

Research on Heavy Metal Pollution and Comprehensive Treatment of Farmland Soil

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Abstract

Heavy metal pollution in farmland soil not only leads to farmland soil pollution and affects crop yields, but also affects the health of residents through the food chain through crops. Therefore, grasp the evaluation of farmland soil heavy metal pollution, assess the current status of farmland soil heavy metal pollution risk, and take corresponding remediation measures in a timely manner. The article analyzes in detail the characteristics, causes and hazards of heavy metal pollution in farmland soil, and proposes comprehensive treatment measures for heavy metal pollution in farmland soil, which has positive practical guiding significance for the improvement of farmland soil pollution control.

Keywords

Farmland; Soil Heavy Metal Pollution; Risk Assessment; Remediation.

1. Introduction

With the acceleration of industrialization and urbanization, the problem of ecological environment pollution has become a important factor in economic and social development. In recent years, heavy metal pollution in the soil accumulated on cultivated land in the main grain-producing areas in my country has shown an upward trend. According to monitoring by relevant departments, the over-standard rate of points increased from 7.16% to 21.49%, an increase of 14.36 percentage points. Heavy metal pollution in farmland soil is mainly composed of elements such as cadmium, nickel, copper, zinc and mercury. Moreover, the heavy metal pollution of farmland soil in the main grain production areas in the south is significantly heavier than that in the north. Heavy metals in farmland soils in the five major grain production areas in the country, including Songnen Plain, Sanjiang Plain, Huanghuaihai Plain, Middle Yangtze River and Sichuan Basin, are mainly lightly polluted. Among them, the proportion of cadmium pollution has increased significantly. 1.32% increased to 17.39%. Heavy metal pollution of farmland soil not only leads to farmland soil pollution and affects crop yields, but also affects the health of residents through the food chain through crops. Therefore, grasp the assessment of heavy metal pollution in farmland soil, assess the current status of the risk of heavy metal pollution in farmland soil, and collect data in time. Taking corresponding remediation and treatment measures has a positive and practical guiding significance for doing a good job in the management of farmland soil pollution[1].

2. Characteristics of Heavy Metal Pollution in Farmland Soil

2.1. Migration and Transformation

Once heavy metal elements are immersed in the farmland soil environment, a series of physical and chemical reactions will occur from this, and migration and transformation will occur in various reaction processes, and the changes in the farmland ecological environment will affect the physics and chemistry reaction. For example, heavy metal elements can be reduced by dissolution, deposition, oxidation, and reduction. But under some special conditions, heavy metal elements in farmland soil are stable. In addition, different biological species have different tolerance to heavy metal elements in farmland soil. Since heavy metal elements are difficult to degrade, they will be converted into organometallic compounds after long-term enrichment in the soil, which is more toxic and harmful, inhibiting the activity of the soil and the effect of biological enzymes. Especially after long-term enrichment, it enters the human body through the food chain, which is more harmful.

2.2. Changeable Form

Most of the heavy metal elements have strong chemical activity, and their valence changes greatly.

Other elements undergo various physical and chemical reactions. Moreover, with the change of soil pH value, the heavy metal elements in farmland soil will undergo various reactions and appear in various forms, which makes the toxicity and stability of heavy metal elements in farmland soil vary greatly, and increases the difficulty of heavy metal pollution control. For example, the transition of heavy metal elements from the natural state to the complex state, ion state, etc., will further increase the toxicity of heavy metals in the soil, especially the ionic state of heavy metal elements such as copper, zinc, and lead, which are more toxic than complexes. In addition, heavy metal elements in farmland soil will also form organic matter through various physical and chemical reactions, and its toxicity is greater than that of inorganic matter formed by heavy metal elements. Therefore, the monitoring and evaluation of heavy metal pollution in farmland soil requires not only the analysis of the types of heavy metal elements, but also the understanding of their forms, in order to more accurately evaluate the corresponding pollution levels.

2.3. Difficult to Eliminate

Once heavy metal elements are immersed in the soil, it is difficult for the microorganisms in the soil to decompose, reduce its concentration or decompose and utilize. Even microbes may accumulate various heavy metal elements and produce various reactions to produce more toxic substances in the soil. It can be seen that due to the difficulty of eliminating heavy metal elements in farmland soil, the later processing difficulty is increased. That is, the heavy metal elements in farmland soil are concentrated in the soil or its microorganisms, and accumulate over a long period of time, which will adversely affect the soil ecosystem and even the human body, and it is difficult to recover in a short period of time.

3. Causes of Heavy Metal Pollution in Farmland Soil

3.1. Pesticides and Fertilizers

My country is the largest producer and consumer of pesticides and fertilizers. Excessive use of fertilizers and pesticides is an important factor leading to heavy metal pollution in farmland soils. According to statistics, in 2019, the application of agricultural chemical fertilizers in China reached 54.035 million tons. Although excessive use of chemical fertilizers can effectively help crops increase production and income, a considerable part of the chemical fertilizers are also absorbed by farmland soil and entered through irrigation, rainwater, etc. Water area, thereby

further increasing the heavy metal pollution of farmland soil. Among them, excessive use of phosphate fertilizer, compound fertilizer, potash fertilizer, nitrogen fertilizer, etc. will increase the content of heavy metal elements in farmland soil. In addition, excessive use of pesticides will also aggravate heavy metal pollution in farmland soil.

3.2. Solid Waste

Solid waste is also one of the important factors of heavy metal pollution in farmland. Especially in the farmland soil near township industrial enterprises and industrial parks, a large number of complex and diverse solid wastes are directly stacked near the farmland and washed by rain, and solid waste leachate pollution will cause heavy metal pollution in farmland soil. Exposure to wind, sun, and water sources will aggravate the heavy metal content of farmland soil and cause pollutants to exceed the standard[2].

3.3. Atmospheric Deposition

Transportation, metallurgy, cement, construction and energy industries will produce a large amount of dust pollution and exhaust gas pollutants during their production operations. Many heavy metal elements in the pollutants enter in the form of aerosols, vapors, etc. along with the exhaust gas emitted. Atmospheric environment, and sink to farmland soil. In addition, the leaded gasoline emitted by a large number of motor vehicles around highways and cities will produce a large amount of heavy metal elements such as zinc, copper, lead, and chromium during the combustion process. As the atmosphere settles, it will eventually affect farmland soil pollution, leading to farmland soil The medium and heavy metal elements exceed the standard.

4. Harm of Heavy Metal Pollution in Farmland Soil

Heavy metal elements in farmland soil will not only destroy the ecological environment, but also change the soil structure, biological growth, and the destruction of ecosystems, which have a greater impact on the ecological environment.

4.1. Affecting the Physical and Chemical Properties of Soil

(1) Destroy the soil structure.

Lead, copper, arsenic, mercury and other heavy metal elements are enriched in farmland soil. After reaching a certain concentration, it will profoundly affect the soil structure, change the soil structure and its effective components, destroy the internal balance of farmland soil, and cause soil compaction and reduce porosity. In turn, affect the permeability and water content of farmland soil, making farmland soil barren.

(2) Affect material transformation.

That is, the heavy metal elements in farmland soil will affect the repeated operation and exchange between organisms and non-living organisms in the soil material, including the organicization of inorganic materials and the inorganicization of organic materials, affecting the structural composition and nutrient components of the soil, such as The carbon, nitrogen and phosphorus cycles of the soil ultimately affect the texture, pH, and porosity of the farmland soil, disrupt the soil material cycle, cause biological malnutrition in the soil, and reduce production.

4.2. Affect the Growth of Soil Organisms

Heavy metal pollution in farmland soil is mainly due to dynamic changes caused by human activities. With the input of heavy metal element pollution sources into farmland soil and farmland soil.

The effects of crop absorption and running water have adverse effects on crops, microorganisms and the human body.

(1) Crops.

The heavy metal elements in the irrigation water source and soil will enter the crops along the apoplast channel or the symplast channel, which will affect the quality of the crops and lead to excessive heavy metal elements in agricultural products, such as rice and radishes. In addition, excessive heavy metal elements will also damage crop enzyme systems, chlorophyll synthesis and change the level of nucleic acid metabolism, etc., which will affect crop yields.

(2) Microorganisms.

The fungi, actinomycetes, algae and other microorganisms in the soil play an important role in soil nitrification, sulfide, nitrogen fixation, organic matter decomposition and nutrient transformation. However, when the content of heavy metal elements in farmland soil is too high, it will inhibit microbial metabolism and death, resulting in changes in the structure of microbial community.

(3) The human body.

Heavy metal elements in farmland soil will pass through the crops and through the food chain, eventually affecting the human digestive tract and other organisms, resulting in bone pain, lead poisoning, and so on. In addition, during farmland operations, due to excessive use of pesticides and fertilizers, a large amount of heavy metal elements float and sink in the air, passing through the human mouth and nasal cavity, affecting the respiratory tract and lungs, long-term accumulation, and causing body disease.

5. Countermeasures for Prevention and Control of Heavy Metal Pollution in Farmland Soil

5.1. Source Governance

Do a good job in the prevention and control of heavy metal pollution in farmland soil from sources such as irrigation, fertilization and medicine. The first is the scientific application of pesticides and fertilizers. According to the actual needs of crops, pesticides and fertilizers are accurately applied, and the number, frequency and time of application are strictly controlled. Vigorously promote organic fertilizers and green fertilizers, and promote ecological and green planting techniques. The high-temperature composting process should be carried out before the application of organic fertilizer, and sterilization can be carried out to reduce pollution. Use limestone and other soil conditioners to reduce the acidity of crop soils, relieve heavy metal aluminum in the soil, and effectively supplement soil nutrients such as magnesium and calcium, improve soil structure, and increase soil biological activity. In addition, we have vigorously promoted precision irrigation technologies such as drip irrigation and sprinkler irrigation to cut off the flow of heavy metals into farmland through water sources[3].

5.2. Indigenous Planting

According to the "Technical Specifications for Soil Environmental Monitoring", do a good job of heavy metal pollution in farmland soil.

Evaluation, as well as the division of soil regions, and the use of differentiated planting for different levels of heavy metal enrichment in the soil, to maximize the efficiency of farmland soil utilization. For farmland that has been severely polluted by heavy metals, it is strictly forbidden to grow crops, and overaccumulate plants such as centipede grass and small wax leaves should be planted to improve the level of heavy metal pollution in the soil. In addition, cash crops such as empty hemp and cotton or ornamental plants can also be planted. According to the heavy metal adsorption capacity and characteristics of different plants, select suitable crops. For example, cadmium metal element seriously pollutes farmland, so peanuts, rapeseed and other low-cadmium accumulation plants can be planted. In short, through monitoring the soil heavy metal elements, reasonable planning, scientific fertilization, and efficient planting.

5.3. Scientific Restoration

For farmland soil heavy metal pollution, physical methods, chemical methods, biological methods, and comprehensive remediation techniques can be selected. According to local conditions, according to the characteristics of soil heavy metal pollution remediation technology, targeted scientific remediation will be carried out to restore the soil ecological structure. For example, the foreign soil method and soil replacement method can be applied to a small range of heavy metal polluted farmland, and advanced technologies such as heat treatment method and soil improvement method can also be used. In recent years, bioremediation and ecological restoration have been widely used, and have a good restoration effect on large areas and long periods of heavy metal pollution in farmland. In addition, adding amendments, biochar, etc. to the soil can volatilize heavy metal elements in the soil, reduce the proportion of harmful heavy metal substances, and achieve the effect of remediation[4].

6. Conclusion

To sum up, my country is a large agricultural production country, and the problem of heavy metal pollution in farmland soil is awaited.

solve. In view of the characteristics and causes of heavy metal pollution in farmland soils, we should attach great importance to the harm of heavy metal pollution in farmland soils, adopt measures such as source control, planting in different places, and scientific remediation, and implement comprehensive measures to reduce the harm of heavy metal pollution in farmland soils, and protect the basics of agricultural production. Farmland is valuable for the implementation of the rural revitalization strategy.

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