

Assessment of Fermentative Activity in Heavy Metal Polluted Soils in Alaverdi Region, Armenia

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Abstract : Alaverdi region is situated in the northern part of the Republic of Armenia. Previous studies (1989) in Alaverdi region showed that due to soil irrigation with the highly polluted waters of the Debed and Shnogh rivers, the content of heavy metals in the brown forest steppe soils was significantly higher than the maximum permissible concentration as a result of which the fermentative activity in all the layers of the soils was stressed. Compared to the non-polluted soils, the activity of ferments in the plough layers of the highly polluted soils decreased by 44 - 68% (invertase - 60%, phosphatase - 44%, urease - 66%, catalase - 68%). In case of the soil irrigation with the polluted waters, a decrease in the intensity of fermentative reactions was conditioned by the high content of heavy metals in the soils and changes in chemical composition, physical and physicochemical properties. 20-year changes in the fermentative activity in the brown forest steppe soils in Alaverdi region were investigated. The activity of extracellular ferments in the soils was determined by the unification methods. The study has confirmed that self-recovery process occurs in soils previously polluted with heavy metals which can be revealed by fermentative activity. The investigations revealed that during 1989 - 2009, the activity of ferments in the plough layers of the medium and highly polluted soils increased by 31.2 - 52.6% (invertase - 31.2%, urease - 52.6%, phosphatase - 33.3%, catalase - 41.8%) and 24.1 - 87.0% (invertase - 40.4%, urease - 76.9%, phosphatase - 24.1%, catalase - 87.0%) respectively which indicated that the dynamic properties of the soils, which had been broken due to heavy metal pollution, were improved. In 1989, the activity of the Alaverdi copper smelting plant was temporarily stopped due to financial problems caused by the economic crisis and the absence of market, and the factory again started operation in 1997 and isn't currently running at full capacity. As a result, the Debed river water has obtained a new chemical composition and comparatively good irrigation properties. Due to irrigation with this water, the gradually recovery of the soil dynamic properties, which had been broken due to irrigation with the waters polluted with heavy metals, was occurred. This is also explained by the fact that in case of irrigation with the partially cleaned water, the soil protective function against pollutants rose due to a content increase in humus and silt fractions. It is supposed that in case of the soil irrigation with the partially cleaned water, the intensity of fermentative reactions wasn't directly affected by heavy metals.

Keywords : alaverdi region, heavy metal pollution, self-recovery, soil fermentative activity

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