

mgr Katarzyna Choroba: *Coordination compounds of selected transition metals with trimine ligands – synthesis, structure, photoluminescence, magnetic, catalytic and biological properties.*

Abstract

2,2':6',2''-Terpyridine and its analogs are widely used building blocks in coordination chemistry used to obtain stable transition metal complexes with important properties for potential applications. The ease of structural modification of these ligands, due to the development of a one-step Kröhnke synthesis, allows for systematic studies of the influence of the ligand structure on the properties of the coordination compound. This work presents research on a group of coordination compounds of selected transition metals: platinum(II), gold(III), copper(II), cobalt(II) and rhenium(II) with derivatives of 2,2':6',2''-terpyridine, 2,6-di(thiazol-2-yl)pyridine and 2,6-di(pyrazin-2-yl)pyridine. The obtained compounds were subjected to structural analysis and experiments determining their properties in biological, catalytic, luminescent and magnetic activity.

In the group of gold(III), platinum(II), and copper(II) complexes with biological activity, it was found that the introduction of a substituent into the trimine ligand leads to an increase in the cytotoxicity of the compounds and the substituents displaying a small dihedral angle between the plane of the substituent and the plane of the central pyridine of the ligand's core favored the planar structure of the complex ion $[MCl(N^{\wedge}N^{\wedge}N-\kappa^3N)]^{n+}$ and increased their ability to interact with the DNA of cells. Research on the mechanism of cell death showed that the obtained compounds induced oxidative stress due to the production of reactive oxygen species, causing cell apoptosis. A particularly strong influence of the change in ligand's core on biological and catalytic properties was confirmed in the case of copper(II) complexes. Cu(II) compounds with 2,6-di(thiazol-2-yl)pyridine ligands were much better catalysts for the oxidation of alkanes or alcohols with the participation of "green" oxidants in comparison to their terpyridine analogues, and their mechanism of catalyzing the reaction was based on generating the hydroxyl radical HO \cdot . On the other hand, Cu(II) coordination compounds with 2,2':6',2''-terpyridine ligands, as a rule, showed higher cytotoxic activity. For carbonyl rhenium(I) compounds, studies of the emission properties and photodynamics of excited states showed that the introduction of strong electron-donating substituents attached to the ligand core leads to a significant increase in the lifetime of excited states and bigger potential of these compounds as an active layer in OLEDs. Low-temperature studies of magnetic susceptibility in a constant and alternating magnetic current confirmed that the obtained cobalt(II) coordination compounds have the single-ion magnets (SIM) properties and their spin-lattice slow magnetic relaxation occurs via various mechanisms.

The correlation of the structural tests with the results of biological, catalytic, spectroscopic and magnetic experiments for all groups of compounds allowed for the determination of structure-property relationships, important for future design of coordination compounds and improving of desired physicochemical parameters.