Description for the general public

Zeolites are a group of minerals with unique physical and chemical properties results in very numerous and important applications. These properties arise directly from their specific structure – the existence of spatial channels and chambers characterized by well-defined molecular dimensions. If thermal stability, chemical resistance, very good catalytic, molecular sieves and, above all, sorption and ion exchange properties ware taken into account, it is not surprising that zeolites are extremely relevant materials in various applications of chemical technology, and their importance increase continuously.

Zeolites can be successfully obtained in the laboratory. By heating the aluminosilicate materials in the presence of alkaline solution for several hours or days, depending on the type of raw materials and process conditions (such as temperature, pressure), the final product can be obtained. Type of zeolite structure, which is formed at a given temperature depends largely on the chemical composition of the starting mixture, but are also relevant process conditions such as pH of the reaction solution, temperature, pressure and time of treatment, as well as granulation of reagents or mixing. During the synthesis, certain properties of the zeolite, such as type of structure, elemental composition, pore size or density of the structure can be regulated.

Under laboratory conditions zeolites are obtained as finely crystalline highly disperse powder, which hinders their practical application. There are several methods of forming this product into larger agglomerates/fitting. The most commonly used method is the granulation using the binder (usually clay with optional additives) and then firing at about 600°C. Methods for the production of molded zeolite by crystallization "in situ" after the process of forming clay mineral have also been developed. However, analysis of related literature indicates that the granulation of zeolites caused several problems. Among other, primarily the lower sorption capacity of the granules as compared to the starting material. Furthermore, the high alkalinity of zeolites leads to the destruction or weakening the strength properties of many common binders. Another disadvantage can be swelling due to the possibility of water adsorption. Furthermore, the potential use of molecular sieves often requires cyclic heating to 350–650°C for regeneration of overworked material (removal of the adsorbate from the zeolite structure), i.e. the matrix material must have a high thermal resistance in this temperature range.

The aim of the proposed project is to provide hard, spherical as well as lightweight zeolite granules for sorption applications. The expanded glass will be used as the starting material. Since the properties of the obtained materials are a consequence of their specific porous structure, seems to be necessary to analyze the process for their preparation, to provide a method for modification, complex structural characteristics of the resulting sorbent, as well as analysis of the sorption process so that will be able to adapt the product to the specific application.