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Synthesis, physicochemical studies, embryos toxicity and DNA interaction of some new Iron(II) Schiff base amino acid complexes

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HIGHLIGHTS

- Some novel Fe(II) Schiff base amino acid complexes were prepared and characterized.
- The stoichiometry and stability of the complexes were determined spectrophotometrically.
- The embryos toxicity of the studied complexes was tested on chick embryos.
- The interaction between CT-DNA and the complexes was studied.

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ABSTRACT

New Fe(II) Schiff base amino acid complexes derived from the condensation of o-hydroxynaphthaldehyde with L-alanine, L-phenylalanine, L-aspartic acid, L-histidine and L-arginine were synthesized and characterized by elemental analysis, IR, electronic spectra, and conductance measurements. The stoichiometry and the stability constants of the complexes were determined spectrophotometrically. The investigated Schiff bases exhibited tridentate coordination mode with the general formulae $[Fe(HL)_2]\cdot nH_2O$ for all amino acids except L-histidine. But in case of L-histidine, the ligand acts as tetradentate ($[FeL(H_2O)_2]\cdot 2H_2O$), where HL = mono anion and L = dianion of the ligand. The structure of the prepared complexes is suggested to be octahedral. The prepared complexes were tested for their toxicity on chick embryos and found to be safe until a concentration of 100 μg/egg with full embryos formation. The interaction between CT-DNA and the investigated complexes were followed by spectrophotometry and viscosity measurements. It was found that, the prepared complexes bind to DNA via classical intercalative mode and showed a different DNA cleavage activity with the sequence: nhi > nari > nali > nasi > nphali. The thermodynamic Profile of the binding of nphali complex and CT-DNA was constructed by analyzing the experimental data of absorption titration and UV melting studies with the McGhee equation, van't Hoff's equation, and the Gibbs–Helmholtz equation.

1. Introduction

Schiff base metal complexes have been studied extensively because of their remarkable chemical and physical properties. Metal complexes of Schiff base phenolates with favorable cell membrane permeability have been exploited in cancer multidrug resistance [1] and used as antimalarial agents [2]. Schiff base amino acid complexes have gained importance from the inorganic point of view and owing to their physiological and pharmacological activities [3,4]. Moreover, metal chelates of Schiff bases derived from o-hydroxy aromatic aldehydes, e.g. o-hydroxynapthaldehyde and amino acids have some relationship to ligands involved in a variety of biological processes, e.g. transamination, racemization and carboxylation [5]. Furthermore, Schiff base complexes have an extensive importance in many fields such as radiotracers [6], biologically active reagents [7–10], catalysts in many number of homogeneous and heterogeneous reactions such as oxidation [11–13], epoxidation [14,15], polymerization [16,17] and decomposition reactions [18–20]. Little effort has been expended to prepare Fe(II) amino acid Schiff base complexes [21–23] regardless of their importance as complexes containing a metal in a very sparingly stable low oxidation state, in addition to connecting unstable ligands. Studying the interaction between transition metal complexes and DNA has attracted many interests [24–31] due to their importance in cancer therapy, design of new types of pharmaceutical molecules and molecular biology. On the other hand, few studies were carried out concerning the interaction of DNA with Schiff base amino acid complexes [32].

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