SENSITIVITY OF MICROBIOCENOSES TO HEXACHLOROBENZENE IN DIFFERENT SOIL TYPES

Dimova M, Yamborko N.
D.K. Zabolotny Institute of Microbiology and Virolog of the NAS of Ukraine,
Department of general and soil microbiology
e-mail: mdildiv@gmail.com

Soil microbiocenosis is an important indicator of the ecological status of the environment. Soil contamination by industrial waste, which includes persistent organic pollution, significantly degrades the state of the ecosystem. Organochlorine pesticide hexachlorobenzene (HCB) is a persistent organic contaminant. Because the main load of HCB is concentrated in soils, the soil microbiocenosis undergo the significant changes. The stability of microbial groups of soils to HCB contamination in different agrocenoses in Ukraine is insufficiently investigated. The aim of the study was to investigate the effects of hexachlorobenzene on soil microbiota of chernozem, dark-kastanozem and sod-podzolic soils.

The experiments were conducted in laboratory conditions with experimental contamination of soil samples with hexachlorobenzene at doses of maximum permissible concentration (MPC): 10, 500, 1000, 5000, 10000, based on the calculation, that the MPC of hexachlorobenzene is 0.03 mg/kg. The quantity of microorganisms was assessed by the method of sowing ten-fold dilutions of the soil suspension on agar media. The rate of basal and substrate-induced respiration was determined by the adsorption method.

The results had shown that HCB has a negative impact on all functional and systematic groups of microbiocenosis of the three studied soil types. Streptomycetes have proven to be one of the most sensitive microorganisms to HCB contamination. In chernozem, dark-kastanozem and sod-podzolic soils at a contamination dose of 10000 MPC, their numbers decreased by 92.0 89.6 and 71.1%, compared to control variants. The highest resistance to HCB contamination was found among micromycetes, whose quantity in the chernozem decreased in 26.2%, in the dark-kastanozem - in 62.2%, and in the sod-podzolic soil - in 37.9% of the control. At the same time, the ability to fully recover after prolonged loading of HCB was not detected in any of the studied soil microbiocenosis. The rates of basal respiration in the control samples of chernozem and dark kastanozem soils were 49.4±2.3 mg/g·h and 50.1±2.4 mg/g·h, respectively, and in the less humus enriched sod-podzolic soil – 42.4±2.2 mg/g·h. Under the action of the highest contamination dose of 10000 MPC, the rate of basal respiration was highest in the sod-podzolic soil – 30.3 mg/g·h. Under the condition of induced respiration substrate, the highest rate of CO_2 production, which was equal to 106.5±3.4 mg/g·h, was found in the experiment with dark- kastanozem soil in control variant. Under the highest contamination of 10000 MPC, the rate of substrate-induced respiration in chernozem and sod-podzolic soils decreased by 63.6% and 31.6% compared to the control. This confirms the high toxicity of HCB at high doses. The calculated Spearman correlation coefficient showed a clearly negative dependence between the amount of microorganisms and the dose of contamination – in experiments with chernozem and dark-kastanozem soils, it ranged from -0.96 to -1 in the sod-podzolic soil – from -0.6 to -1. Microbiocenoses of chernozem, dark-kastanozem and sod-podzolic soils showed high sensitivity to HCB loading in the range 10-10000 MPC.