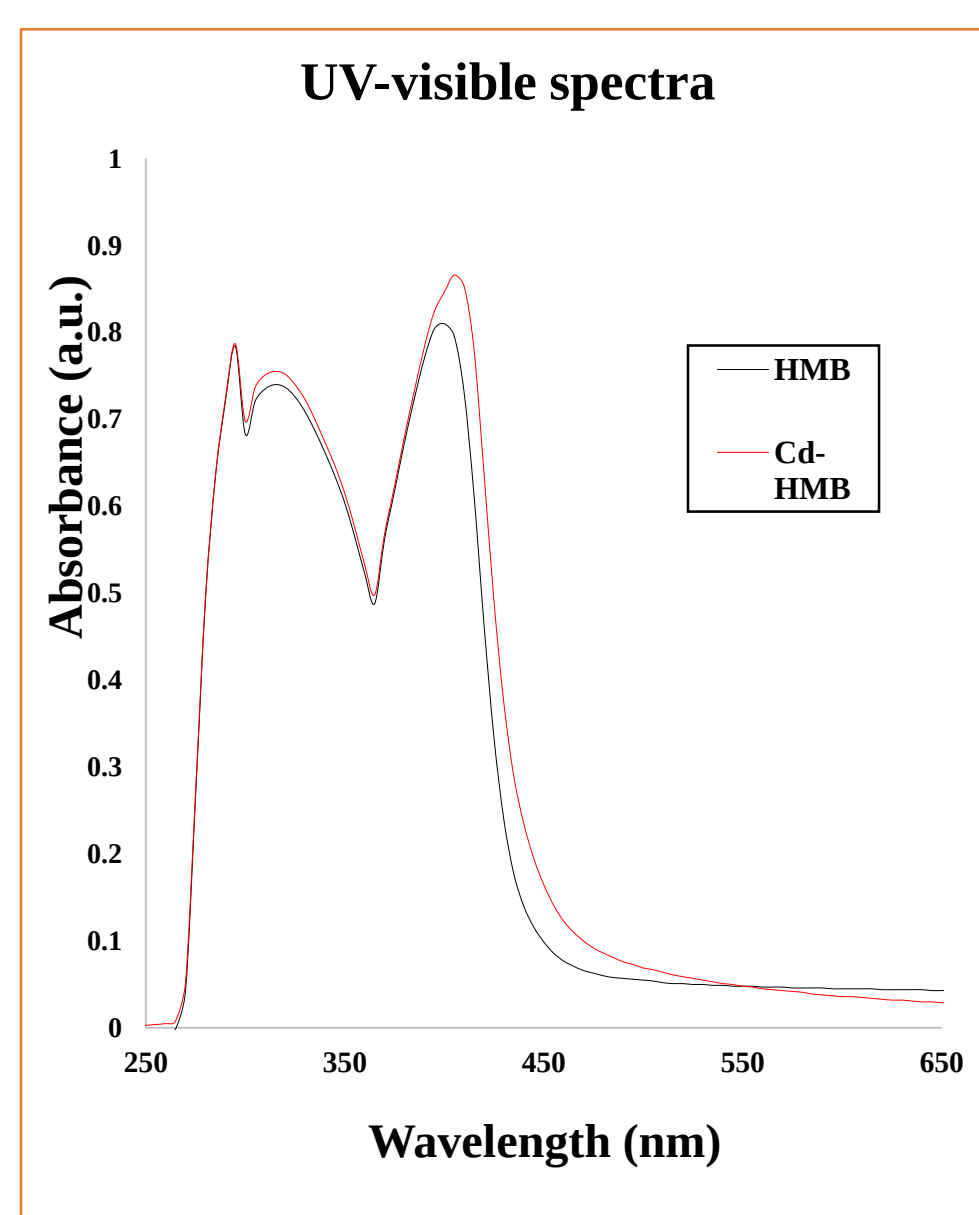


Fig. 2: UV-Vis

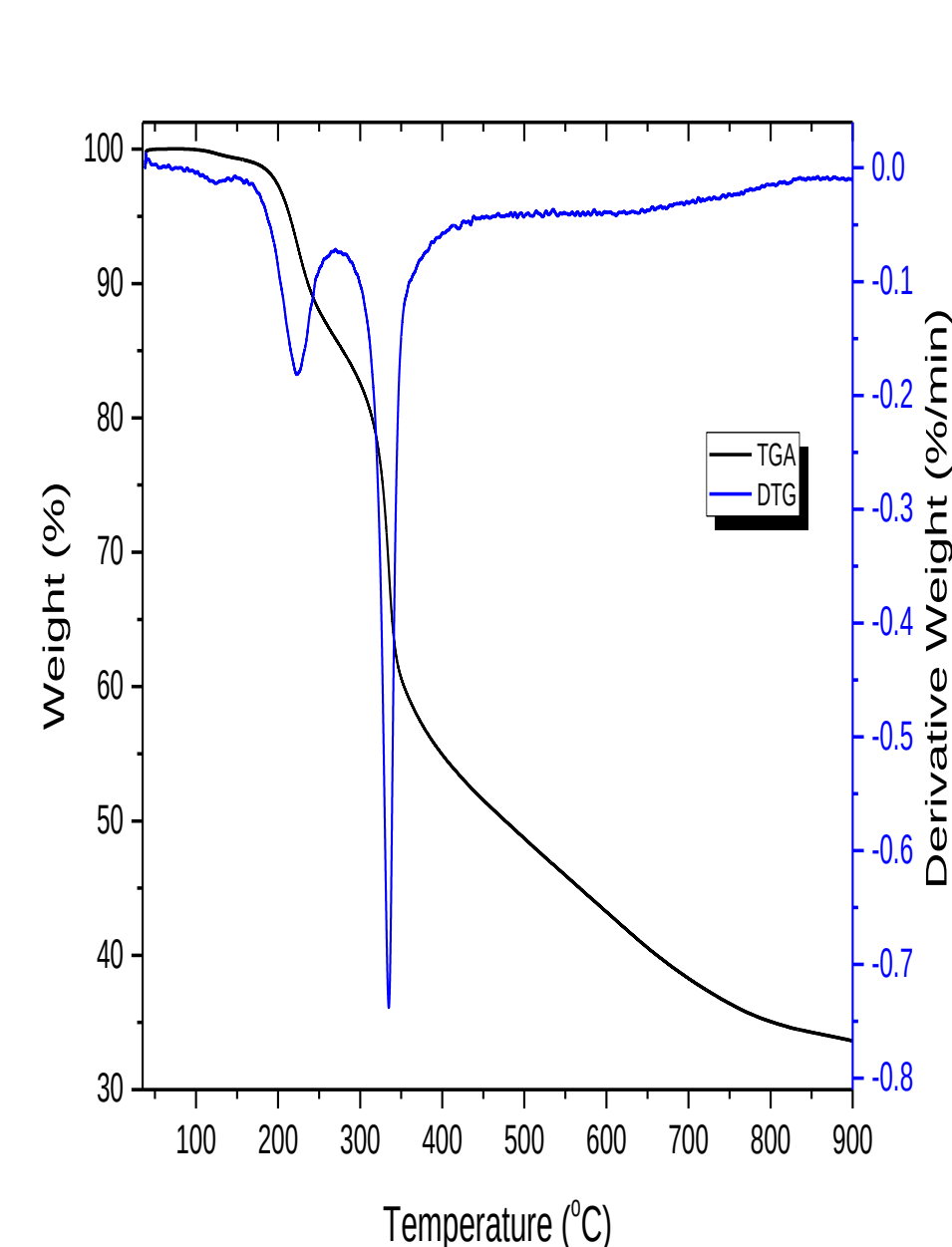


Fig. 3: TGA/DTG for the metal complex

Thermogravimetric and derivative thermogravimetric analysis (TGA/DTA) of the synthesized Schiff base compounds were measured under a nitrogen atmosphere at a heating rate of $5\text{ }^{\circ}\text{C min}^{-1}$ from $0\text{ }^{\circ}\text{C}$ to $900\text{ }^{\circ}\text{C}$. The Cd(II) complex, showed an absorption band at 415 nm is due to the LMCT/ MLCT transitions of zinc complex in a tetrahedral geometry [2].

Metal Oxide Nanoparticles

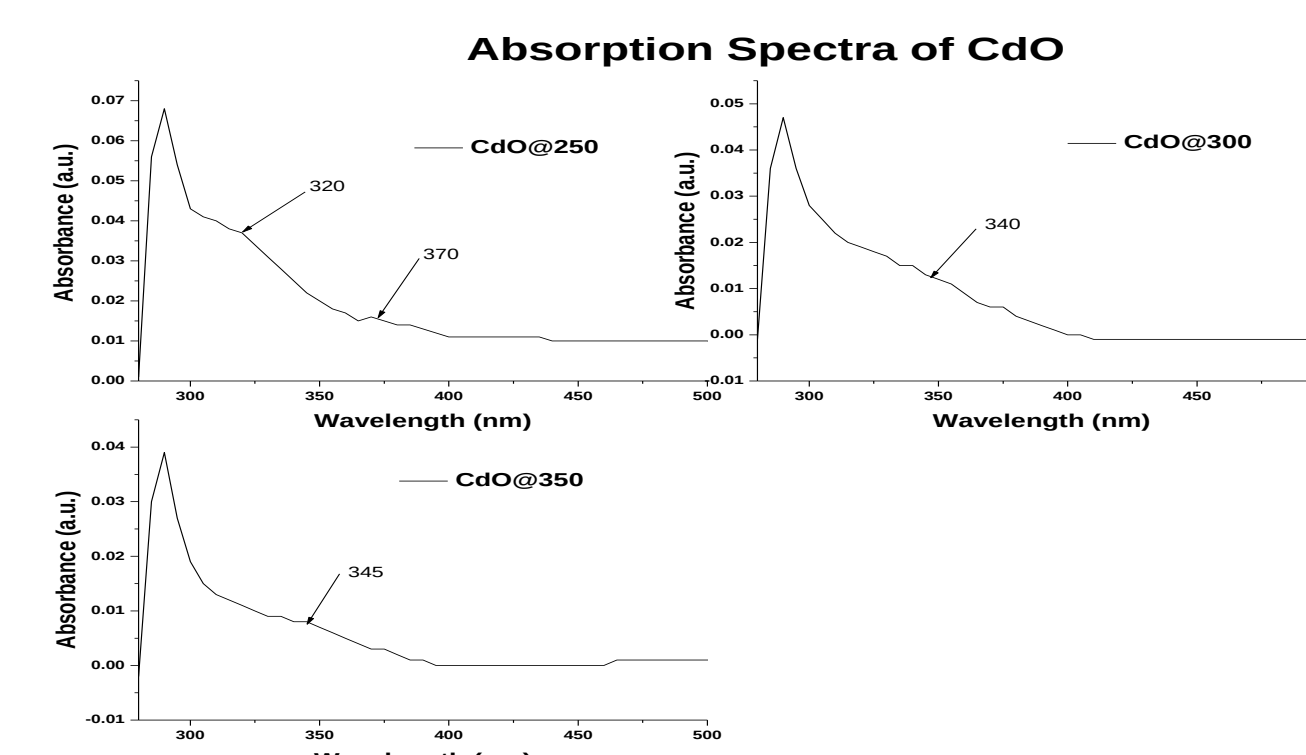
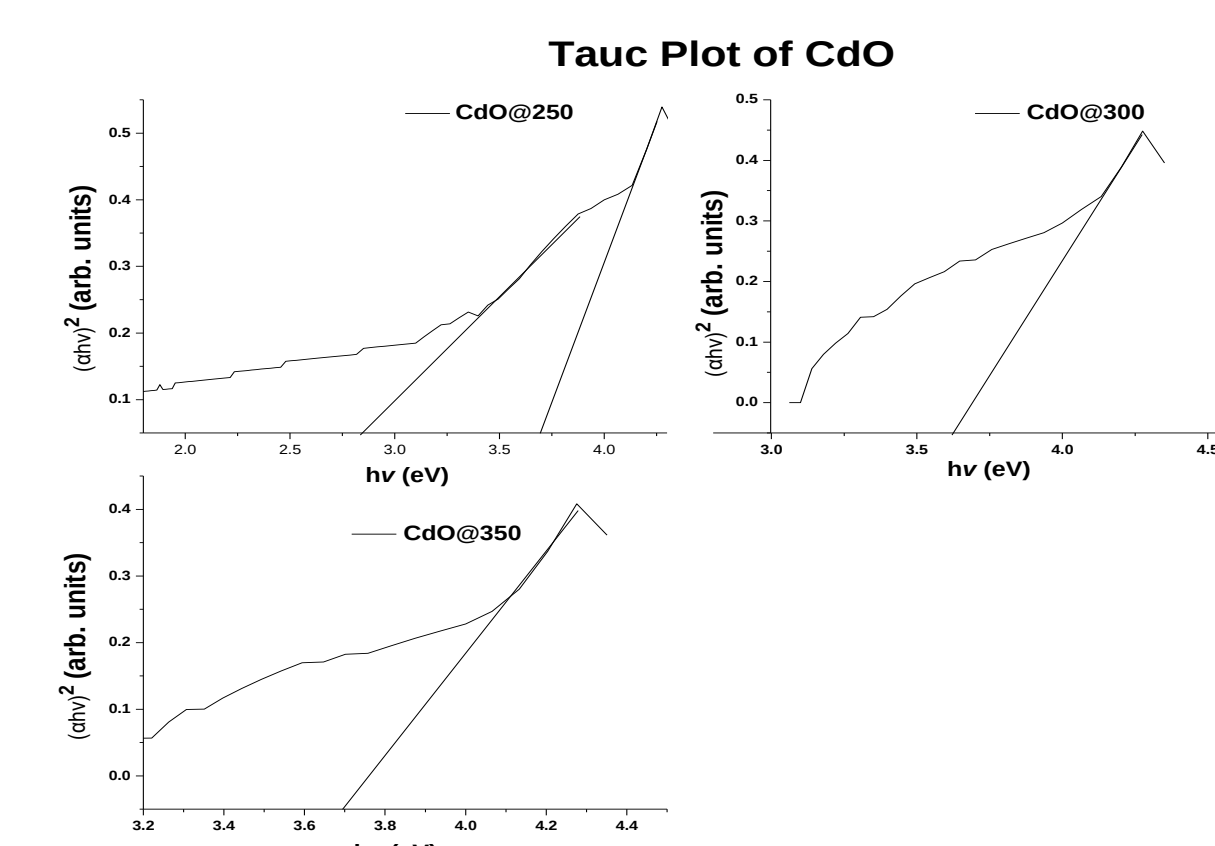


Fig. 2: UV-Vis spectra of CdO



Tauc Plot from UV-Vis

The absorption spectrum of CdO nanoparticles showed various absorption peaks, which are significantly blue-shifted relative to the bulk CdO materials. When the band gap increases, the particle size decreases which makes the electron hole states increases [4]. Bulk band gap = 2.2 eV ; CdO@250 = 2.85 eV / 3.69 eV ; CdO@300 = 3.62 eV ; CdO@350 = 3.68 eV . The FTIR spectra of the CdO Np's synthesized from the complex, shows CdO vibrations at 762 cm^{-1} .

XRD diffraction pattern of CdO nanoparticles

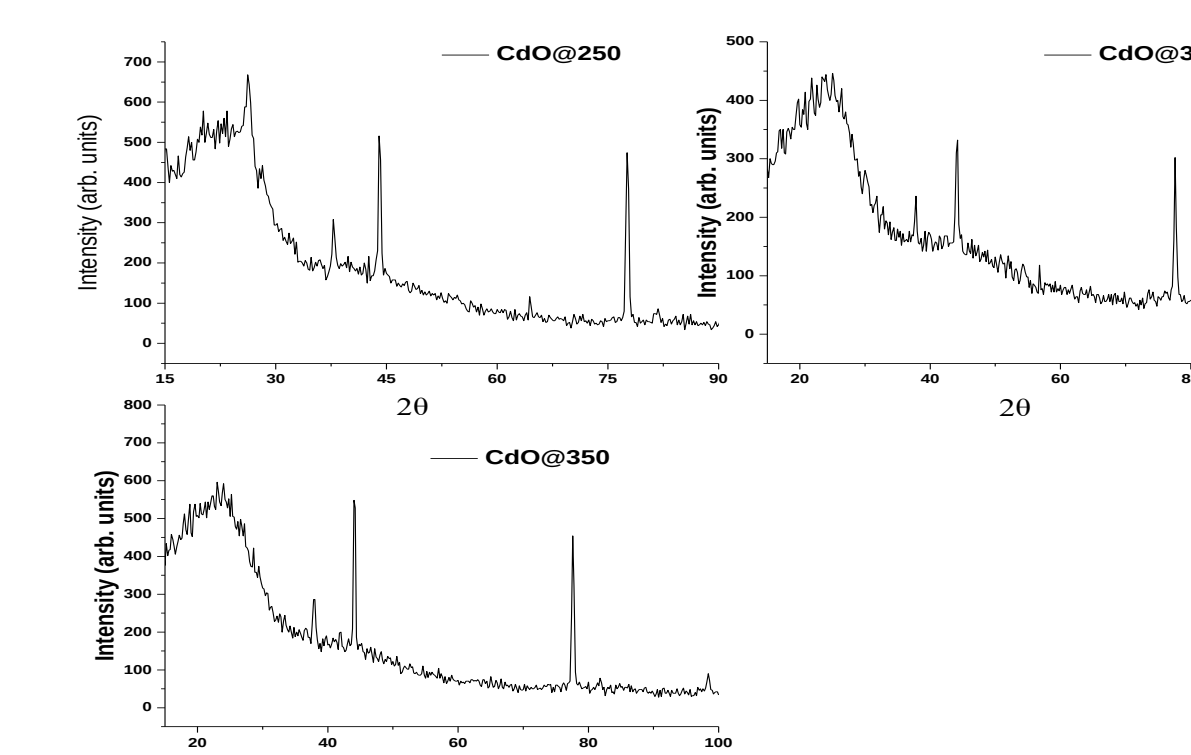
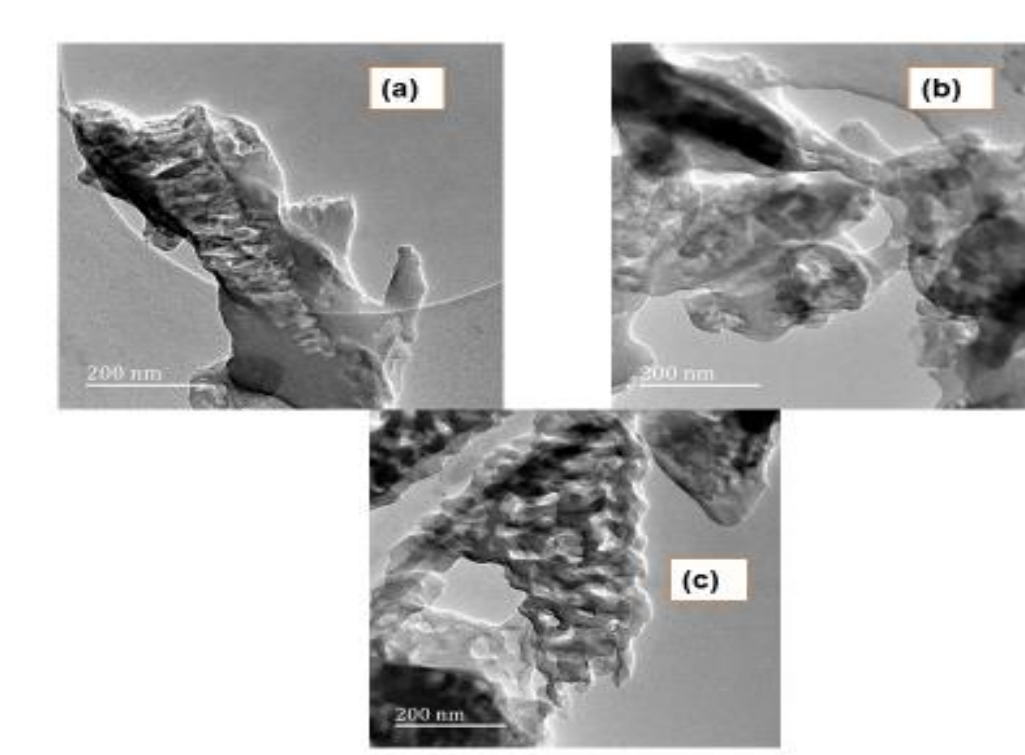


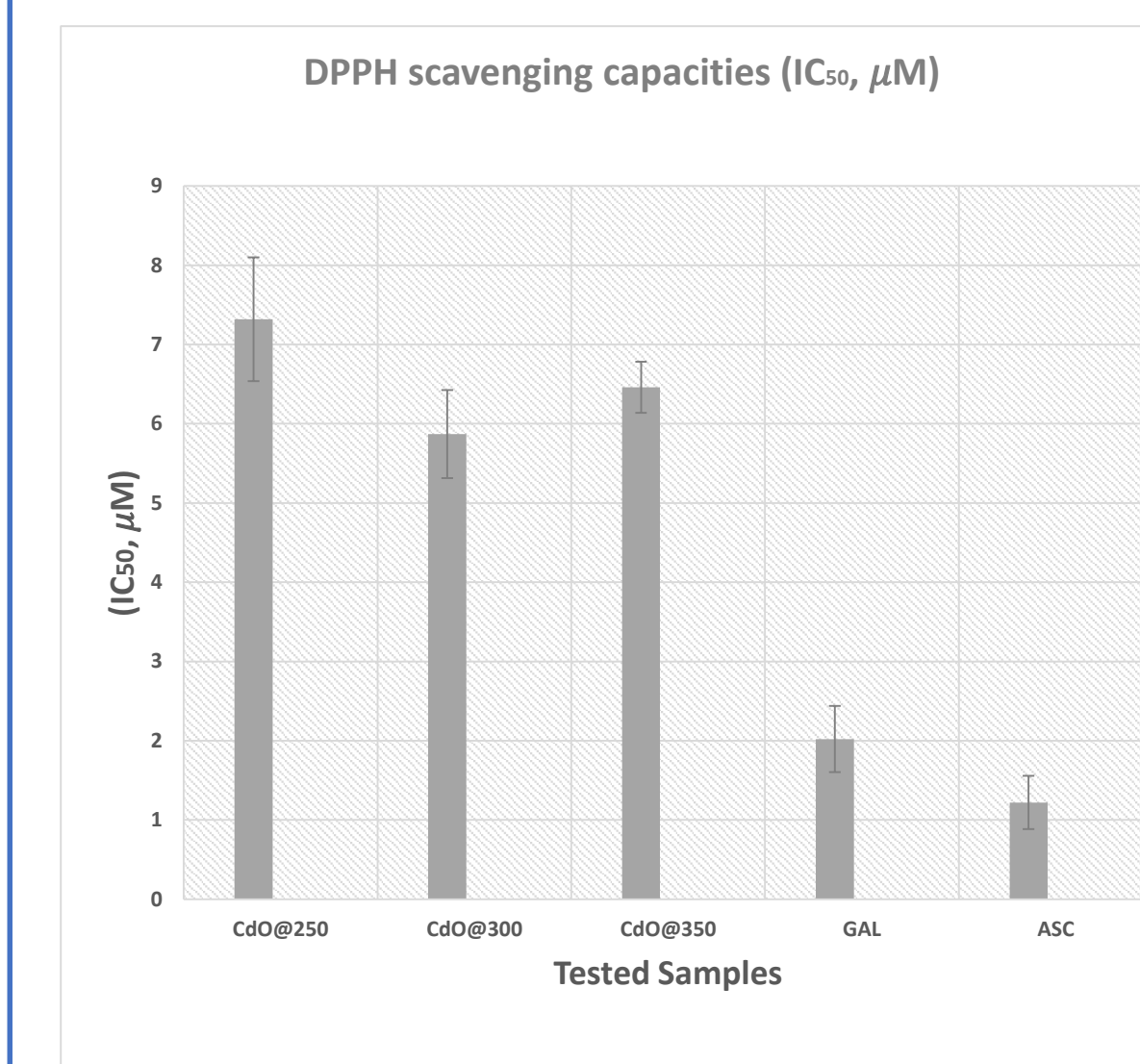
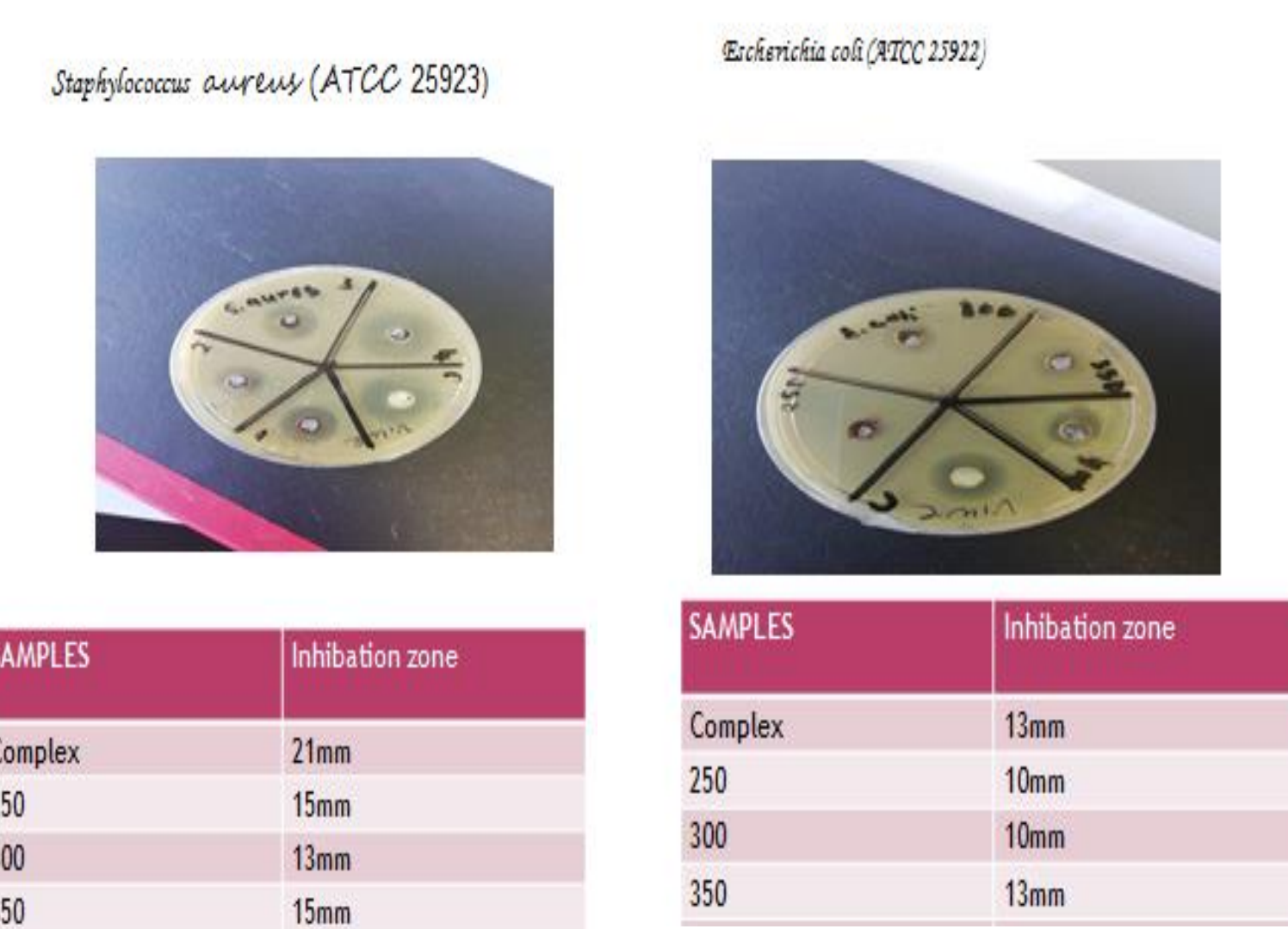
Fig. 3: XRD pattern for the CdO nanoparticles



TEM images of the CdO nanoparticles

The standard diffraction peaks reveal that the crystal structure of CdO nanoparticles are of face-centred cubic (fcc) structure. When the band gap increases, the particle size decreases which makes the electron hole states increases [4]. The TEM images of the CdO NPs from which the average of nanoparticle were calculated to be $\sim 30\text{ nm}$ with spherical and hexagonal shaped was observed. The mean particle size of CdO nanoparticles obtained from TEM analysis is consistent with the average crystallite size estimated by XRD analysis

Biological evaluation of CdO nanoparticle



The DPPH radical scavenging activity decreased as follows: $\text{ASC} > \text{GAL} > \text{CdO@300} > \text{ZnO@350} > \text{ZnO@250}$.

CONCLUSION

The main goal of the present work is to synthesize Cadmium Oxide nanoparticles from the Schiff base complex and their application as antiradical agents. Cadmium ion to ligand binding was confirmed by spectral analyses. Ligand-Cd complex was observed to possess tetrahedral geometry. Thermal stability of the complexes was obtained by TGA studies. Formation of the CdO nanoparticles synthesized from the Cd(II)-Schiff base complexes were confirmed by FT-IR, UV-Vis, XRD, and TEM spectra. The nanoparticles were also evaluated for their free radical scavenging property and observed varying antioxidant activities as compared to the standards; standard drugs showed higher DPPH scavenging potentials than the various CdO nanoparticles. The antibacterial properties were shown by the Cd-complex and nanoparticles using the agar diffusion method.

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