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Heavy metals accumulation in plants of the dry-steppe zone of the East Kazakhstan region

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ABSTRACT

In this article data of a long-term research of the main regularities of distribution of heavy metals (Cu, Zn, Mn, Co, Pb, Cd) in plants of dry-steppe zone of the East Kazakhstan region are described. The field under study is of considerable scientific significance, as it includes the former nuclear plant of Semipalatinsk, as well as the protected area of the Abai Museum-Reserve. Zone typical plants of a steppe and desert-steppe zone were investigated; all 100 tests of plants, 18 views from 6 families were studied. It is shown that the wild vegetation of the study region contains much higher amounts of lead than cobalt. A significant scatter in the content of heavy metals in wild plants is characteristic. The maximum change in heavy metals is observed in cadmium (72%) and manganese (62%), the minimum change in zinc (25%). For the researched region by the level of biological absorption by plants, copper, manganese, cobalt, lead belong to the group of elements of average absorption; zinc, cadmium – to a group of elements of intense absorption. For zinc and cadmium, biogenic migration, apparently, can act as the main factor in the migration of these elements in the landscape. For zinc a basipetal distribution in various parts of plants is shown, and for copper and manganese an acropetal distribution in various parts of plants is revealed. Cobalt, lead and cadmium are characterized by the greatest accumulation in the roots of plants, while the content of these heavy metals in plant stems is minimal.

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1. Introduction

Regulation of environmental quality is impossible without an adequate assessment of its current state. Obtaining such information based on the background study, evaluation and forecast of the state of natural objects, including plants, is the main task of the global environmental monitoring system. Information on these issues will help to predict the accumulation of these toxicants in products of plant origin, normalize their admission to the trophic migration chain and develop measures to limit this income in order to produce environmentally friendly products [1–4]. In connection with the growth of human impact on the biosphere, a real danger of its negative consequences on the environment has been created. The most important pollutants in the atmosphere, water and soils are heavy metals (HM) [5–9]. HM are special pollutants, so determining their content in the environment and monitoring their transformations in air, water and soil are mandatory and systematic. HM take the second place by degree hazards, second only to pesticides and well ahead of well-known pollutants such as carbon dioxide and sulfur. It is possible that they may become more dangerous in the future than waste from nuclear power plants and solid waste. Heavy metal pollution is associated with their widespread involvement in industrial production. Methods of cleaning industrial enterprises from the products of their activities are imperfect, so heavy metals fall into the environment, including the soil, polluting and poisoning it.

The establishment of theoretical bases for regulating the quality of HM in natural objects is an especially significant and urgent challenge because of the rise in the rate of industrial production

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