CARBONCONTAINING SORBENTS IN THE PROCESSES OF PHYTOREMEDIATION OF RADIOPOLLUTED SOILS

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Introduction

Decontamination of radioactively polluted soils remains one of the most urgent problems after Chernobyl accident. Now much attention is drown to phytoremediation - one of the perspective methods for removal of radionuclides and heavy metals from environment. However natural ability of plants to accumulate radionuclides does not provide fast decontamination of soil.

The main idea of this research consists in usage of a combined approach to a problem of decontamination of soils including simultaneous application of sorbents and radio-accumulated plants. Taking into account the many-side properties of carbon and natural sorbents, it was of interest to investigate their influence on character of behaviour of radionuclides in a system soil-sorbent-plant.

Experimental

The field experiments were carried out in an exclusion zone of Chornobyl Nuclear-Power Plant on the sites with different activity of soil during 1996-1998 years [1-2]. The choice of sorption materials was determined by their physicochemical parameters, selectivity in relation to radionuclides, and economic criteria. The carbon and natural sorbents, and also combined carbonmineral sorbent were used for experiments. The sorbents were placed into soil together with a sowing material on depth of arrangement of a rooted system. Analysis of plants on the contents of radiocesium were made after completion of a vegetative period.

Results and Discussion

The results of field experiments demonstrated that the plant's ability to accumulate radiocesium depends on their kind and nature of sorbent, introduced into soil. So, for example, in the presence of mineral sorbent the extraction of radiocesium by lupine only a little bit exceeds the natural process of phytoaccumulation, while usage of carbonmineral sorbents essentially increase the radioaccumulative capacity of lupine (Fig. 1). Such effect is observed on soils with different activity. It's necessary to note, that the application of carbonmineral sorbent in a simple mechanical mixture of active carbon and mineral sorbent, increase accumulation of radiocesium by plants more, than the usage of carbonmineral sorbent in form of large granules (Fig.2).

Confirmation of high efficiency of usage of carbonminerals sorbents is expressed in results of investigation of radioaccumulative properties of different plants (Fig. 3). These results show that in the presence of carbon-mineral sorbents the radioaccumulative effect is the most vivid.

On the basis of analysis of experimental data it was suggested, that the sorbent acts in a role of a transport depot in a system soil–sorbent–plant. It may be explained by the radiation effect from radionuclides on the heterogeneous system, causing simultaneously radiation-stimulated transition of radionuclides into soluble form, radiation-stimulated adsorption by carbonmineral material and radiation-stimulated diffusion in the soil-sorbent-plant system.

Conclusions

The obtained results show that phytosorption is the most effective process in presence of carbon-mineral sorbents. It's defined that the nature of carbon-mineral sorbents is the main factor of phytosorption decontamination of soils.

References

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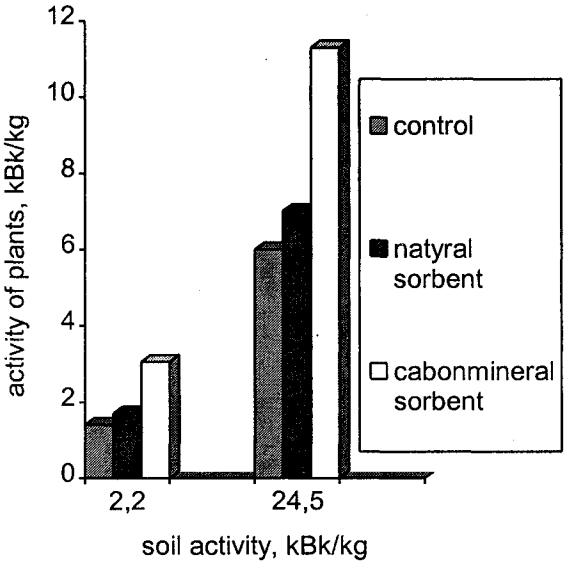

Figure 1. Influence of different sorbents on accumulation of radiocesium by lupin

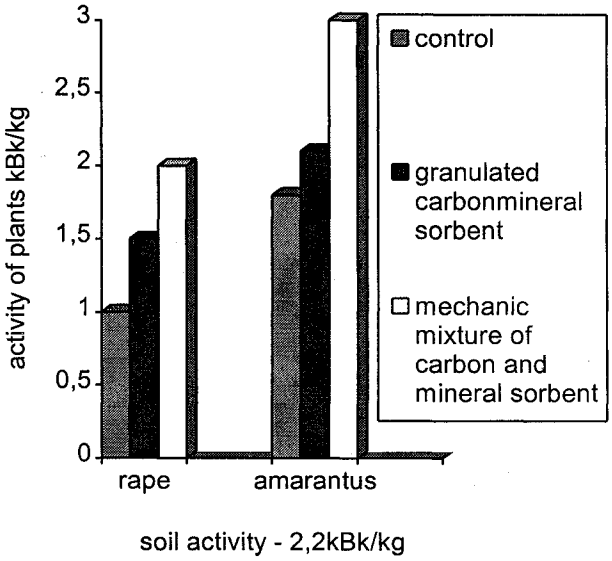

Figure 2. Influence of different forms of carbonmineral sorbents on ability of plant accumulation of radiocesium

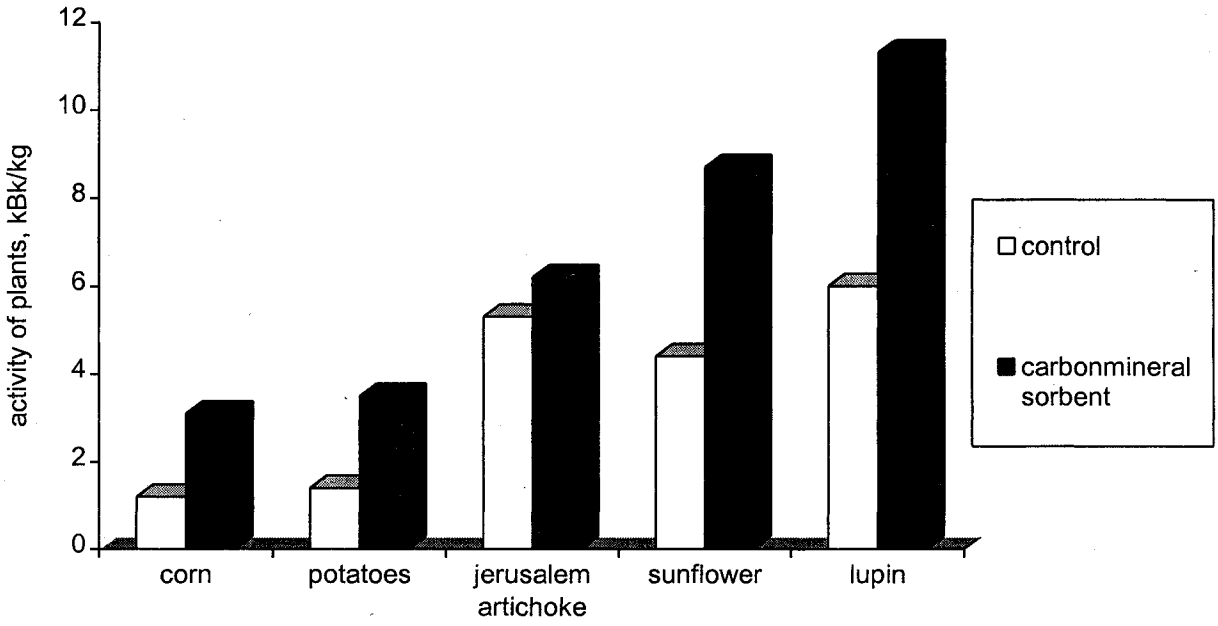

Figure 3. Influence of carbonmineral sorbents on accumulation of radiocesium by different plants (soil activity ~24 kBk/kg)