SYNTHESIS, CHARACTERIZATION AND BIOLOGICAL ACTIVITIES OF METAL COMPLEXES/NANOCOMPOSITES OF CHITOSAN/ 2-HYDROXYBENZALDEHYDE/4-AMINOPYRIDINE IMINE LIGANDS

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ABSTRACT

Interesting metal ion clusters around N^N donor atoms and nanocomposites of biologically active compounds as ligand strike a contribution to the field of inorganic biochemistry. Multi drug resistant bacteria and adverse effect of non-steroidal anti-inflammatory drugs have been a global issue. This study synthesized and characterized silver (Ag), bismuth (Bi) and copper (Cu) complexes/nanocomposites (MCs/NCs) from novel imine ligands and studied their biological potentials. The synthesis and characterization of two groups of imine ligands and their MCs/NCs were carried out. Nanochitosan, 2-hydroxylbenzaldehyde (HBA) and 4-aminopyridine (4APy) were used as precursors for 2-hydroxylbenzaldehyde/4-aminopyridine (HBA4APy) and 2-hydroxylbenzaldehyde/nanochitosan (HBANCS) ligands with their MCs/NCs. The compounds were characterized using Ultra-violet/Visible spectroscopy (UV-vis), Fourier Transform Infra-red spectroscopy (FTIR), Scanning Electron Microscopy coupled with Energy Dispersive X-ray Analysis (SEM-EDX) and Powdered X-ray diffraction technique (PXRD). The 2-hydroxylbenzaldehyde/nanochitosan bismuth complex (HBANCS-Bi), 2-hydroxylbenzaldehyde/nanochitosan silver complex (HBANCS-Ag) and HBA4APy are soluble in 2% acetic acid and 70% methanol respectively. The UV-vis absorption bands of HBANCS-Bi and HBANCS-Ag showed a shift to shorter wavelength (hypsochromic) at 261 and 234 nm respectively. This suggests a ligand to metal charge transfer, compared to the ligand, HBANCS with two absorption bands at 396 (n-π^*) and 328 nm (π-π^*), while HBA4APy was recorded at 398 (n-π^*) and 268 nm (π-π^*). The FTIR result showed that both ligands, HBA4APy and HBANCS have the $\upsilon C{=}N_{str}$ (imine/azomethine) functional group at 1643 and 1638 cm^{-1} respectively. However, upon complexation, HBANCS-Bi showed a lower vibrational frequency (red shift) in the region of $\upsilon C{=}N_{str}$ at 1628 cm^{-1} but HBANCS-Ag at 1638 cm^{-1}, the same as the ligand, an indication that HBANCS-Bi coordinates via the imine functional group. The HBANCS-Ag

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might have bonded through the $\upsilon O\text{-}H_{str}$ functional group adjacent to the imine functional group. The SEM depicted morphology of an aggregate of clustered irregular particles for HBANCS-Bi and a clusters of rough surfaced material for HBANCS-Ag. The EDX revealed the elemental composition of the MCs/NCs. The XRD result presented the two complexes as an amorphous and semi-crystalline compounds with cubic and monoclinic structures respectively. The HBANCS-Bi showed antibacterial activity, although not effective as the standard (Amoxicilin) when screened for *in vitro* antibacterial activities against *Pseudomonas aeruginosa*. The HBANCS-Ag showed antibacterial activity against *Staphylococcus aureus* in reference to the standard with minimum inhibitory concentration (MIC) of 2.50 mg/mL and minimum bactericidal concentration (MBC) of 5.00 mg/mL. HBANCS-Bi, HBA4APy-Cu and HBANCS-BiNPs showed potential biological promotion and HBA4APy showed biological inhibition of the membranes according to their hill coefficients when screened for *in vitro* anti-inflammatory activity on membrane lysis assays. The half maxima inhibitory concentration (IC_{50}) for HBA4APy-Cu compared to Indomethacin on heat induced heamolysis was 0.115 to 0.121 μM, which was the best activity of all the test samples. The metal complexes/nanocomposites have biological potentials which could be suggested for possible inclusion in the rank of drug design rationale.

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