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Nanocomposites on the base of bio- and hydrogels as soil substrates for land application

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Growing population, limited food resources and anthropogenic wastes raise a problem of an increase of plant productivity and its quality. This problem is facing many communities. We suggest that for its solution nanocomposite soil substrates based on pH-sensitive acrylic hydrogels and sludge biogel (sludge solid of wastewater treatment plant) can be used. At the same time, there is a possibility of rational solving of the challenge of disposal of huge amounts (mln. tons) of sludge annually produced all over the world and occupying vast suburban fields. The sludge contents plant-essential nutrients, including nitrogen, phosphorus, potassium, microelements (heavy metals), vitamins, aminoacids and organic matter. All that causes the value of biogel for soil quality enhancement. The only obstacle for its application as a fertilizer is high concentration of heavy metals. Acrylic hydrogel is a new generation of sorbents ("smart hydrogels"), which has a unique property of fast and repeatedly its volume changes in cycles "swelling-compression / collapse". At swelling, bioelements incorporation into the hydrogel matrix from external solution takes place, at compression – their release.

The gel nanocomposites contain clusters of nanoparticles of heavy metals compounds for plant nutrition and show prolonged desorption of the bioelements. It provides intensifying growth processes in plants and significant crop productivity increasing due to application the soil substrates for poor and exhausted soils.

Thus, we proposed the technologies of obtaining nonocomposites with immobilized heavy metal compounds (micro- and macroelements) on the base of acrylic hydrogels and sludge biogels as soil substrates for land application. They include incorporation bioelements into hydrogels templates or biogel conditioning from heavy metals access by bioleaching after sludge biota activation.

A distinctive feature of our development is complex non-waste "green technology" of complete utilization of sludge from wastewater treatment plants as an effective fertile soil substrate for land application.