The aim of proposed research Project is to evaluate the possibility of using electrodialysis enhanced with complex formation to selective removal and concentration of some transition metal ions (Cu^{2+}, Ni^{2+}, Zn^{2+}, Fe^{2+}, Fe^{3+}, Co^{2+}, Cd^{2+}, Pb^{2+}) from model solutions of their various metal salts. The purpose of the research Project is also to determinate the effect of process parameters on the selectivity efficiency of the removal of metal ions in ED enhanced with complexation and elaboration of theoretical basis to solve the problems of selective removal of metal ions from multi-component solutions (at wide concentration range), which are difficult to solve using simple electrodialysis or other separation methods.

Realization of the Project includes some basic research. The following tasks are planned:

- selection of complexing agents capable of creating stable complexes with selected metal ions,
- investigation of the influence of complexing agent (ligand) type and concentration, metal ion concentration, current density, pH, and membrane type and brand (homogenous, heterogeneous) on selectivity the removal of selected metal ions during the course of ED,
- investigation of osmotic and electroosmotic water transport across ion-exchange membranes in electrodialysis enhanced with complex formation, which limits the maximum content of metal in the produced concentrate,
- development of transport model of transition-metal ions in the electrodialysis enhanced with complex formation, which allows to estimate the selectivity of the proposed process.

In addition, to verify this phenomena occurring on the membrane surface, "fresh" membranes (membranes before their assembly inside the electrodialyzer) and "post-ED" membranes (membranes taken out the electrodialyzer after the metal ions transport experiments) will be subjected to their morphology tests by scanning electron microscopy (SEM), wettability test by the sessile drop method, and chemical composition tests by EDS and deposit phase composition tests by XRD.
In the recent years, the possible application of membrane processes for transition-metals ions recovery has been investigated. Electrodialysis (ED), one of these methods, has been effectively applied for the removal of metal ions, and its use seems to be of growing importance. Nevertheless, ED methods have also some drawbacks. One of the electrodialysis disadvantage might be a relatively low selectivity, which makes impossible an efficient separation and selective recovery of metal salts from multicomponent mixtures. Moreover, an important issue is water transport across the membranes, which limits the maximum content of metal in the produced concentrate.
It is expected, that the selectivity of metal salt removal by ED can be substantially increased by the introduction of additives (ligands, complexing agents) which are known to create highly stable complexes with the metal ions. In this case, metal complexes migrate across ion-exchange membranes much slower, than free metal ions or their aqua-complexes, which allows for efficient separation.
Available literature present some results on electrodialytic removal of transition-metal ions from dilute aqueous solutions with metal concentration approx. tens of mg/dm3. These investigations are mainly aimed on the concentration of metal ions and technological water recovery, however does not allow for selective metal recovery from multi-component solutions of metal salts. Literature also suggests that many scientific researchers are focused on electrodialytic concentration of solutions containing only one transition-metal. Scientific literature indicate that there are only few papers which describes the electrodialysis-similar process enhancement by complex formation. There are also no scientific works on selective removal of metal ions from highly concentrated solutions of transition-metal salts (metal concentration approx. tens g/dm^3).
The main reason for choosing the research topic is obtaining a new knowledge about the selective removal of some of the transition-metal ions from their multicomponent solutions. Additional reason for choosing proposed scientific topic is:

- determination of selectivity coefficients of metal ions in the electrodialysis enhanced with complex formation,
- elaboration of theoretical basis to solve the problems of selective removal of transition-metal ions from multi-component solutions (at broad concentration range), which are difficult to solve using simple electrodialysis or other separation methods,
- development of transport model of transition-metal ions in the electrodialysis enhanced with complex formation, which allows to estimate the selectivity of the proposed process.

The main feature of proposed Project is a combination of electrodialysis process and coordination chemistry. Investigations of model two-component (binary) solutions will allow to identify the basic process parameters, that have determinative impact on the selectivity of metal separation in the proposed system.