

## **DESCRIPTION FOR THE GENERAL PUBLIC**

The purpose of the project is development of chemical compositions and synthesis methods of the silicate-phosphate glasses modified with the maximum additive of sulphur, having a feature of controlled chemical activity.

Sulphur is one of the elements having the most important biochemical and physiological functions in the plant. Sulphur, apart from playing the role of essential component for growth and development of plants, has also an impact on increasing their resistance to various kinds of pathogens. However, proecological activities leading to sulphur emission reductions in the industry, conducted in recent years, as well as the increasing use of high-grade fertilizers (less concentration of sulphur) led to the situation that in many soils, especially in areas located away from industrial areas, sulphur is running out. The applied fertilisers that introduce sulphur to the soil are characterised by a large solubility in water, causing an easy leaching of this element from the upper layers of soil, which results in a low concentration of sulphate sulphur that can be absorbed by plants.

So as to solve the above problem, it can be helpful to focus on sulphur glassy carriers in the form of silicate-phosphate glasses containing suitably designed chemical compositions, poorly soluble in water, but soluble in soil solutions. Such materials, as potential mineral fertilizers, could slowly introduce sulphur to the soil and be controlled by both their chemical composition and individual plants capability to sulphur absorption. Therefore, the research, which is the subject of this project include glasses with silicate-phosphate matrix modified with sulphur, as well as other elements (K, Mg, Ca, Zn, Fe) being plant nutrients, are obtained by conventional high-temperature melting of raw materials mixture.

Taking into consideration the fact that sulphur has diverse solubility in the structure of silicate and phosphate glasses, and its occurrence at different oxidation states in the glass structure, the project is expected to determine – using XRD method – glass forming ability of silicate-phosphate systems, containing variable amount of sulphur and other components which modify their network. Oxidation state of sulphur and its influence on the structure of glasses with silicate-phosphate matrix will be determined by using spectroscopic (XANES, IR, Raman spectroscopy and MAS NMR) and thermal (DTA/DSC) methods. It will be also investigated what amount of the ions of particular elements is released from the glass structure by water, citric acid, ammonium citrate, and hydrochloric acid simulating soil environment, using ICP-AES method and the mechanism of their release by the SEM EDS method. Chemical activity of the obtained glasses also will be examined based on incubation experiments in the soils differing in physico-chemical properties.

Studies on the design of glassy materials containing sulphur carried out in this project can form a basis to the technology of sulphur glassy carriers synthesis, and that enables to enrich the soil with sulphur but also with a series of other nutrients in appropriate amounts to the nutritional needs of the plants. In addition, they will function to increase phytosanitation of soil environment by the limited use of chemical pesticides.