

Industrial development leads to the generation of industrial effluents, and if untreated results in water, sediment, groundwater and soil pollution. Industrial wastes and emission contain toxic and hazardous metal ions, most of which are detrimental to human health. Heavy metals from industrial processes are of special concern because they produce chronic poisoning in aquatic environment. More strict environmental regulations on the discharge of toxic metals require developing various technologies for their removal from polluted streams (i.e. industrial wastewater, mine waters, landfill leachate, groundwater). Groundwater contaminated with heavy metals is typically treated by “pump and treat” that is neither a cost-effective nor sustainable approach. Permeable reactive barriers (PRBs) seem to provide an effective and sustainable alternative for the in situ treatment of groundwater contaminated with heavy metals. On the other hand the separation processes using modified polymer materials provide a viable attractive alternative for toxic metal ions removal from industrial effluents due to their high efficiency and selectivity.

The project is aimed at studying novel immobilized polymer materials as potential remediation agents for the elimination of numerous toxic metal (Pb, Cd, Hg, As, Cr) ions from polluted streams within PRB. The research study will enable to assess the efficiency of immobilized polymer materials, their selectivity and stability. Moreover the results of project allow to determine the factors affecting the separation processes using immobilized polymer materials and to optimize these techniques for remediation of hazardous industrial effluents. The project implementation requires research team with experts of chemical technology, geochemistry, geotechnics, hydrogeology and representing a broad spectrum of engineering sciences related to contaminated groundwater and wastewater. Team members will deal with chemical synthesis, geochemical modelling, separation of toxic metal ions from contaminated aqueous solutions, determination of the impact of various factors on the effectiveness of the process, as well as optimizing the treatment system using modified polymer materials.

Positive results in separation of toxic metal ions using immobilized polymer materials containing macrocyclic derivatives, along with their high selectivity, high removal efficiency, increased stability, and low energy requirements, are promising for applying these sorbents to improve the environmental quality. Moreover, the results of the project concerning modified polymer materials may lead to development of a treatment system that could be used for the removal of toxic metal ions from contaminated groundwater or landfill leachate as well as for the separation of chosen metals from industrial wastewater.