

## A Review on the Sources of Soil Heavy Metals

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### Abstract

With the development of industrial production and urbanization, soil heavy metal pollution is becoming more and more serious, causing adverse effects on human living environment and health. Accurate identification of soil heavy metal pollutant sources is the premise of efficient control and treatment of pollution sources. Based on the recent studies on the sources of soil heavy metal pollution by domestic and foreign scholars, this paper summarizes the three main sources of soil heavy metal pollution: agriculture, industrial production and transportation. Agricultural pollution includes fertilizers, pesticides, domestic waste compost and mulch; Industrial pollution includes irrigation of industrial sewage, stacking of industrial smelting slag and waste gas from coal burning in thermal power plants. Transportation pollution includes vehicle exhaust emissions and wear and tear of vehicle parts.

### Keywords

Soil; Heavy Metal Pollution; Source of Pollution.

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### 1. Introduction

According to the “National Survey Bulletin on Soil Pollution Status” released in 2014, China’s soil environment is generally not optimistic, and soil problems in cultivated land and abandoned industrial and mining land are prominent. And the main pollutants are heavy metals, including toxic Cd, Hg, As, Cu, Pb and Zn. Heavy metal ions form chelates in the soil and continue to migrate and transform. They are enriched in plants and microorganisms and enter the human body through the food chain. This not only poses threats to the ecological environment, food safety, and human health, but also causes huge losses to the environment and economy. Therefore, through a full understanding of pollution sources, the efficient formulation and implementation of soil protection measures can be promoted. Therefore, it is of great significance to carry out research on the sources of soil heavy metal pollution.

### 2. Agricultural Pollution

Due to the increasing demand for food in our country, in order to ensure the smooth and efficient progress of agricultural production, pesticides and fertilizers are often used to increase yields. Although these agricultural materials play an important role in promoting agricultural development, some of them are due to defects in the production process, and abuse will cause the risk of residual heavy metal elements such as cadmium, lead, mercury, arsenic, copper, and zinc[1]. These heavy metal elements will accumulate directly into the farmland with the use of fertilizers, resulting in excessive heavy metal content in farmland and crops[2].

In recent years, due to improper application of chemical fertilizers and pesticides, many serious pollution incidents have been caused. Moreover, China traditionally believes that poultry manure is high-quality organic fertilizer, which can increase soil organic matter, etc., so it has advocated and has long used a large amount of organic fertilizer. However, the modern aquaculture industry

generally uses trace element additives. For example, in order to improve chicken growth efficiency and disease prevention, chicken feed generally adds a large amount of heavy metals such as Cu and Zn[3]. However, studies have shown that due to the low utilization rate, poultry manure also contains a lot of heavy metals. Long-term application of organic fertilizers can generally lead to excessive accumulation of heavy metals such as copper, zinc, and arsenic in the soil[4]. For example, when organic fertilizer (pig manure) is used alone as a fertilizer source, it can significantly increase the accumulation of heavy metals in soil and vegetables[5].

In order to cope with the severe weather in Xinjiang and other areas, the amount of mulch film increased, but the recovery was delayed, resulting in a large number of debris stranded in the land. Relevant experimental results show that due to the thermal stabilizers containing cadmium and lead in the mulch film, long-term use of mulch film fragments in farmland will cause soil cadmium and lead content to exceed the standard, resulting in heavy metal pollution in the soil[6].

In addition, some farmers will use domestic waste rich in nitrogen, phosphorus, potassium and organic matter to compost[7]. However, the classification of garbage in China is not thorough, and domestic garbage often contains metal substances, which can easily cause the accumulation of heavy metals in compost. In addition, the use of sludge compost will also significantly increase the Hg and Cr content in the soil. However, the current research results show that in the short term, domestic waste and sludge composting will not cause heavy metal pollution in the soil, and whether long-term application will cause heavy metals to exceed the standard needs further research.

### 3. Industrial Production Pollution

With the rapid development of industry, it is inevitable that heavy metal elements will be widely used. However, some industrial wastewater containing heavy metals is directly discharged without strict treatment and inspection, so the surrounding soil is easily polluted by concentrated and dispersed heavy metals. At the same time, the distribution of water resources in China is uneven and water resources are scarce in some areas. In order to save water resources, some people choose to use industrial sewage for irrigation, which causes a large amount of heavy metals to enter the soil and cause pollution[8]. For example, Li Chunfang and others measured and analyzed the sewage irrigated soil in Longkou City and found that the average value of Cd was 3.06 times the local background value, and the comprehensive pollution index was 6.10, which was classified as heavy pollution[9].

Industrial smelting waste slag also contains a lot of heavy metal elements. Due to the limited capacity or lack of management of waste slag storage warehouses in some enterprises, heavy metals diffuse into the surrounding soil and cause pollution after long-term open-air storage or treatment, after exposure to sunlight, rain and snow showers, and dissolution and leakage[10]. For example, the Zn and Cr pollution of the slag from a smelter in Shenyang spreads out of 700m away from the storage yard in concentric circles. However, Zhang Yanhong and others found that the heavy metals As, Cu, Ni, Zn, Cd, Pb, Cr, and Hg in the waste slag were very high in the soil testing of an industrial waste slag accumulation site for a long time, resulting in the surrounding soil Cu, Ni, Zn, Cd exceeding The maximum background value in this area. It shows that over time, the migration and transformation of stacked industrial waste residues will lead to more serious heavy metal pollution in the soil.

In addition, there are industrial waste gas. According to research, heavy metals in the exhaust gas emitted by coal-fired power plants are one of the main sources of heavy metal pollution in China's atmosphere[11]. A large amount of volatile heavy metal elements enter the surrounding soil and cause pollution through rain and natural settlement. According to related research, unreasonable emission of waste gas from coal-fired power plants will generally cause heavy metals such as Cu, Zn, Ni, Cd, Cr, Pb, and As to accumulate in the surrounding soil to varying degrees and cause serious pollution. For example, Yang Zipeng and others conducted detection and analysis of the soil around coal-fired power plants in South China. The comprehensive pollution index showed that the area was heavily polluted by Zn, Cd and Pb, and As and Cr were moderately polluted; and a series of correlation

analyses were used to explore the sources of heavy metals. It is found that the excessive content of Cd, Zn, Pb and Cr is indeed mainly affected by coal-fired power plants[12].

#### 4. Transportation Pollution

With the improvement of people's living standards and the development of China's automobile industry, and in order to promote the common progress of local economies, the transportation industry has developed rapidly, but it has also increased heavy metal pollution. In particular, poor maintenance of some old vehicles or poor emission performance of vehicles has led to the emission of secondary dust and particulate matter during driving. Motor vehicle exhaust emissions are the key reason for the increase in the content of heavy metals such as Cu, Pb, Zn, and Cd in the atmosphere[13]. Not only that, but also caused soil heavy metals pollution on both sides of the road, and Pb, Zn, Cu, Cr, Cd, etc. host. He Benqing et al. analyzed the distribution of heavy metals in the soil on both sides of the Guihuang Highway, and the results showed that the heavy metals in the soil on both sides exceeded the standard, most of which came from the wear of automobile parts[14]. As the antioxidant and dispersant in automobile lubricants are zinc dithiophosphate, and there are impurities in cadmium salts in tires and lubricants, lubricating oil combustion and tire wear are one of the main sources of heavy metal Cr and Zn pollution[15]; The plate is galvanized for anti-corrosion, and a large amount of zinc-containing dust will be generated during use, and it will also cause heavy metal Zn pollution; in addition, brake linings are also a source of heavy metal Cu pollution on roads[16,17].

#### 5. Conclusion

Under normal circumstances, the low content of heavy metals naturally present in the soil will not cause harm to the human body and the ecosystem. However, for the sake of social progress, a series of production activities have caused serious soil pollution by heavy metals. Heavy metal pollutants in the soil are difficult to degrade and have strong concealment characteristics. Under certain conditions, heavy metals can undergo various complex reactions such as oxidation-reduction reactions and acid-base reactions in the soil. And affected by different soil types, physical and chemical properties, and the types and content of soil colloids, heavy metals exhibit varying degrees of activity and toxicity through the transformation of valence states, thus harming plants and animals. Therefore, in view of the different levels of heavy metal pollution in various regions, more funds and personnel should be invested in pollution remediation research in various regions. In addition to strengthening scientific research and development and application promotion, it is also necessary to promulgate more detailed and targeted laws and regulations on soil heavy metal pollution in various regions as soon as possible. Under strict supervision, only by promoting people to fulfill their responsibilities and obligations in soil environmental protection can we fundamentally control heavy metal pollution.

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