A Survey of Heavy Metal Pollution in Waste Brick Factory

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Abstract. Dust pollution and waste pollution caused by abandoned brick factories have been widely concerned, but their soil pollution to production and operation sites has been neglected. In this paper, the detection of chromium, nickel, copper, zinc, arsenic, cadmium and lead heavy metals in the waste brick plant soil, the content of Cu, As, Cr and Zn has far exceeded the soil environmental quality standards, which is potentially harmful. This study provides theoretical support and scientific basis for the development and utilization of abandoned brickyards.

1. Introduction
With the development and advancement of the social economy, urban infrastructure construction is constantly improving and developing. The residential conditions of urban residents have undergone rapid changes, and new residential buildings have replaced old residential houses. At the same time, as a basic enterprise in the construction industry, the brick factory has also developed rapidly and made great contributions to the basic construction of the city. However, the damage and pollution caused by the environment has become increasingly serious and has become a problem that cannot be ignored. Since brick factories mostly contract privately or rent land from townships, towns and villages, enterprises only pay attention to earning economic benefits. After the land use contract expires, they leave the land and resources without any damage and pollution. The geological environment of the brick factory is extremely poor. Any measures have been taken to dig the pits in the mining area, destroying the environment and protecting the environment. Some brick factories have abandoned the pits and used new land after using the clay to close the pit. Without re-pits and reclamation, large areas of clay resources were destroyed. There was a waste pit and no vegetation at all, resulting in serious damage to the geological environment and ecological environment in the mined areas. When a brick factory signs a land lease contract, there is no clear text on how to deal with the need to deal with the complex pit reclamation. Therefore, the brick factory owners only develop clay bricks, burn bricks, and sell bricks, and only seek economic benefits. Regardless of the negative consequences of the resource environment. People used to focus on particulate pollutants and waste gas pollution in brickyards. They mainly carried out related research on dust, sulfur dioxide and fluoride emitted...
during the operation of brick factories. The severity of soil pollution is ignored. This paper selects the waste brick plant land, analyzes the distribution of chromium, nickel, copper, zinc, arsenic, cadmium and lead in the soil of the site, analyzes the soil pollution status of the abandoned brick factory, and provides theoretical guidance and scientific basis for the later land use planning.

2. Overview of the test area

The brick factory is located in the central plain area. The climate is a warm temperate continental monsoon arid climate. Light energy resources are sufficient, heat and precipitation are less, and time and space are unevenly distributed. Due to regional development needs, the rise of a large number of brick factories has had a certain impact on local air quality and soil. Before re-exploitation and utilization of abandoned sites, it is necessary to investigate the soil pollution status, and prevent and control the improper use of the type of planning to seriously harm the health of local residents.

In this study, four abandoned brick factories were selected. Each site was uniformly collected by 9 points using an “S-shaped” sampling method to form a mixed sample and remove animal and plant residues. The sampling depth was 0-30 cm surface soil. The soil sample was air-dried and passed through a 0.149 mm sieve for the determination of heavy metals in the soil.

The contents of chromium, nickel, copper, zinc, arsenic, cadmium and lead in the soil were determined by ICP-MS, and the data were analyzed by Excel2010 and SPSS.

3. Study on the content of heavy metals in the soil of brick factory

The content of heavy metals in the four brick factories is shown in Figure 1. It can be seen that heavy metal pollution does exist in the production and operation process of the brick factory. The concentration of heavy metals in the soil at different sampling points is higher than that in the soil.

The contents of Cd and Ni in brick factory 3 were 99.86 mg/kg and 32.53 mg/kg, respectively, and the contents of Cd and Ni at other sampling points were between 70.08-85.48 mg/kg and 25.57-28.27 mg/kg, respectively. The contents of Cu and Zn in brick factory 4 were 209.96 mg/kg and 578.71 mg/kg, respectively, and the contents of Cu and Zn at other sampling points were between 158.45-202.20 mg/kg and 97.46-146.57 mg/kg, respectively. The contents of Cr and Pb in brick factory 2 were 3.53 mg/kg and 63.04 mg/kg, respectively, and the contents of Cr and Pb at other sampling points were between 1.99-2.96 mg/kg and 38.07-50.99 mg/kg, respectively. The highest as content in brick factory 4 is 4646.11 mg/kg. The content of as in the other three plants is between 1210.71-1744.26 mg/kg.

![Figure 1. Seven heavy metal contents at different sampling points](image-url)
Note: Due to the difference in the content of various metals, the content of Cd, Ni, Cu, Zn, Cr, Pb is compared with the vertical axis on the left, and the content of As is compared with the vertical axis on the right.

It can be seen that the abandoned brick factory will produce serious Cu, As, Cr heavy metal pollution during the production process. The content of As is seriously exceeded, which will cause serious harm to biological and human health. In order to rationally develop and utilize the abandoned brick factory, corresponding measures should be taken to passivate and fix the migration of heavy metals to prevent them from entering the farmland and water bodies through surface runoff.

| Sample point      | Heavy metal element (mg/kg) |
|-------------------|----------------------------|
|                   | Cd | Ni | Cu  | Zn  | As  | Cr | Pb |
| Standard          | ≤350 | ≤60 | ≤100 | ≤300 | ≤25 | ≤0.6 | ≤350 |
| Brick factory 1   | 70.082 | 26.065 | 158.450 | 97.455 | 1586.615 | 2.155 | 38.068 |
| Brick factory 2   | 84.082 | 28.273 | 180.604 | 119.366 | 1744.258 | 3.525 | 63.035 |
| Brick factory 3   | 99.864 | 32.533 | 202.199 | 146.565 | 1210.709 | 2.962 | 50.993 |
| Brick factory 4   | 85.477 | 25.574 | 209.964 | 578.706 | 4646.114 | 1.993 | 39.825 |

According to the soil quality standards, it can be concluded that the contents of Cu, As and Cr in the four brick factories are far above the standard value. Among them, Cu exceeds the standard value of 58-110%, as exceeds the standard value by 48-185 times, and Cr exceeds the standard value of 232-488%. The content of Zn in brick factory 4 exceeds the standard of 92.9%. According to the analysis results, the pollution of Cu, As, Cr and Zn in the abandoned brick factory is very prominent.

### 4. Results and analysis

According to the analysis results, the problem of soil pollution by abandoned brick factories has not been taken seriously in the previous research. The pollution caused by the operation of brick factories not only causes air pollution, but also causes serious pollution to the soil, among which Cu, As, Cr and The content of Zn has far exceeded the soil environmental quality standards. If these heavy metals enter other organisms and human bodies through the food chain, they will cause heavy metal poisoning. In order to avoid this phenomenon, the land use type needs to be carefully selected when the later abandoned brick factory is redeveloped.

Brick factory is an indispensable part of urban construction development, especially China's continuous improvement of per capita housing conditions, residential area and residential environment. In order to avoid the ecological environment from being damaged in the production process, we should strengthen management and supervision. Force brick factory to install pollutant control devices; strengthen the responsibility system for environmental protection protection, severely punish the situation of smuggling and leakage; strengthen the reporting and registration of sewage discharge and supervision and monitoring work, regularly report and register sewage discharge, and reasonably control the brick factory Production capacity; for the site where the service life has arrived and is abandoned, the relevant part should be evaluated scientifically, providing necessary technical support and theoretical guidance for the later redevelopment land use type.

### 5. References

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