Streszczenie w języku angielskim

The chemistry of coordination compounds includes design, synthesis, and research on the properties and transformations of metal ion complexes. Over the past century, this area of chemistry has evolved significantly into a vast and constantly developing branch of science. The properties of a given complex are defined by its geometry and the distribution of electronic structures of all components of the complex, therefore, research leading to the determination of this structure and its connection with the physicochemical properties of the system are of particular importance for the development of coordination chemistry.

The structure of the ligand used in the coordination process can significantly affect both the thermodynamic stability and the properties of the complex. Appropriate selection of ligands for specific needs enables the development of innovative complexes for applications in the biomedical industry, technology and agriculture.

Multi-donor low-molecular ligands are among the most popular molecules that allow the formation of coordination compounds, which is due to their ability to effectively bind metal ions by creating more than one coordination bond at the same time. This process involves the release of solvent molecules from the metal ion coordination sphere and the formation of chelate rings, which significantly increases the thermodynamic stability of the complex, compared to analogous complexes with single-donor ligands. The increase in stability is mainly due to the positive entropy effect evoked by the chelate effect. An additional advantage of multifunctional ligands is the possibility of various donor groups introduction in their structure, controlling the properties of the ligand itself and its affinity for various metal ions. The number of metal chelators described in the literature is constantly growing.

The aim of this work was to look for multifunctional compounds with potential applications in medicine and technology, as well as a detailed analysis of the coordination properties of selected ligands towards Cu(II) ions, and to understand the impact of the ligand structure on the formation of complexes. In order to carry out full physicochemical characterization of the studied ligands and their complexes with Cu (II) ions mass spectrometry, potentiometric titrations, absorption spectroscopy in the range of UV- Vis and EPR spectroscopy were used.

As part of this study, the multi-donor Schiff base, as well as the aminophosphine and triazolylpyridine ligands, were selected for analysis due to the wide spectrum of the coordination properties they present, caused by the presence of several alternative donor atoms in the ligand structure. The coordination properties of selected ligands were studied towards Cu(II) ions, due to the biological significance of this metal, as well as its magnetic properties, enabling the creation of compounds for use in technology. It has been shown that all studied compounds form stable complexes with Cu (II) ions, however, differing in stoichiometry and thermodynamic stability.

In the case of imine ligand, the stoichiometry of the complexes formed depends on the Cu(II):L molar ratio used in the experiment, and the coordination of Cu(II) ions occurs primarily through a

pyridyl and hydrazide nitrogen atoms and oxygen of amide bond. The involvement of an additional pyrazole nitrogen in the binding of Cu(II) ions occurs when dimeric and oligonuclear complexes are formed.

Asymmetrical bis(aminomethyl)phosphinic ligands form complexes with Cu(II) ions with stoichiometry strictly dependent on the structure of the ligand. The formation of 1:1 complexes, CuL, is observed for ligands containing several additional donor atoms in the structure, and not possessing significant steric hindrance on the aminomethyl group nitrogen. It has also been shown that the tetrahydroisoquinoline nitrogen does not reveal the ability to bind Cu(II) ions, probably due to the influence of the aromatic ring. Ligand containing this group, as the only bis(aminomethyl)phosphinate studied here, is characterized by a tendency to form complexes with 1:2 stoichiometry, CuL_2.

Triazolylpyridine ligands are also capable of forming stable complexes with Cu(II) ions, with stoichiometry depending both on the Cu(II):L molar ratio and on the presence of a substituent in the triazole ring. The unsubstituted ligand forms two-nuclear complexes of the dimeric Cu_2L_2 and oligomeric Cu_2L_3 type, however, regardless of the molar ratio used, the system seems to aim for 2:3 stoichiometry. The presence of the substituent on the structure of the triazole ring creates steric hindrance, preventing self-aggregation into oligomeric structures, however, substituted triazolylpyridine ligands are capable of forming dimeric complexes in an equimolar solution. As the electron-donating properties of the substituent group increase, the coordination properties of the ligand expand, which is particularly evident when comparing the spectroscopic spectra of the studied systems.