

Research progress on soil pollution and remediation methods

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Keywords: Soil pollution, repair method, research progress

Abstract: After entering the new period, China's industrialization level is continuously improving and urbanization is accelerating, exacerbating the problem of soil pollution. The seriousness of soil problems will not only adversely affect China's agricultural production, but also pose a greater threat to people's health and safety. Therefore, it is necessary to thoroughly analyze the types and ways of soil pollution, and constantly innovate and improve the repair technology.

1. Introduction

In recent years, the construction of an environment-friendly society has received full attention from the whole society, and the problem of soil pollution will directly restrict the construction of an environment-friendly society. Therefore, it is necessary to study soil pollution remediation technology in depth. Western developed countries began to study the remediation of soil pollution early, and have rich technical experience. In China, a series of soil remediation technologies have been developed step by step based on the successful experience of foreign countries.

2. Effects of Soil Pollution on Human Health

It is found that once the problem of soil pollution occurs, the composition and structure of soil will change, and the normal growth needs of plants will not be guaranteed. At the same time, more harmful substances will remain in plants, causing indirect harm to human health.

2.1. Harm of Organic Compounds

Organic matter is an important component of soil pollution, which can be divided into two aspects: easy degradation and difficult degradation. Degradable organic matter can be effectively decomposed without endangering human health. The hard-to-decompose organic matter cannot be decomposed, and when people eat these residual organic plants, their health will be affected.

2.2. Heavy metal hazard

The pH value of the soil affects the absorption of heavy metals by the soil. According to relevant research, there is an inverse proportional relationship between soil pH and heavy metal activity. The lower the PH value, the stronger the activity of heavy metals, and the stronger the ability of plants to absorb these heavy metals. If the plant eaten by human body is polluted by heavy metals, it will stay in human body and easily cause poisoning incidents.

2.3. Harm of Radioactive Material

It is found that radioactive substances will do harm to human health to a large extent, and will not be affected by time factors. Consumption of contaminated food or inhalation of contaminated gas will carry out radioactive substances to the human body, and then continue to irradiate the body, destroying part of the body's tissue cells.

3. Main Soil Pollution Types and Ways

Soil pollution includes many types, has different pollution pathways and components, and needs to be analyzed in depth to better apply the repair technology and improve the soil pollution repair effect.

3.1. Chemical pollution

Among them, unreasonable application of chemical fertilizers and pesticides, or no scientific discharge of pollutants, easily lead to the emergence of soil chemical pollution. China has very limited resources for the use of cultivated land. In order to meet people's needs, a series of substances such as fertilizers, pesticides and growth regulators have been widely used. If they are not used properly, they will pollute the soil and pose a threat to human health. In addition, the random discharge of industrial wastewater and domestic wastewater is also an important way for chemical pollution problems. Because the wastewater contains a lot of heavy metal ions, it causes serious pollution to the soil.

The survey found that about 90% of the pesticide application in farmland in China is concentrated in the surface of arable soil within 20cm. Therefore, there will be more serious residual pollution problems. Pesticides have a long history of use and major changes have taken place in the components. Organochlorine pesticides have been widely used in the last century and have contaminated the soil to a large extent. After entering the new period, although a large number of organochlorine pesticides have been banned, they are still difficult to degrade due to their relatively stable chemical properties, and remain in various media and organisms, causing serious pollution problems. Organophosphorus pesticides belong to the category of synthetic pesticides, have short residual time and high efficiency, and are widely used. Among them, dichlorvos and dimethoate are common organophosphorus pesticides. Although the organism and the environment can degrade a part of the phosphorus-containing wastewater, some of the remaining pollutants still cause serious pollution problems. After 70 years of the last century, carbamate synthetic pesticides have been widely used in our country. Although it does not have high toxicity, it will stimulate growth and seriously endanger human health and the environment. At present, the whole society pays full attention to the problem of carbamate pesticide residues. In recent years, a new type of pesticide, pyrethroid pesticide, has emerged. It has good insecticidal effect and low toxicity, but it still scatters most harmful substances into the environment, resulting in soil pollution. In addition, heavy metal pollution is also the focus that needs attention. Heavy metal pollution refers to the introduction of some heavy metals into the soil during human activities, which leads to a substantial increase in the content of heavy metals in the soil, thus causing soil pollution problems. Among them, the unreasonable exploitation of mineral resources and the unreasonable discharge of industrial wastes are all man-made activities. With the development of these unreasonable activities, the problem of heavy metal pollution in soil will gradually become severe. The investigation found that among the heavy metal pollution in soil, cadmium pollution is more common.

3.2. Physical pollution

It was found that radioactive contamination is the main way of soil physical contamination, which should be paid more attention to. Nuclear facilities, radiation devices, radioactive isotopes and so on are the main sources of radioactive materials. Without scientific and timely treatment of waste gas or wastewater in the source area, it is easy to cause soil physical pollution problems.

It is found that physical pollution mainly pollutes the environment and soil by various forms of radiation, and the more common radioactive substances include radium and iodine. Natural radioactive substances will not pose a greater threat to human health, but science and technology are becoming more mature. Many radiation sources have been constructed artificially, and a large number of radioactive substances have been produced. If the soil is contaminated by these radioactive materials, the radioactive elements in the soil will increase greatly. This not only causes direct damage to human health, but also enters the human body through animals and plants, causing direct damage to human tissues and organs. In addition, under the influence of radiation, the genetic mutation of plants and animals is also prone to occur, which in turn seriously damages the ecological environment.

3.3. Biological pollution

After freely discharging pollutants such as domestic garbage and domestic wastewater, some

organisms or pathogens will invade the soil, which will not only pollute the soil, but also spread the toxins, which will affect the normal growth of the organism. In addition, after invading a large number of microorganisms, the content of organic matter and nutrients in the soil will be greatly reduced, significantly reducing soil quality and causing serious damage to the balance of the ecosystem.

4. Soil pollution repair method

At present, the whole society pays full attention to the problem of soil pollution, and has developed a targeted repair method for different types of soil pollution.

4.1. Physical repair

In the field of soil pollution repair, the most common method is physical repair, which has been widely used. In the practice of soil remediation and treatment, although people can apply the targeted remediation methods in combination with the differences in the types and properties of soil contaminants, they require high overall costs and it is difficult to effectively control large areas of contaminated soil. Among them, engineering measures, pyrolysis, motor drive, etc. are commonly used physical repair methods.

The engineering measures method is to apply soil cultivation, solidification, landfill and other measures to reduce the concentration of pollutants in the soil and achieve the goal of soil remediation. However, these curing, farming and other measures have higher costs and are difficult to apply to large-area soil pollution restoration and treatment. The pyrolysis process is the high temperature treatment of heavy metals and organics to volatilize volatile organic compounds or volatile heavy metals by gaseous forms. Practical research shows that this method has higher efficiency, but it also requires higher cost, and if there is no scientific treatment of these volatile gases, it will pollute the air and the human body. The vitrification method is to apply high temperature and high pressure methods to effectively collect pollutants in the form of glass flakes. If the soil in the area is seriously polluted, this method can be used. It has high efficiency and can be applied to a wide range of areas, but it needs high cost, and it is difficult to use the remedied soil. Electromagnetic driving method is mainly used to treat soil by electrification. After increasing the concentration of pollutants near the electrode, the purpose of aggregation can be achieved. Practical research shows that the application of this technology in remediation of soil pollution can effectively remove harmful elements such as zinc and copper in soil. It should be noted that although the electromagnetic driving method can effectively remove metal ions from soil, it is difficult to apply to the treatment of large-scale contaminated soil, and requires a higher cost of treatment.

4.2. Chemical remediation

In this method, modifiers and inhibitors were added to contaminated soil to increase soil organic matter and improve soil physical and chemical properties. There is a chemical reaction between modifiers, inhibitors, etc. and harmful substances, so that the pollutants in the soil can be effectively reduced or eliminated. Among them, elution, catalysis, chemical passivation, etc. are frequently used chemical repair techniques.

The leaching method is to apply the solvent-soluble pollutant reagent, dissolve the pollutant, and then absorb the pollutant by the water pressure, and then extract the eluent containing the pollutant from the soil for effective repair. And to control the soil that is contaminated. Some scholars in China have applied the citric acid leaching method to the arsenic-contaminated soil, achieving a removal rate of more than 70%. The catalysis rule is to use the catalyst to effectively decompose organic matter. At present, photocatalysis is the main method of catalytic sparking, but it is necessary to ensure sufficient reorganization of light, otherwise there may be secondary pollution problems. The chemical passivation remediation principle is to exert the role of passivator and improve the physical and chemical properties of heavy metals in soil. The results show that the passivator can effectively adsorb, precipitate, exchange and reduce heavy metals, so that the

migration and biological activity of heavy metals will be significantly reduced. Practical studies show that the use of nanomaterials can effectively adsorb and intercept pollutants, so that the concentration of heavy metals on the soil surface can be significantly reduced.

4.3. Bioremediation

This method mainly uses organisms to transfer, decompose or accommodate harmful substances, which can effectively reduce the concentration of pollutants in the surrounding environment. At present, animal remediation, phytoremediation and microbial remediation are commonly used bioremediation methods. Among them, the animal remediation method is to use lower animals such as earthworms and rodents to remedy contaminated soil. Some experts have applied the earthworm treatment method in the treatment of waste and sediment of polluted rivers. The results show that earthworms can effectively absorb and enrich Cd in waste and sediment. The phytoremediation method mainly utilizes plants to effectively absorb and volatilize toxic and harmful substances in environmental media, and promotes environmental management objectives through transfer, transformation and containment without pollution. According to practical research, most plant roots can fix heavy metal ions in the soil, and some plants can transform metal elements in the soil in a gaseous form. However, it should be noted that although the current plant treatment technology can volatilize the pollutants in the soil, it is easy to fall back to the soil with volatile pollutants, resulting in the occurrence of secondary pollution. Microbial remediation is the application of microorganisms, through the secretion of organic acids, to promote the soil pH value, so that the biological activity of pollutants in the soil is improved, which can better naturally degrade or treat these pollutants. In addition, due to the metabolism of microorganisms, the toxicity of heavy metals will also show a decreasing trend. Because there are a large number and types of microorganisms widely present in the soil, which can effectively affect the toxicity of heavy metals in the soil, the society generally pays attention to and pays attention to the microbial remediation method.

5. Conclusion

In summary, the problem of soil pollution is an important issue in the development of China in the new era. Many factors will lead to the occurrence of soil pollution, which will bring serious consequences and adverse effects, such as the difficulty of achieving sustainable development goals and the difficulty in safeguarding human health. In this context, people need to pay full attention to deepen the study of remediation methods of soil pollution and effectively remediate contaminated soil. At the same time, it is necessary to formulate specific prevention programs to minimize the probability of soil pollution and avoid further aggravation of soil pollution.

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