

HYDROTALCITE-LIKE MINERAL COMPOSITES OBTAINED BY TRANSFORMATION OF SELECTED MINERALS AS HYBRID SORBENTS FOR THE REMOVAL OF ANIONS FROM MULTI-ELEMENT AQUEOUS SOLUTIONS

Nanomaterials derived from layered crystal phases are an important group of structures used in industry and environmental protection. They are mainly used as adsorbents of ions and/or molecules in remediation technologies of gas, waters and wastewaters, catalysts supports and drug carriers. Pollution of the environment is a common problem which is often connected with the presence of inorganic elements of anthropogenic origin which are highly soluble and bioavailable. These elements, even in small amounts, can pose a significant threat to the environment and subsequently to human health. The removal of pollutants of anionic type, which have negative charge, requires the use of materials which show anion-exchange properties and these are characteristic for hydrotalcite-like layered minerals (HTLc). The HTLc are rarely found in nature, however their synthesis is easy to carry out in the laboratory. The disadvantage of this approach is the relatively high cost of used chemical reagents.

Therefore, in the project, experimental procedures are proposed which will enable to obtain HTLc phases and their composites by transformation of widely available minerals as sources of elements building HTLc structure: dolomite, magnesite, kaolinite and halloysite. The obtained materials will be characterized with the use of selected chemical and mineralogical methods in order to investigate their chemical composition, structure, texture, morphology and surface chemistry. Afterwards, an evaluation of their sorption properties will be carried out in artificial single- and multi-anion aqueous solutions containing elements forming anions: arsenic, chromium, phosphorus, molybdenum, vanadium and selenium. The performed research will provide information on the efficiency of anions removal from aqueous solution in function of different variables and mechanisms which are responsible for that. Moreover, the binding strength of anions by the obtained HTLc sorbents will be estimated.

The proposed research was designed to investigate the possibility of obtaining HTLc sorbents of anions using unconventional methods. The project novelty involves the use of widely available minerals, mainly from Polish deposits, as substrates for the synthesis. The obtained results will undoubtedly extend the knowledge on the design of new mineral materials and their applications in future environmental remediation technologies. The interdisciplinary project combines knowledge of experimental mineralogy with environmental protection. The work will be an original contribution to the development of research regarding the use of selected minerals for the synthesis of mineral sorbents having rarely observed anion-exchange properties.