In Poland, each year increasing amount of waste, including municipal waste, industrial waste, and thus hazardous waste. It created a huge problem with their management and disposal. One of the most important factors degrading the environment are heavy metals. Although most of them are naturally occurring in trace amounts, may constitute a serious environmental problem. Their presence in the soil disturbs the biological balance, and their presence in water inhibits the processes of self-purification and water treatment processes difficult. Heavy metals fairly easily penetrate biological membranes, causing damage to the cells and their metabolic function disorders. All the heavy metals are toxic and some of them also have a carcinogenic effect, eg. Cadmium. Unfortunately, it often incorrect waste from industrial processes contributes to the presence of heavy metals in municipal wastewater. Improper handling of waste caused the industry has become one of the biggest polluters of the environment. Following this started to pay more attention to the problem of purification of waste waters. There are many modern techniques such as ion exchange, membrane processes, electrolysis or microbiological methods aimed at treatment of water resources.

One of the most interesting technique is liquid-liquid extraction, which has been widely used in chemical, pharmaceutical, food, metallurgy, biotechnology and others. The extraction process involves performing component dissolved in the aqueous phase to the organic phase. It is used for purification or separation of components from aqueous solutions. The undoubted advantage is its low power consumption and the ability to re-use chemicals. This method is attractive in terms of economic and environmental.

The main objective of the project is the synthesis of new ligands (qateranry pyridinium salts) and using them in the process of complexation and transport of metal ions. One of the assigned tasks in the project will be to compare the classical method of extraction and extraction in hollow fiber membrane module (PEHFSD) using the compounds obtained.
The advantage of the PEHFSD technique is connected to either membrane extraction process, whereby a single membrane module is carried out simultaneously extraction and re-extraction, the extractant and the consumption it is much smaller than in the classical extraction. Pseudoemulsion system is a very promising method for treatment of liquid waste streams with toxic or valuable metal ions.

Hydrometallurgy is an alternative to pirometallurgy in particular when we talk about the processing of raw materials with an unfavorable composition, or such that processes with significant problems. Factors which cause great interest in the Polish market hydrometallurgical techniques (one of the steps of hydrometallurgical methods is to extract) are:
• environmental pollution occurring when using pyrometallurgical methods;
• the need for extraction and processing of increasingly poorer fields;
• recovery of high purity metal from the remains of flotation solutions, a variety of solid waste, scrap metal, mine water, etc .;
• winning both the main ingredient how and secondary components;
• a high tendency for the construction of small plants (hydrometallurgical method can be realized in a much smaller scale than pyrometallurgical processes).

Utilization and recovery solutions is easier if they contain a single metal. The most reasonable solution is to prevent the formation of mixed solutions. However, in practice it is not possible to completely prevent mutual pollution of the solutions. Separation metals from mixtures is possible, even on a large scale cost-effective, but the process is complex and technically difficult. Therefore, one of the objectives which were assumed in design is to determine the selectivity of the obtained compounds (eg. selective extraction of Zn(II) with a solution containing also Pb(II), Fe(II) and Fe(III)).

This approach will allow us to find an answer to the question whether the presence of the quaternary alkyl chain will always be transferred through the ion-pair complex into the organic phase, even in the presence of additional groups, which may coordinate metal.
The proposed project with the detailed studies has a chance to be helpful in the future especially in application of the new selective ligands for example in the hydrometallurgical processes.