Hybrid inorganic-biopolymeric sorbents for cesium removal

The most known cesium isotope is isotope ^{137}Cs, which due to the long half-life (30.17 years) and radioactivity is a serious threat. It is highly soluble and easy migrates in aqueous media causing environmental pollution. It may be easily incorporated in plant and animal tissues. It also exhibits some carcinogenic and teratogenic effects. ^{137}Cs is one of the products of fission and is found in spent nuclear fuel and radioactive wastes. It may be introduced to the environment with some radioactive wastes which are generated by various industrial and medical applications of radionuclides or due to the nuclear weapon production and testing.

The growing interest in the nuclear power resulting from both the growing demand for energy and more concerns over the climate change may cause a significant increase in the amount of generated radioactive waste. Therefore, the development of new methods and materials enabling effective purification of solutions contaminated with cesium ions is demanded.

Adsorption and ion exchange are the most economic and efficient methods of water and waste water purification, particularly when the ion concentration in the purified solution is very low. Various adsorbents with good cesium affinity exist in the form which makes their practical usage difficult. Separation of fine powders from purified solution is very difficult and application of the dynamic mode is impossible. Also the usage of sorbents in granular form may be impractical due to the poor mechanical properties.

The aim of this project is to prepare the new hybrid inorganic-biopolymeric sorbent preparation and to investigate its sorption properties. The active component will be the inorganic substance. While the matrix, which provide the proper shape, good mechanical properties and stability, will be a natural polymer – pectin. Pectin is a byproduct of the processing of vegetables and fruits and it has the ability to form insoluble in water gels. Therefore, as a result, materials in the form of beads may be obtained. The materials will be characterized in terms of their chemical composition, homogeneity and structure using various techniques such as scanning electron microscopy, infrared spectroscopy or thermogravimetric analysis. Obtained hybrid sorbents will be applied in the batch studies and the optimal parameters of sorption process will be established (pH, initial cesium ions concentration, sorbent dose). Also the dynamic sorption studies will be conducted.