**ABSTRACT**

The presented scientific achievements include synthesis, physicochemical and microbiological characteristics and application ability of new Ni(II) and Cu(II) coordination compounds with isomers of vitamin $B_6$, not yet described in the literature.

Studies on new metal complexes with vitamin $B_6$ isomers were initiated due to the progressive growth of resistant strains of microorganisms to the previously used drugs, preservatives and disinfectants. Environmental pollution caused by an excessive use of non-biodegradable pharmacological agents or causing the formation of toxic decomposition products, the occurrence of allergic reactions and various diseases caused by frequent contact with such products are some of the reasons that lead to the search for new compounds with pharmacological activity. The emergence and accumulation of resistant infections has created a need for more effective and safe antimicrobial agents. Achievements of coordination chemistry in the design of new coordination compounds exhibiting a pharmacological effect combine a number of information on the structure and properties of the tested compounds. They are a significant contribution to the development of more effective methods of destruction microorganisms. This creates a chance to overcome existing resistance and inhibit microbial proliferation.

As a part of this doctoral dissertation, the acid-base properties of three forms of vitamin $B_6$ were determined using a pH-metric-spectrophotometric and potentiometric titrations in a wide range of pH values. Ligands have been shown to undergo gradual deprotonation reactions, and the substituents in the fourth position of pyridine ring have a pronounced effect on the pKa values determined. The presented dissertation is a combination of three independent, complementary instrumental techniques: spectrophotometric, potentiometric and conductometric titrations, which enabled qualitative and quantitative studies of coordination properties of vitamin $B_6$ in aqueous solution. It was found that as a result of the complexing process in aqueous solution, stoichiometry metal to ligand of coordination compounds equals 1: 1 in the case of Ni(II) complexes with *PM* and *PN*, as well as stoichiometry metal to ligand 1: 2 was observed in the case of other systems studied. As a result of the synthetic work, mononuclear coordination compounds of Ni(II) and cationic coordination polymers of Cu(II) were obtained. Conducted experimental work allowed for the development of a simple, but above all repetitive and effective synthesis methods. Based on X-ray studies, elemental analysis, IR and UV-Vis spectroscopy, the composition and structure of metal complexes were determined. In addition, it was shown that the coordination compounds could be used not only as pharmacological agents, but also as acid-base indicators in volumetric titration. The acid-base properties of Ni(II) and Cu(II) complexes were determined using pH-metric-spectrophotometric and potentiometric titrations. In addition, spectrophotometric and electrochemical studies of the interaction of Ni(II) complexes with CT-DNA were performed. It has been proven, that the tested compounds bound to the deoxyribonucleic acid *via* N7-guanine nitrogen in a small groove and were further stabilized by hydrogen bonds. The conditions of microbiological tests were determined based on structural, spectroscopic, electrochemical and thermogravimetric assays. It has been shown that the $[Ni(PL)_2]Cl_2$ complex has antiproliferative activity against selected bacterial strains and coordination Cu(II) compounds were an interesting alternative for currently used disinfectants.