



# Remediation Technology and Practice of Heavy Metal Polluted Soil

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## Abstract

China has always attached great importance to economic development, and the economic level is rapidly improving. However, in this process, there is a lack of attention to the ecological environment. Many enterprises and factories discharge untreated or simply treated heavy metal pollutants into the soil during production and operation, causing serious impacts on human health and the ecological environment. With the continuous development of the times, China has gradually realized the importance of environmental protection. With the continuous innovation and development of biotechnology, chemical technology, and physical technology, many new technologies for heavy metal contaminated soil remediation have emerged. These technologies have been continuously applied and improved in practice, hoping to effectively solve the problem of heavy metal pollution. This article will review the current common remediation technologies for heavy metal contaminated soil, evaluate and analyze them, aiming to provide reference and reference for solving the problem of heavy metal contaminated soil remediation.

## Keywords

Heavy metal pollution, Soil remediation technology, Repair Practice

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Heavy metals are the foundation of industrial development. In the process of applying heavy metals, it is inevitable to produce heavy metal pollutants, and many enterprises have not scientifically and reasonably treated heavy metal pollutants due to technical and economic factors, and directly discharged them into the ecological environment, resulting in adverse consequences. Based on this, China has strengthened its attention to this aspect and introduced relevant policies and guidelines to remediate and treat heavy metal contaminated soil [1].

## 1. Overview of heavy metal contaminated soil

Soil is an important foundation in the construction and development of a country, especially for China. With the development of the economy, China has built more and more smelting and chemical factories on land, effectively promoting the construction and development of industry. At the same time, while developing industry, many heavy metal pollutants have been generated, causing serious pollution to the soil under the arbitrary discharge of factories.

Heavy metal pollution accounts for a large proportion of soil inorganic compound pollution. Although plants can absorb some heavy metal pollutants to a certain extent, most of the pollutants cannot be decomposed, and will accumulate in plants and soil for a long time, which will have a certain impact on animals, plants and residents in the surrounding areas. There are many types of heavy metal pollutants in soil, including mercury, lead, manganese, chromium, nickel, arsenic, etc. From the perspective of chemical elements, arsenic is not within the range of heavy metals. However, in terms of toxicity, arsenic and heavy metals are similar [2]. Relevant personnel regard arsenic as a heavy metal for testing and treatment work. For soil, the destructive power of heavy metal pollutants is very significant, and with the continuous accumulation of heavy metal pollutants, it will cause serious damage to soil elements. At the same time, different heavy metals have varying properties, some of which are radioactive and some are toxic, which can have adverse effects on the surrounding ecological environment, flora and fauna, as well as residents. For example, under natural

conditions, mercury, a metal ion, does not evaporate, and microorganisms in the soil are also unable to decompose mercury, resulting in long-term accumulation and accumulation in the soil. Under the influence of its toxicity, it can affect the soil and surrounding plants, potentially leading to the inability of plants to grow. At the same time, metal ions such as mercury can also cause pollution to water sources, and the survival and growth of animals and plants are closely related to the water source. If animals and plants absorb or drink water sources containing a large amount of mercury ions, it may lead to the death of animals and plants. If surrounding residents drink mercury contaminated water sources, they may experience mercury poisoning or blood diseases, posing a threat to the safety of residents' lives and property. It can be seen that the harm caused by heavy metal pollutants is very significant, and it is difficult for both plants and animals to survive in such areas. In addition, from the perspective of agricultural development, if crops are planted in soil contaminated with heavy metals, the resulting crops do not meet relevant standards and cannot be sold or consumed, which not only leads to food waste but also causes losses to farmers' economic property [3].

## **2. The current situation and causes of heavy metal pollution in soil in China**

### **2.1 Current situation of heavy metal pollution in soil in China**

At the current stage, China is facing heavy metal pollution in soil, with a wide range of pollution areas. Further improvement is needed in remediation and governance. The cadmium rice incident in the past few years was caused by heavy metal pollution. Rice cultivation was carried out in cadmium contaminated soil. With the continuous accumulation and accumulation of cadmium, cadmium exceeded the standard in the rice produced. After consuming cadmium contaminated rice for a period of time, cadmium poisoning appeared, causing bone pain and affecting the safety of people's lives and property.

At the same time, the mining area pollution is the main soil pollution area in China, especially in the Yunnan-Guizhou Plateau, where there are rich metal mineral resources, but also the high incidence of heavy metal pollution. In the development of heavy industry in China, natural gas and oil resources are the foundation, and the content of these resources in the northwest region is very rich. In order to promote the development of heavy industry, excessive development of energy materials has to some extent changed the soil structure layer, which has an impact on the soil structure and can cause soil pollution. At the same time, China's lead ore resources are very abundant, and both from the perspective of consumption and production, China occupies an important position. The harm of lead, a heavy metal, is relatively high, especially for children, who are more susceptible to the influence of lead, resulting in the occurrence of excessive blood lead levels in children. Therefore, in response to the problem of soil heavy metal pollution, China has strengthened its attention to this aspect and proposed relevant policies and guidelines, aiming to effectively solve the problem of soil heavy metal pollution in China, such as the 12th Five Year Plan for the Prevention and Control of Heavy Metal Pollution [4].

### **2.2 Causes of heavy metal pollution in soil**

Under normal circumstances, the content of heavy metals in soil is relatively low and will not cause adverse effects on the surrounding environment, animals, and plants. Human activities are the main cause of soil heavy metal pollution in China. Whether it is the discharge of sewage in human life or the discharge of various waste materials in industrial production, heavy metal pollutants are generated and accumulated, with the accumulation of heavy metals in industrial production being more significant.

At the current stage, there are many ways to cause the discharge and pollution of heavy metal pollutants, of which the mining and smelting of mineral resources is a key part, which has relatively large impact. While affecting the local environment of the soil, it will also have an impact on the surrounding environment. The scope of impact is very large, which will lead to heavy metal pollution in the soil. In this case, it is very difficult to repair and control, it is difficult to completely eliminate heavy metal pollutants in the soil. During the process of mining and smelting mineral resources, the content of heavy metal pollutants in the soil will continue to increase, and the harm caused will also further increase. In chemical production, there are three main types of pollution, namely exhaust gas pollution, wastewater pollution, and solid waste pollution. With the arbitrary discharge of solid waste, it will continue to accumulate in the soil, causing serious pollution to the surrounding soil. Waste gas pollution refers to the gradual infiltration of pollutants into the soil over time under gas deposition, leading to the occurrence of heavy metal pollution in the soil through the infiltration and accumulation of pollutants. Wastewater pollution refers to the discharge of pollutants into the surrounding environment with water flow, during which the water source gradually seeps into the soil, leading to the occurrence of heavy metal pollution in the soil over a long period of time. Meanwhile, liquid wastewater can also accumulate heavy metal pollutants in the soil through crop irrigation, which not only pollutes the surrounding soil but also interferes with crop production [5].

From this, it can be seen that there are many reasons for heavy metal pollution in soil, which can cause numerous adverse consequences, and have a negative impact on the surrounding environment, the growth of animals and plants,

and the lives of residents. Therefore, it is necessary to choose the most suitable remediation and control measures based on the different causes of soil heavy metal pollution.

### **3. Remediation technology for heavy metal contaminated soil**

#### **3.1 Physical and chemical remediation techniques**

In the remediation and treatment of heavy metal contaminated soil, physical and chemical remediation techniques are commonly used to eliminate, stabilize, and solidify heavy metal pollutants in the soil. Choose appropriate remediation and treatment methods based on the area and situation of soil pollution. If the pollution area of the soil is relatively small, methods such as deep tillage, soil replacement, and soil removal can be adopted. The method of deep cultivation is to replace the deep soil with the surface soil, because the heavy metal pollution in the surface soil is heavier, while the heavy metal pollution in the deep soil is lighter. Through soil replacement, the impact on the surrounding environment and plants can be reduced, and the migration ability of heavy metals can also be reduced. Soil replacement refers to the application of clean soil to replace contaminated soil, while processing and removing heavy metals from the soil. Soil removal refers to the excavation of soil contaminated with heavy metals, in order to minimize the content of heavy metals in the soil as much as possible. Although physicochemical remediation technology has good remediation effect in soil remediation and can quickly remove heavy metals, the application of displacement fluid will pollute the surrounding environment, animals and plants, and it will take a long time to restore the ecological environment and soil fertility. In this process, agricultural planting recovery technology and biological recovery technology need to be applied [6].

#### **3.2 Agricultural planting restoration technology**

In the remediation of heavy metal contaminated soil, agricultural planting remediation technology refers to the application of water, fertilizers, and pesticides in agricultural planting, regulating and controlling the content of heavy metals in the soil, preventing the accumulation of large amounts of heavy metal pollutants in the soil, thereby affecting crop production. At the same time, crops also belong to the category of plants, and the roots and stems of crops produce secretions during their growth process, which can decompose a certain amount of heavy metal pollutants. In addition, controlling the moisture content during crop growth can to some extent fully utilize the heavy metal pollution remediation and prevention effects of this technology.

#### **3.3 bioremediation technology**

Bioremediation is also a very important technology in the remediation of heavy metal contaminated soil. this technology effectively reduces the content of heavy metal pollutants in soil through the role of microorganisms and plants. This is because during plant growth, the roots and stems secrete related substances, which decompose heavy metal pollutants in the soil, thereby reducing the content of heavy metal pollutants in the soil. For example, the cultivation and application of tobacco can remove metal ions such as mercury from soil. In addition, microorganisms also play an important role in the remediation and treatment of heavy metal contaminated soil. Although they cannot decompose heavy metal pollutants, they play an important role in solidifying metal ions. The oxidizing substances produced by them can combine with free metal ions, thereby changing the form of metal ions and significantly reducing the harm of heavy metals, exerting the remediation effect of heavy metal contaminated soil, the role of mycorrhizal fungi is very significant [7].

### **4. Remediation Practice of Heavy Metal Polluted Soil**

The importance of heavy metal contaminated soil remediation technology is self-evident. With continuous practice and development, heavy metal contaminated soil remediation technology has achieved good research results, and the level of various remediation technologies is constantly improving, with more significant remediation effects and better control of remediation costs. The current research and analysis on remediation technologies for heavy metal contaminated soil provide strong support for future remediation work. In foreign regions, relevant scholars have conducted six years of research to achieve the remediation and treatment of heavy metal contaminated soil through the application of relevant amendments. In this process, the application of amendments can significantly improve the soil remediation effect and reduce the heavy metal content in the soil. At the same time, the remediation and management of heavy metal contaminated soil can be achieved through planting activities and agricultural activities. The most suitable method can be selected based on the actual situation of soil pollution, effectively reducing the harm of heavy metal contaminated soil. In addition, the application of fertilizers and pesticides in agricultural production can lead to the generation and accumulation of heavy metal pollutants in soil, as the application of organic fertilizers can affect the properties of heavy metals. From this, it can be seen that in the practice of heavy metal contaminated soil remediation, it is necessary to

have a comprehensive understanding of the functions of the ecosystem, the environment, and the reproductive patterns of animals and plants. Based on this, the remediation objectives should be determined, and the most suitable remediation technology and method should be selected.

## 5. Conclusion

To sum up, at present, China is very concerned about the problem of heavy metal contaminated soil. Currently, the commonly used technologies are physical and chemical remediation, agricultural planting remediation and bioremediation. According to the causes and actual conditions of heavy metal pollution in soil, select one or several remediation technologies to effectively reduce the content of heavy metal pollutants in soil and avoid the impact on the surrounding ecological environment, animals, plants and residents.

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