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NEW TECHNOLOGIES FOR REMEDIATION OF RADIONUCLIDE CONTAMINATED ENVIRONMENT

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Contamination of the environment in the Republic of Moldova may be caused as a result of the collection, processing, storage and disposal of wastes associated with the use of radioactive isotopes for industrial, research and medical applications. As a result of such contamination, in the Republic of Moldova have been initiated projects to assess and remediate radioactively-contaminated sites.
The Chernobyl nuclear accident also affected the territory of the Republic of Moldova. In the early months after the accident, the levels of radioactivity of agricultural plants and plant-consuming animals were dominated by surface deposits of radionuclides. The deposition of radioiodine caused the most immediate concern. Radioisotopes of caesium (137Cs and 134Cs) were the nuclides which led to the largest problems and even after decay of 134Cs the levels of longer lived 137Cs in agricultural products from highly affected areas still may require environmental remediation.
Many of the currently available methods for cleanup of the residual contamination are very expensive or ineffective in given situations. The most obvious intervention is the simple removal of contaminated material. Biological processes of in situ treatment technologies have an important economic role [2, 3, 4]. Over 97% and about 85% removal of137Cs and 60Co, respectively, from the pool water were reported, at a flow residence time of 7 days in Korea [6]. It is supposed that microorganisms degrade radioactive substances in a relatively short time (about 15 hours) [5].
The aim of the paper was to develop modern biotechnology for environmental remediation of contaminated with radioactive compounds. Research objectives: monitoring the concentration of natural radionuclides in soils from main geographical areas of the country, including the radioactive waste storage facility; isolating fungi from investigated soils in laboratory conditions; testing of the fungi pathogenicity and selecting non-pathogenic strains; testing in vitro influence of fungi Mucur vulgaris, Penicillium viride and Aspergillus niger on solubilisation of cobalt phosphate compound (CP). Material and methods. Testing of a set (n=46) of fungal strains according to their capacity to dissolve radioactive compounds was conducted. Qualitative assessment of potential biosynthesis able to solubilise CP by strains of fungi was performed by determining the development of fungal colony diameter and the diameter of expansion solubilising area over 24, 48, 72, 94 etc. hours of cultivation on the wort-agar medium (control), and supplemented with the CP in a concentration of 0.5...1.5%. Diameter of fungus colony and diameter of solubilising area around the colony was measured [1] (fig.1).

Fig. 1. Penicillium viride colony and cobalt phosphate solubilising area development.

Results: It has been demonstrated that all species of studied fungi dissolved FC but their capacity were different. So, in variant with 0.5% concentration of CF, solubilising diameter area under the action of Penicillium viride strain 2 was 90.0±0 mm, with 10.0 mm being greater than if the action of Aspergillus niger strain, and consisted 112.5% compared to the analogue 1. At the same time, in the second variant with the 1% concentration of CP, solubilising diameter area of CF under the action of Penicillium viride strain 2 was 90.0±0 mm, 26.25 mm being higher than if action Aspergillus niger strain. So efficiency consisted 204.5% compared to analogue. Efficiency versus analogue 2 –Mucor vulgaris X varied between 116,1–141,2%.
Interesting results have been obtained studding another radionuclide compounds and microbes, which will be reported in poster presentation.
Conclusion: The application of bioremediation as a biotechnological process involving microorganisms, especially fungi has great value, because of its increasing potential of solving the dangers of many radionuclide pollutants through biodegradation. Bioremediation using biodegradation represents a high impact strategy, but still a low cost way tool of removing pollutants, hence a very viable process to be applied. The principles of bioremediation are based on natural attenuation/bio augmentation/bio stimulation.
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