World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:9, No:09, 2015

Copper (II) Complex of New Tetradentate Asymmetrical Schiff Base Ligand: Synthesis, Characterization, and Catecholase-Mimetic Activity

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Abstract : Metalloenzymes are enzyme proteins containing metal ions, which are directly bound to the protein or to enzyme-bound nonprotein components. One of the major metalloenzymes that play a key role in oxidation reactions is catechol oxidase, which shows catecholase activity i.e. oxidation of a broad range of catechols to quinones through the four-electron reduction of molecular oxygen to water. Studies on the model compounds mimicking the catecholase activity are very useful and promising for the development of new, more efficient bioinspired catalysts, for in vitro oxidation reactions. In this study, a new tetradentate asymmetrical Schiff-base and its Cu(II) complex were synthesized by condensation of 4-nitro-1,2-phenylenediamine with 6-formyl-7-hydroxy-5-methoxy-2-methylbenzopyran-4-one and by using an appropriate Cu(II) salt, respectively. The prepared compounds were characterized by elemental analysis, FT-IR, NMR, UV-Vis and magnetic susceptibility. The catecholase-mimicking activity of the new Schiff Base Cu(II) complex was performed for the oxidation of 3,5-di-tert-butylcatechol (3,5-DTBC) in methanol at 25 °C, where the electronic spectra were recorded at different time intervals. The yield of the quinone (3,5-DTBQ) was determined from the measured absorbance at 400 nm of the resulting solution. The compatibility of catalytic reaction with Michaelis-Menten kinetics was also investigated. In conclusion, we have found that our new Schiff Base Cu(II) complex presents a significant capacity to catalyze the oxidation reaction of the catechol to o-quinone.

Keywords : catecholase activity, Michaelis-Menten kinetics, Schiff base, transition metals
Conference Title : ICCEAC 2015 : International Conference on Chemical Engineering and Applied Chemistry
Conference Location : Rome, Italy
Conference Dates : September 17-18, 2015