A smart platform of bioinspired materials of ionic nature possessing beneficial impact on plants

One of the main factors enforcing the increase in the effectiveness of plant growing methods is the continuous increase in the demand for food. Most often, harvest efficiency is lowered by pathogens, insects, other pests or atmospheric conditions; therefore, the tasks set for modern agriculture focus on, among others, looking for new and more effective products that have a beneficial effect on plant development. New directions in the development of plant protection necessarily entail constant attempts to carry out research on non-toxic and environmentally safe plant protection products. The project will create a smart platform of bioinspired materials, containing a wide range of ionic compounds that have beneficial effects on plants. These materials will include components occurring in nature, in particular monoterpenes, natural plant growth regulators, and compounds with biologically active components. First of all, ionic organic salts, in particular ionic liquids, surfactants, eutectic mixtures, will be synthesized. The final bioinspired material will be produced as hydrogel and 3D printing hydrogel containing an immobilized biologically active compound. Hereby, it will be possible to regulate and control the release rate of the active compound. In addition, the resulting 3D hydrogel biomaterials can be used in various forms of printing for both soil and hypotonic plant breeding.

The project involves conducting research determining the effect of new substances introduced into the soil both in free form and bound on hydrogel matrices on the growth and development of selected cereal species (wheat and maize) and cucumber. This will be implemented through determining the fresh and dry matter of plants, plant length, root length and morphology and germination capacity of grain. The analysis of changes in chlorophyll fluorescence parameters will ensure the assessment of the efficiency of photosynthesis, which determines the yield of plants. In order to evaluate the interference of the studied materials in plant physiological processes, the amount of oxidative stress will also be determined by measuring the accumulation of free oxygen radicals, the content of natural antioxidants and changes in the activity of selected antioxidative enzymes.

The research results will contribute to the development of science, while the acquired knowledge can be used in pro-ecological and agrotechnical activities in the context of the selection of chemical compounds that will make it possible to obtain optimal plant yields in terms of size and quality.