

Synthesis, characterization, and antioxidant activity of the copper(II) complexes with novel ligand: *N*-[4-({2-[1-(pyridin-2-yl)ethylidene]hydrazinecarbothioyl}amino)phenyl]acetamide

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Abstract:

Free radicals play a significant role in various detrimental biological processes, including protein denaturation and lipid peroxidation, contributing to the development of numerous diseases. Hence, investigating the antioxidant activity (AOA) of the synthesized compounds becomes crucial to determine whether they can mitigate the levels of free radicals and provide protection against oxidative stress in the human body.

The aim of the present investigation is the synthesis, characterization, and study of AOA of the new ligand: *N*-[4-({2-[1-(pyridin-2-yl)ethylidene]hydrazinecarbothioyl}amino)phenyl]acetamide (**HL**) and Cu(II) coordination compounds with **HL**: [Cu(L)CH₃COO] (**1**), [(Cu(L)Cl)₂·H₂O] (**2**), [Cu(L)H₂O·DMF]NO₃ (**3**).

The new thiosemicarbazone based on 4-aminoacetanilide was synthesized, and functionalized according to the organic synthesis procedure: synthesis of the isothiocyanate group and hydrazone following the nucleophilic addition reaction with the formation of the HL ligand.

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The **HL** was characterized by NMR, FTIR spectroscopy, and X-ray crystallography. Single crystal X-ray diffraction analysis elucidated the structures of thiosemicarbazone **HL** as well as complexes **1-3**.

The AOA against the 2,2-azinobis-(3-ethylbenzothiazoline-6-sulphonate) (ABTS^{••}) was evaluated for the compounds under examination: **HL** and copper(II) complexes **1-3**. The obtained results are represented as semimaximal inhibitory concentrations (IC₅₀). The **HL** and complexes **1-3** possessed notable antioxidant activity with IC₅₀ of 8.5±1.5, 47.44±1.9, 24.3±1.3, 23.3±0.9 μM, respectively.

Thus, the ligand **HL** and complexes **2, 3** exhibit remarkable antioxidant activity, surpassing the activity of Trolox, a standard antioxidant utilized in medical applications. The tested ligand **HL** demonstrates activity that is four times higher than that of Trolox. Among the copper(II) complexes, the antioxidant potency follows this sequence: [Cu(L)H₂O·DMF]NO₃ ≥ [(Cu(L)Cl)₂·H₂O] ≥ [Cu(L)CH₃COO].

Keywords: coordination compound; thiosemicarbazone; antioxidant activity.

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