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Research Article

METHODOLOGICAL SIGNIFICANCE OF STUDYING THE MIGRATION OF MICROELEMENTS IN WATER AND SOILS

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ABSTRACT

This article discusses the importance of studying the migration of trace elements in the air, soil, water and plants. Regularities in the distribution of microelements in nature depending on their location in the periodic system of chemical elements are revealed.

KEYWORDS

Methodology, chemical pollution, environment, trace elements, water, soil

INTRODUCTION

The growing needs of the population for various types of raw materials, on the one hand, facilitates and improves human life, on the other hand, worsens the living conditions not only of the person himself but of a living being in general. Assessing his activities, a person always strives to realize and understand the

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essence of the processes taking place around him and apply appropriate measures.

Today it is very important for scientists to help not only children, pupils, and students, but all segments of the population in a deep understanding of the processes that occur in nature and pollute the environment.

This article is devoted to the methodological analysis of microelement migration in water and soils.

THE MAIN PART

Trace elements are present in natural waters (ground and surface), and their sources are associated either with natural processes or with human activities. The main natural processes supplying microelements to the waters are the chemical weathering of rocks and the release in the processes of soil formation. Both of these processes appear to be largely controlled by biological and microbiological factors. Anthropogenic sources of trace elements in waters are mainly associated with the extraction of coal and ores, as well as with industrial and municipal wastewater. Water pollution with microelements is an important factor affecting the geochemical cycle of these elements and the quality of the environment. Most microelements, especially heavy metals, cannot be in dissolved form in water for a long time. They are present mainly in the form of colloidal suspensions or are captured by organic and mineral substances. Therefore, their concentration in bottom sediments or plankton is often an indicator of water pollution with microelements. Precipitation can be considered as the final point of migration of heavy metals entering the aquatic environment. On the other hand, volatile elements such as bromine and iodine can reach high concentrations in surface waters, from which, under certain climatic conditions, they can easily escape. Of great importance for the migration ability of a group of metals - mercury, selenium, tellurium, arsenic and tin - which are present mainly in sediments and suspended matter in water [1-5]. Therefore, their concentration in bottom sediments or plankton is often an indicator of water pollution with microelements. Precipitation can be considered as the final point of migration of heavy metals entering the aquatic environment. On the other hand, volatile elements such as bromine and iodine can reach high concentrations in surface waters, from which, under certain climatic conditions, they can easily escape. Of great importance for the migration ability of a group of metals - mercury, selenium, tellurium, arsenic and tin - which are present mainly in sediments and suspended matter in water [1-5]. Therefore, their concentration in bottom sediments or plankton is often an indicator of water pollution with microelements. Precipitation can be considered as the final point of migration of heavy metals entering the aquatic environment. On the other hand, volatile elements such as bromine and iodine can reach high concentrations in surface waters, from which, under certain climatic conditions, they can easily escape. Of great importance for the migration ability of a group of metals - mercury, selenium, tellurium, arsenic and tin - which are present mainly in sediments and suspended matter in water [1-5]. can reach high concentrations in surface waters, from which, under certain climatic conditions, they can easily volatilize. Of great importance for the migration ability of a group of metals - mercury, selenium, tellurium, arsenic and tin - which are present mainly in sediments and suspended matter in water [1-5]. can reach high concentrations in surface waters, from which, under certain climatic conditions, they can easily volatilize. Of great importance for the migration ability of a group of metals - mercury, selenium, tellurium, arsenic and tin - which are present mainly in sediments and suspended matter in water [1-5].

It has been established that both phytoplankton and vascular aquatic plants selectively concentrate trace elements. Due to this selectivity, the concentrations of some trace elements in waters may decrease seasonally, while other elements may go into solution when vegetation dies off.

Wastewater used in agriculture is generally a source of some trace elements. Therefore, their use in this area will be limited due to the possibility of soil

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contamination with heavy metals accumulating in the upper soil horizon to dangerous concentrations.

The indirect impact of air pollution is manifested in the soil. It is important because of the long duration of exposure of the soil to dry and wet atmospheric precipitation containing trace elements. Soil is a very specific component of the biosphere since it not only geochemically accumulates pollution components, but also acts as a natural buffer that controls the transfer of chemical elements and compounds into the atmosphere, hydrosphere, and living matter.

Metals that accumulate in soils are slowly removed by leaching, plant consumption, erosion, and deflation. The first period of semi-removal (i.e., removal of half of the initial concentration) of heavy metals varies greatly for soils under lysimeter conditions: for zinc, from 70 to 510 years; for cadmium, from 13 to 1100 years; for copper, from 310 to 1500 years and for lead - from 740 to 5900 years.

The balance of input-output of metals in soils showed that the concentrations of microelements in the surface layer of soils on a global scale seem to increase with the expansion of industrial and agricultural activities. There are indications that surface soils are likely to be subject to both local pollution and regional transport of pollution.

The degree of contamination of soils in cities is now so high that it is possible to identify most soil samples as urban or rural by their content of several microelements, known as the main components of pollution in the urban environment. Regional soil pollution, as indicated in most publications, occurs mainly in industrial areas and in the centres of large settlements. The most important sources of micronutrients here are businesses, transport and municipal wastewater. However, long-range air transport of trace element contaminants, especially those that form volatile compounds (eg arsenic, selenium, antimony, mercury), has made it difficult to determine the natural background levels of some trace elements in soils.

In addition to the air sources of trace elements, the entry of the latter into the soil with fertilizers, pesticides and irrigation should also be noted. An important source of soil pollution in some industrial areas can be the dumps of metallurgical plants and mines due to the mobilization and transfer of heavy metals by water seeping through them or the wind-carrying dust.

Long-term use of inorganic phosphate fertilizers significantly increases the natural level of cadmium and fluorine in soils, while for other elements, such as arsenic, chromium, lead and vanadium, it does not noticeably increase. The impact of sewage irrigation on soil composition is of particular concern and has been the subject of much research and legislative action. Recommended standards and instructions for preventing the accumulation of microelements when irrigating fields with runoff are still under development and discussion. However, several authors have already established limit values for maximum micronutrient supplements, both one-time and over a certain period of time. Despite some differences in the estimates, they are generally consistent, especially with regard to the maximum concentrations of heavy metals in soils. The maximum allowable limits set for rice fields vary somewhat [7]. The following contents were determined as critical for rice cultivation: copper - 125 mg/kg (soluble in 0.1 N HC1) arsenic - 15 mg/kg (soluble in 1 N HC1). Hazardous concentrations of cadmium in soils are determined by its permissible concentration in rice, which should not exceed 1 mg/kg. However, it must be taken into account that when setting the allowable limits, one should take into account not only the properties of a given plant-soil system but also the ratios between individual chemical elements and their total load on the soil. 1 N HC1) arsenic - 15 mg/kg (soluble in 1 N HC1). Hazardous concentrations of cadmium in soils are determined by its permissible concentration in rice, which should not exceed 1 mg/kg. However, it must be taken into account that when setting the allowable limits, one should take into account not only the properties of a given plant-soil system but also the ratios between individual chemical elements and their total load on the soil. 1 N HC1) arsenic - 15 mg/kg (soluble in 1 N HC1). Hazardous concentrations of cadmium in soils are determined by its permissible concentration in rice, which should not exceed 1 mg/kg. However, it must be taken into account that when setting the allowable limits, one should take into account not only the properties of a given plant-soil system but also the ratios between individual chemical elements and their total load on the soil.

In the works of a number of authors [8-12], increased doses of irrigation with wastewater are recommended, because heavy metals are relatively inaccessible to plants. In addition to the usual monitoring of levels of copper, nickel, zinc, cadmium, chromium and lead, when using runoff to irrigate fields, it is necessary to monitor the levels of silver, barium, cobalt, tin, arsenic, mercury, and possibly molybdenum, bismuth, manganese, antimony until it is determined that their probable accumulation in the surface layer of the soil is harmless.

The work [13] provides a review of monitoring data on the accumulation of heavy metals in soils irrigated with wastewater. They note that it would be unreasonable, without verification, to draw conclusions about whether heavy metals in the soil will be immobile after time or not.

Many authors [9-10] indicate that soil contamination with heavy metals is usually very stable. Therefore, it must be borne in mind that heavily contaminated soils - especially those contaminated with microelements - can be an accumulator of these contaminants, which results in the degradation of the biological and chemical properties of the soil.

Some specific methods of land reclamation and restoration of fertility using a variety of industrial effluents are described in [14].

CONCLUSION

For soils contaminated with microelements, methods aimed at plant protection are based on two main reactions - leaching of easily mobile elements and transfer of cationic microelements in the soil into difficultly mobile forms. Heavily polluted soil needs special treatment.

An analysis of the literature gives a clear methodological idea that a correct understanding of those chemical processes that occur in nature is important not only from the scientific and didactic side but also from the point of view of the protection of the whole living being.

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