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Soil Heavy Metal Pollution Control Technology Research

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Abstract

Soil is an important component of the terrestrial ecosystem, an irreplaceable and important factor for human survival and an important safeguard for human health, and plays an important role in maintaining the ecological balance. In recent years, a series of man-made production activities such as industrial agriculture have seriously polluted the soil, leading to a decline in the quality of food and other crops grown in the soil. Therefore, research on soil heavy metal pollution control technology is important for ecological environmental protection and purification of the soil environment.

Keywords

Soil; Heavy metal pollution; Remediation technology.

1. SOIL HEAVY METAL POLLUTION AND ITS CHARACTERISTICS

As much as 12 million tonnes of foodstuffs are contaminated with heavy metals due to the impact of heavy metal pollution. Soil heavy metal pollution in China is very serious. The main characteristics of soil heavy metal pollution are as follows: firstly, it is hidden and lagging. Compared to atmospheric pollution and water pollution, which the human body can perceive through its organs, soil pollution is difficult to be detected directly. Instead, it can only be determined through crop testing and soil sampling and analysis techniques. In some places, heavy metal contamination of the soil is only detected after it has already caused harm to humans or livestock. Soil contamination by heavy metals takes a long time to produce direct harm, so there is often a delay in treatment due to the hidden nature of heavy metal contamination in soil; secondly, it is cumulative. Pollutants in the atmosphere and water resources disperse and move much faster than in less mobile soils. Therefore, heavy metal pollutants in the soil will continue to accumulate and increase over time, thus making it gradually more difficult to control them; third, uneven distribution. The nature of the soil and the sources of pollutants in different regions differ significantly, and the mobility of the soil is poor, so pollutants will gradually spread in the soil over time, resulting in an uneven distribution of heavy metal pollution in the soil, and a large difference in the spatial extent of the soil.

2. SOIL HEAVY METAL POLLUTION MANAGEMENT TECHNIQUES

2.1. Physical Remediation Techniques

Electric remediation technology: Electric remediation technology is an in situ remediation technology for the decontamination of soils, mainly for contaminated soils with low permeability and groundwater. The heavy metal ions and inorganic ions in the soil can be

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affected by electric currents and under the influence of an electric field will move towards the electrodes by means of electromigration and then be concentrated for treatment. Electroremediation is suitable for clay and silt soils with low permeability and can influence the direction of flow of heavy metal contaminants. The electro-thermal remediation technique is easy to operate, efficient and can be carried out on the basis of maintaining the integrity of the soil, and shortens the remediation time and improves the efficiency of the remediation; the electro-thermal remediation technique uses high frequency voltages to generate electromagnetic waves, which raise the temperature of the soil and generally detach the heavy metal contaminants from the soil. This technology is mainly used for soils contaminated with heavy metals such as Hg and Se.

2.2. Biological Treatment Techniques

Biological treatment techniques are mainly plant treatment techniques and microbial treatment techniques. The phytocontrol techniques for heavy metals in soils focus on the soil remediation mechanisms of plants and the selection of plants for treatment. Phytoremediation techniques cover not only the treatment and removal of heavy metal pollutants, but also the in situ immobilisation and transformation of pollutants. For example, root-enhanced phytoremediation techniques. Plant root secretions, as part of inter-root deposition, contain high molecular weight extracellular enzymes and low molecular weight amino acids. Plant root secretions can act as a vehicle for material exchange between plants and soil, reducing the diffusion capacity of heavy metals in the soil through activation and chelation, thereby reducing the toxicity of heavy metals. Root secretions can activate heavy metals in the soil, for example, duckweed root secretions can activate the heavy metal Cu in the soil, thereby reducing the chemical toxicity of heavy metal pollutants [1]. Root secretions can also adjust the pH of the soil, thus promoting the development of plant roots and enhancing the formation of root secretions at the same time, ultimately improving the ability of plants to remediate heavy metals. Microbial remediation technology uses the metabolic capacity of microorganisms to absorb heavy metal ions from the soil and transform them into the compounds they need to remediate the soil. Microbial remediation uses the oxidative metabolism of heavy metal ions, which is transformed by the metabolism of the microorganisms into secondary metabolic compounds that are less harmful to the soil environment [2].

2.3. Chemical Treatment Techniques

Chemical remediation technology is to add improvers to the soil. By adding different improvers to the land polluted by different types of heavy metal elements, the soil organic matter, cation substitution and mucilage content can be enhanced to adjust the pH, conductivity and other physical and chemical properties of the soil, which makes the heavy metals in the soil appear redox reactions, adsorption, etc., in order to reduce the effectiveness of the soil heavy metal administration. The core of chemical remediation and treatment technology lies in the selection of economically excellent amendments. Commonly used chemical soil conditioners include lime, silicates, phosphates and other organic substances that can drive reduction reactions. Different types of chemical amendments can have different effects on heavy metals, and care should be taken to avoid secondary pollution when choosing specific uses. In addition, there are chemical drenching and fixation techniques. Chemical drenching and immobilisation techniques both use chemical techniques to remove heavy metals from the soil. Chemical drenching uses chemical elution to separate the soil from the heavy metals. This serves to clean the soil. However, as chemical elution may result in the elution of metal ions inherent in the soil, the eluted soil is often not suitable for growing crops. Chemical fixation, on the other hand, can be achieved by adding chemicals to the soil to reduce the mobility of heavy metal ions, or by directly converting them from their free state to a fixed chemical state. During the

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transformation process the biological toxicity of the heavy metal ions is greatly reduced, thus providing a cure for the soil [3].

3. CONCLUSION

At present, the phenomenon of heavy metal pollution in China's soil is very serious, and the treatment of heavy metal pollution in soil has become an important element in protecting soil and purifying the environment. Soil heavy metal pollution remediation management is a comprehensive process, the influence of many factors, a single remediation management technology, although a good remediation effect, but has certain defects and application range. Therefore, in the process of soil heavy metal pollution remediation and restoration can be targeted to integrate physical, biological, chemical and other methods to create heavy metal soil.

4. FUNDING

DJNY2022-52-Salt Tolerance Evaluation and Germplasm Screening of Main Planting Varieties of Wheat in Shaanxi Province.

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