

# SOLIDIFICATION REMEDIATION METHOD FOR SOIL HEAVY METAL POLLUTION WHILE CONSIDERING ENVIRONMENTAL BEARING CAPACITY

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**Abstract.** As heavy metal pollution in the soil is becoming more and more serious, a solidification remediation method considering environmental carrying capacity is proposed. Firstly, the index system for soil environmental carrying capacity is constructed to obtain an evaluation method and grade soil carrying capacity, in order to be able to take the evaluation results into account. According to the soil remediation standard, the method of solidification remediation is used to remediate the heavy metal pollution in soil. The method first measures the soil sample and adds water to the mixture based on the results of measurement; excavates the soil and sprinkles the mixture with water; mixes the mixture until the color and moisture are uniform; smoothes and regularly compacts the toppled soil to solidify the contaminated elements in the soil. In order to remedy the contaminated soil, the organic and inorganic pollutants in its solid phase are transferred into the liquid phase by ethylenediamine tetraacetic acid (EDTA) reagent. The experimental results show that the average reduction rate of soil contaminated elements is 95.86% after remediation by the proposed method, and this method can effectively remediate the various forms of heavy metal contaminated elements in soil.

**Keywords:** *evaluating indicator, comprehensive evaluation value, range standardization, data preprocessing, expert evaluation method*

## Introduction

In recent decades, with the rapid development of China's industry, heavy metals have been widely used in production. However, with the adjustment of industrial structure and the implementation of policies such as "retreat into three" and "retreat to the city and enter the park", a large number of industrial and mining enterprises have been shut down and relocated. "Retreat into three" is the phenomenon that the original plant land is re planned as residential land. Many industrial enterprises in the old urban area move to the industrial park, suburb or development zone. This process is called "retreat to the city and enter the park". According to the data released by the State Environmental Protection Administration in 2013, from 2006 to 2012, there were nearly 100,000 industrial relocation sites in China (Matos et al., 2017). Due to the extensive environmental safety management model, the disorderly discharge or leakage of industrial wastewater and the stacking of metal slag, a large number of heavy metal contaminated sites have been produced, which has exerted tremendous pressure on the subsequent land development and utilization.

Land resources are the basic guarantee for human survival and development, sustainable utilization of ecological environment and regional economic construction. In recent years, with the rapid development of urbanization in China, there are many problems such as environmental pollution and shortage of resources. There is a "one more

and three less” phenomenon: more land resources, less per capita, less high-quality arable land and less arable land reserve (Liu et al., 2018). Therefore, according to the regional population, economy, industry, agriculture, city, transportation, energy, environmental management, industrial environmental governance, urban environmental governance and other factors, this paper establishes a comprehensive evaluation model of environmental carrying capacity (Chen and Li, 2018) to evaluate the level of soil environmental carrying capacity in the region, which provides scientific basis for strengthening the scientific management of regional land resources, protecting the ecological environment, improving the productivity of regional soil cultivated land and ensuring human health.

Heavy metal pollution has the characteristics of wide pollution range, long duration, hidden pollution, and cannot be degraded by microorganisms. It directly or indirectly endangers human health and life (Tian et al., 2017). With the continuous transformation of regional economy and the constant adjustment of economic structure, enterprises located in urban areas began to “retreat to the city and enter the park”. A number of enterprises with high pollution and low productivity are facing relocation, transformation or elimination. The polluted soil left behind must be repaired before it can be transferred and redeveloped.

The remediation of heavy metal contaminated soils has been a hot topic both at home and abroad. Wang et al. (2016) focuses on the application of remediation methods for heavy metal contaminated soil, but the remediation of heavy metal contaminated soil is not carried out under the premise of considering the environmental carrying capacity. Rutsikii et al. (2017) only described the remediation of pollution elements Cu and Pb in detail, however, it does not show that the method adopted has the effect of remediation for most of the contaminated elements. Yang et al. (2016) uses a variety of chemical reagents to transfer organic and inorganic pollutants from the solid phase of contaminated soil to liquid phase fluid, but this process is only carried out once, and the data obtained from heavy metal pollution of soil are not accurate.

In this paper, physical, chemical and biological methods (Lü et al., 2017) are used to remediate heavy metal contaminated soils through the following ways: (1) reducing the concentration of heavy metals in soil by dilution; (2) changing the form of heavy metals to fix or passivate them, and reducing their mobility and bioavailability in the environment; (3) removal of heavy metals from soil. The domestic soil remediation industry is still in its infancy and growing stage. Most of the pilot projects are site pollution control in urban relocation plant areas. There are many cases of organic pollution remediation, few cases of heavy metal pollution remediation, and many heavy metal technologies are still in the laboratory research stage (Chen et al., 2017). Based on the index system of soil environmental carrying capacity, the evaluation method and grade of soil environmental carrying capacity are obtained, and the solidification remediation method of soil heavy metal pollution is studied considering the effect of environmental carrying capacity. This method first determines the soil sample and adds water to the mixture on the basis of the measured results; excavates the tested soil and sprays the mixed material with water; mixes the mixed soil until the color and moisture are uniform; smoothes the overturned soil, and regularly rolls the soil to make it uniform. Polluted elements in soil are solidified, organic and inorganic pollutants in the solid phase of contaminated soil are transferred to liquid phase fluids by chemical reagents to achieve the purpose of remediation of contaminated soil (Wang et al., 2016). According to the above analysis, the soil treated by this method has been significantly improved, and a variety of heavy metal pollution elements have been effectively repaired.

## Material and methods

### *Establishment of evaluation index system for soil environmental carrying capacity*

In order to objectively, comprehensively and scientifically evaluate the status of soil carrying capacity, when studying and determining the evaluation index system of soil carrying capacity and its evaluation method, we should follow the scientific principles of selecting evaluation index, determining index weight, the scientific principle of calculating and synthesizing index, the dynamic principle of the change of soil carrying capacity in time and space, and the feasibility principle based on regional sustainable development (Rutskii et al., 2017).

According to the five principles of index selection, an index system for evaluating soil environmental carrying capacity in Liaoning province is established, with 522 indexes (Yang et al., 2016). Specific indexes are shown in *Table 1*.

**Table 1.** Evaluation index system of soil environmental bearing capacity

Project level	Factor layer	Index layer	Company	
Pressure	Population economy	Population density	Ten thousand people/km <sup>2</sup>	
		Natural population growth rate	%	
		Per capita GDP	Ten thousand yuan	
		The proportion of output value of secondary industry	%	
	Industry	Emission intensity of industrial smoke and dust	Tons/km <sup>2</sup>	
		Discharge intensity of industrial wastewater	10,000 tons/km <sup>2</sup>	
		Discharge intensity of industrial solid waste	10,000 tons/km <sup>2</sup>	
	Agriculture	Use strength of chemical fertilizer	10,000 tons/km <sup>2</sup>	
		Pesticide use intensity	Tons/km <sup>2</sup>	
	City	Domestic sewage discharge	10,000 m <sup>3</sup>	
		Domestic waste emissions	Ten thousand tons	
	Transportation, energy	Ten thousand yuan GDP energy consumption	Ton standard coal	
		Highway passenger transport intensity	Ten thousand people/km <sup>2</sup>	
	Environmental management	Proportion of environmental protection input to GDP	%	
	Response	Industrial environmental governance	Achievement rate of industrial wastewater discharge from key pollution sources	%
			Comprehensive utilization rate of industrial waste	%
Urban environmental governance		Urban domestic sewage treatment rate	%	
		Harmless treatment of municipal domestic waste	%	

### *Evaluation method of bearing capacity*

Select the data provided by Google dataset search dataset as the data source of the experiment. Google dataset search data set can be regarded as a one-stop data set, which contains massive data of different sizes and types from NASA, propublica and other sources. The data source is comprehensive, so the data set has strong

application value. In this database, six datasets are selected as the experimental data. The datasets involve image and other fields, and contain 150000 kb different data groups. In order to facilitate evaluation, the above basic data is standardized by the range standardization method (Li et al., 2015), that is, the data is dimensionless and unified by an order of magnitude. Soil environmental assessment indexes are divided into favorable indexes and unfavorable indexes. According to the different types of indexes, standardized treatment is carried out according to the formula. Among them, the higher the favorable index is, the better the soil bearing capacity is, and the lower the unfavorable index is, the better the soil bearing capacity is (Wang et al., 2015).

$$P = (X_i - X_{\min}) / (X_{\max} - X_{\min}) \quad (\text{Eq.1})$$

$$Q = 1 - (X_i - X_{\min}) / (X_{\max} - X_{\min}) \quad (\text{Eq.2})$$

where  $P$  represents favorable index after standardization;  $Q$  represents the disadvantageous index after standardization;  $X_i$  represents the measured value of an index;  $X_{\max}$  represents the maximum value in the statistical range of an index;  $X_{\min}$  represents the minimum value in the statistical range of an index.

Because of the coexistence of quantitative index and qualitative index in the evaluation index of soil environmental carrying capacity (Liu et al., 2018), this paper uses expert evaluation method to determine the weight of each evaluation index. Five experts scored the importance of each indicator, obtained the scoring results, and calculated the average value of each indicator. According to the standardized results of *Equations 1* and *2*, the weight of each indicator is allocated after the implementation of inspection as shown in *Table 2*.

### ***Computation of comprehensive evaluation value***

The final comprehensive evaluation value is calculated by multiplying the dimensionless utility value of an index in the terminal index by the corresponding weight of the index to the target layer (Yu et al., 2015), which is expressed by the following formula:

$$Y = \sum_{i=1}^n X_i P_i \quad (\text{Eq.3})$$

In the formula,  $Y$  is the total score of soil carrying capacity,  $P_i$  is the utility value of the  $i$ -th index and  $X_i$  is the weight of the  $i$ -th index to the target.

### ***Criteria for evaluating soil environmental bearing capacity***

According to the comprehensive score of soil carrying capacity of cities in the provincial capital city group, this study formulates five bearing capacity grades (Girsowicz et al., 2018), as shown in *Table 3*.

Based on the above assessment results of soil environmental carrying capacity and soil remediation standards, the following remediation schemes are adopted to remediate heavy metal pollution in soil.

**Table 2.** Weight distribution of index system

Project level		Factor layer		Index Layer		Comprehensive weight
Pressure	0.554	Population economy	0.071	Population density	0.444	0.032
				Natural population growth rate	0.222	0.029
				Per capita GDP	0.222	0.029
				The proportion of output value of secondary industry	0.111	0.027
		Industry	0.424	Emission intensity of industrial smoke and dust	0.164	0.041
				Discharge intensity of industrial wastewater	0.297	0.054
				Discharge intensity of industrial solid waste	0.539	0.077
		Agriculture	0.134	Use strength of chemical fertilizer	0.5	0.04
				Pesticide use intensity	0.5	0.04
		City	0.239	Domestic sewage discharge	0.333	0.043
				Domestic waste emissions	0.667	0.062
		Transportation, energy	0.134	Ten thousand yuan GDP energy consumption	0.667	0.045
				Highway passenger transport intensity	0.333	0.035
		Environmental management	0.539	Proportion of environmental protection input to GDP	1	0.131
Response	0.446	Industrial environmental governance	0.297	Achievement rate of industrial wastewater discharge from key pollution sources	0.333	0.077
				Comprehensive utilization rate of industrial waste	0.667	0.089
		Urban environmental governance	0.164	Urban domestic sewage treatment rate	0.333	0.072
				Harmless treatment of municipal domestic waste	0.667	0.078

**Table 3.** Criteria for evaluating soil environmental carrying capacity

Interval value of soil bearing capacity	Grade of bearing capacity	Representation state
<0.2	I	More weak bearing capacity
0.2-0.4	II	Weak bearing capacity
0.4-0.6	III	General bearing capacity
0.6-0.8	IV	Strong bearing capacity
>1.0	V	More strong bearing capacity

### Standards for soil remediation

#### Remediation standard

Secondary development of sites requiring remediation is carried out. Remediation criteria are selected according to different development projects. This paper mainly assumes that the secondary development project is commercial land. Then, after the

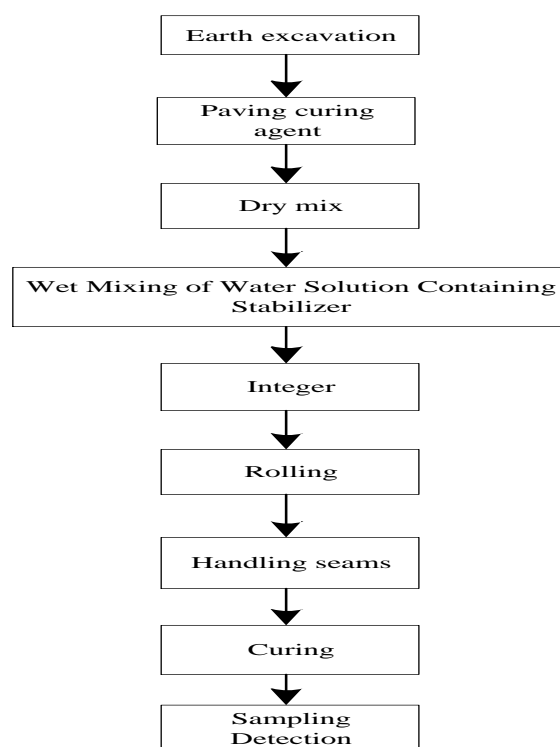
demonstration of industry experts, the standard of site excavation and remediation is the commercial land standard in the secondary standard of Soil Environmental Quality Standard (GB 15618-2008) (Arenaslago et al., 2018), i.e. the standard values of  $C_r$ ,  $C_u$ ,  $N_i$ ,  $P_b$  and  $Z_n$  are 800, 500, 200, 600 and 700 mg/kg, respectively.

### *Scheme of solidification remediation*

The solidification method solidifies contaminated soil with solidifying agent, which reduces the mobility and bioavailability of contaminated molecules. The selection of solidifying agent is very important for the remediation of contaminated soil by solidification method.

### *Flow chart of solidification remediation process*

Figure 1 is the flow chart of solidification remediation. It can be seen from the figure that: (1) the moisture content of the soil sample in the field is measured to determine the water content of the mixture; (2) earthwork excavation; (3) material distribution; (4) mixing: dry mixing for 3-4 times, and spraying water solution containing stabilizer on the mixture; mixing twice more carefully and turning the bottom “plain soil” up each time without loosening the underlying stratum; the mixture has uniform color without gray strips, ash and flower surface, no coarse and fine particle nests, and suitable moisture content; (5) shaping: preliminary scraping and shaping, straight line section from both sides to the center, return to scraping if necessary, pay attention to the flat seam.(6) rolling: Rolling requires following the paving closely with no wheel tracks, generally rolling first slow and then fast, first light and then heavy; (7) Maintenance; (8) Testing: testing dry density and moisture content, calculating whether the compaction coefficient meets the requirements (Yan et al., 2015).



**Figure 1.** Flow chart of solidification remediation

### *Content analysis of soil leaching solution for remediation*

Leaching is the main way for harmful substances from solid waste to enter the environment (Li et al., 2017). Leaching experiment is a laboratory simulation of leaching process. Its purpose is to assess the environmental risk of different solid waste under different treatment environments and treatment modes. According to the current management needs and disposal methods of solid waste in China, in the standard experimental study, there are two hypothetical scenarios: non-standard landfill treatment of industrial solid waste, waste accumulation, land use of wastes after innocuous treatment (Xiao et al., 2017); 5% of industrial wastes or harmless wastes enter sanitary landfills and are combined with 95% of municipal wastes. In the first scenario, nitric acid sulfate solution is used as extractant to simulate this adverse environmental factor. In the second scenario, acetic acid buffer solution is used as extractant.

When sulfuric acid nitric acid solution is used as leaching agent, its acidity is helpful for metal leaching, but it has no buffer capacity, and the leaching amount of metal is very low. If the content of any hazardous substance in leaching liquor exceeds the standard value of leaching toxicity in “Hazardous Waste Identification Standard of Leaching Individual Identification” (GB5085.3-2007), it is determined that the solid waste is a hazardous waste with leaching toxicity characteristics.

When acetic acid buffer solution is used as leaching agent, the complexation effect on metal leaching is obvious, and the acidity of the system changes slightly after leaching (Ma et al., 2017), and the amount of metal leaching is very high.

These two extractants have their own advantages and disadvantages in remediation of heavy metal pollution in soil, but EDTA is often used as a leaching agent for heavy metal pollution in soil and as an amendment for the bioavailability of heavy metals in soil (Zhang, 2018). Soil elution is to transfer organic and inorganic pollutants in the solid phase of contaminated soil to liquid phase fluid by chemical reagents, so as to achieve the purpose of remediation of contaminated soil. In this paper, EDTA is used as soil eluent, and the hydrolysis stability is high in the range of high temperature and wider pH value.

## **Results**

### *Analysis of remediation effect of different methods on heavy metal contaminated soil*

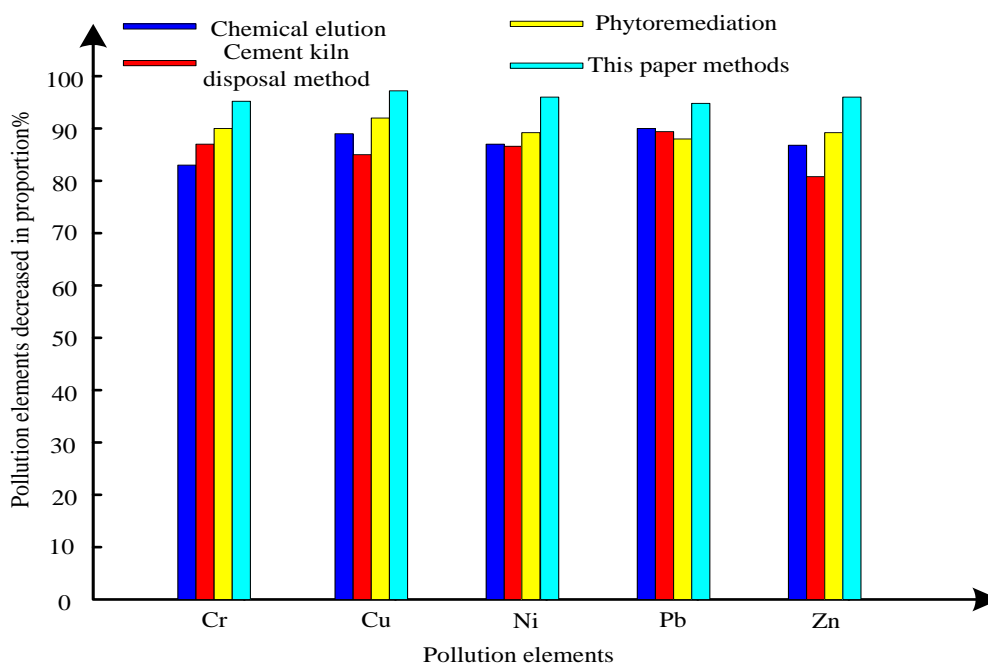
In order to verify the best remediation effect of the proposed method for heavy metal contaminated soil, on the premise of sufficient soil environmental carrying capacity. The experiment was carried out under the hardware conditions of Intel core-m480i5cpu @ 2.67 GHz, 4 GB memory, 32-bit operating system and windows 7 version. And the simulation data set my sea is selected as the basic data set, and the data is analyzed by the online data analysis software MOA (an experimental tool for massive online analysis). The effects of chemical leaching, cement kiln co-disposal, phytoremediation (Bennabi et al., 2017) and the proposed method on remediation of heavy metal contaminated soil are compared, as shown in *Table 4*.

*Table 4* shows that after the remediation of heavy metal contaminated soil by the proposed method, the content of various contaminated elements has been greatly reduced. The average reduction rate of the content of contaminated elements after remediation is 95.86%, which is higher than that of the contaminated elements removed by other methods.

**Table 4.** Comparison of reduction rates of contaminated elements after remediation of heavy metal contaminated soil

Repair Technology	Reduction ratio of Cr content%	Reduction ratio of Cu content%	Reduction ratio of Ni content%	Reduction ratio of Pb content%	Reduction ratio of Zn content%
Chemical elution	83.22%	89.19%	88.33%	90.02%	87.54%
Co-disposal of cement kiln	88.49%	85.32%	86.13%	88.96%	81.23%
Phytoremediation	90.22%	91.32%	89.01%	88.39%	88.14%
The method in this paper	95.32%	97.19%	96.33%	94.56%	95.92%

In order to make the data comparison in *Table 4* more intuitive, a column chart is constructed to analyze the content of pollutant elements reduced by various methods, as shown in *Figure 2*.



**Figure 2.** Percentage decrease of various pollutant elements after remediation of heavy metal land pollution

As can be seen intuitively in *Figure 2*, the method in this paper has the highest removal rate of various pollutant elements in all comparison methods, so the method in this paper has the best effect on remediation of heavy metal pollution in soil by considering environmental carrying capacity.

### Morphological analysis of heavy metals removal

In order to verify the remarkable effect of DETA extractant on remediation of heavy metal pollution in soil, the morphological analysis model of heavy metal removal is constructed. The precipitation of 0.2 mol/L citric acid and 0.05 mol/L EDTA is analyzed after washing once and five times, respectively, in order to find out the mechanism of removing copper and nickel from soil by the eluent, as shown in *Table 5*.

**Table 5. Morphological analysis of precipitation after elution**

Project		Cu			Ni		
		Content of each speciation in precipitation (mg/kg)	Removal rate of various forms (%)	Proportion of each form in removal amount (%)	Content of each speciation in precipitation (mg/kg)	Removal rate of various forms (%)	Proportion of each form in removal amount (%)
0.2 mol/L citric acid pickling once	Commutative state	56.2444	84.98	46.22	203.8444	86.89	84.33
	Carbonate state	8.4111	94.16	19.7	14.7667	77.69	3.21
	Iron ferocity	41.5556	67.42	12.49	15.786	32.54	0.48
	Organic state	43.6	39.29	4.1	11.4017	39.83	0.48
	Residual state	231.7556	34.18	17.48	860.9679	17.64	11.51
0.05 mol/L EDTA wash once	Commutative state	14.7222	96.07	47.89	129.3328	98.8	85.37
	Carbonate state	6.3324	96.27	20.89	8.5769	92.09	3.23
	Iron ferocity	27.5839	83.28	13.57	5.4433	38.2	0.52
	Organic state	29.7333	40.12	5.88	8.0667	41.05	0.51
	Residual state	210.9985	44.35	19.34	769.3831	26.4	14.62
0.2 mol/L citric acid pickling 5 times	Commutative state	6.9444	98.015	45.48	9.3367	99.4	82.06
	Carbonate state	2.0889	98.55	17.57	2.378	96.41	3.39
	Iron ferocity	16.3333	87.2	13.76	7.9613	65.98	0.82
	Organic state	30.1333	58.04	5.16	6.8083	64.07	0.64
	Residual state	206.4333	41.37	18.03	799.019	23.56	13.08
EDTA wash 5 times at 0.05 mol/L	Commutative state	3.0667	99.18	46.32	5.6252	99.83	84.83
	Carbonate state	2.0113	101.98	17.6	2.2698	96.57	3.49
	Iron ferocity	11.9778	94.34	14.42	6.302	70.43	0.85
	Organic state	20.9667	61.82	7.85	4.2667	68.65	0.65
	Residual state	183.3111	45.1	19.81	763.903	26.92	14.66

In Table 5, the removal rates of five forms of copper and nickel by citric acid and EDTA at one and five leaching times show that the removal rates are almost exchangeable > residual > carbonate-bound > iron-manganese oxide-bound > organic-bound, which are related to the content of the original forms of heavy metals in soil. The main forms of copper removal by citric acid and EDTA are exchangeable, carbonate-bound and iron-manganese oxide-bound and the removal rates are above 60%, while the removal rates of organic and residual states are generally low. The data in the observation table show that the removal rates of various forms of contaminated elements by citric acid are weaker than EDTA. Therefore, the removal rate of various forms of contaminated elements is very high by the proposed method.

### **Comparison of remediation techniques for different heavy metal contaminated elements**

In order to verify the best effect of the proposed method on remediation of heavy metal contaminated soil, the heavy metal contaminated soil area in the suburb of a city is selected as the experimental area, the range value of soil environmental carrying capacity is 0.6-0.8, and the soil environmental grade is grade IV. Taking the carrying capacity as the consideration factor, chemical leaching method, cement kiln co-treatment method and phytoremediation and the method in this paper are used to make compare. Table 6 is a comparative table of four methods.

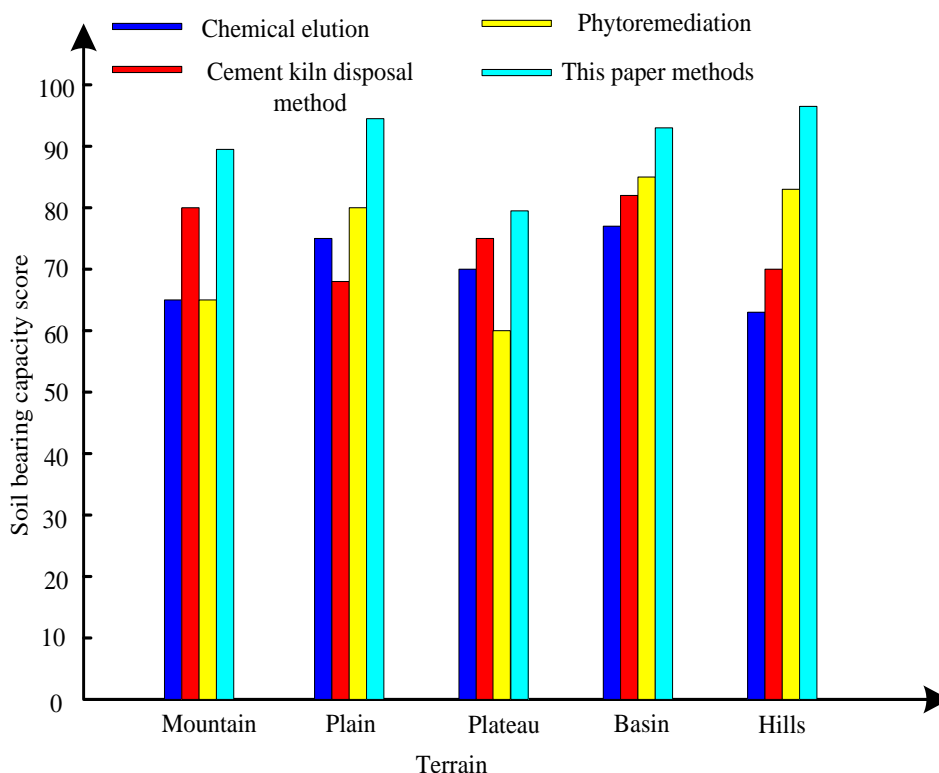
As can be seen from Table 6, the proposed method has mature technology, the lowest cost of remediation, the highest efficiency of remediation, and little impact on the environment. Therefore, the effect of the proposed method on remediation of heavy metal pollution in soil is remarkable.

**Table 6.** Comparison of remediation methods for different heavy metal contaminated soils

Repair technology	Technical maturity	Repair unit price	Repair efficiency	environmental effect	Advantage	Shortcoming
Chemical elution	More mature	2000-3000	Higher	Less	Disposable compound contaminated soil, safe operation	Not suitable for soils with high clay content
Co-disposal of cement kiln	Test phase	800-1000	Commonly	Less	Disposal cost is relatively low and operation is simple and safe	Limited by cement production and emission
Phytoremediation	Test phase	It depends	Low	Less	Polluted soils need not be excavated and the cost of disposal is low	Remediation takes a long time and plant screening is difficult
The method in this paper	More mature	500-800	High	Less	The disposal cost is low, the disposal quantity is large, the operation is simple and safe	No pollutants were removed from the soil

**Analysis of soil remediation capacity and environmental bearing capacity**

In order to verify that the proposed method can improve the soil environmental carrying capacity, the improvement of soil carrying capacity after remediation of heavy metal contaminated soils in mountainous, plain, plateau, basin and hilly areas is compared, as shown in *Figure 3*.



**Figure 3.** Score of soil carrying capacity after remediation of heavy metal contaminated soil

The comparative results of soil remediation capacity of different methods are shown in *Table 7*.

**Table 7.** Comparison of soil remediation capacity

Terrain	Soil remediation capacity/m <sup>3</sup> .s				Standard for element content of soil pollutants			
	Chemical elution	Cement kiln disposal method	Phytoremediation	The method in this paper	Chemical elution	Cement kiln disposal method	Phytoremediation	The method in this paper
A mountain country	15	12	13	24	Excessive content	The content is up to the standard	The content is up to the standard	The content is up to the standard
Plain	18	11	16	28	The content is up to the standard	Excessive content	The content is up to the standard	The content is up to the standard
Plateau	10	15	15	29	Excessive content	Excessive content	Excessive content	The content is up to the standard
Basin	20	17	15	31	Excessive content	Excessive content	The content is up to the standard	The content is up to the standard
Hill	20	16	12	33	The content is up to the standard	The content is up to the standard	Excessive content	The content is up to the standard

### **Remediation time and cost analysis of heavy metal contaminated soil**

In order to verify that the proposed method can reduce the repair time-consuming and reduce the cost, the repair time and cost of the five topographies mentioned above are compared. The results are shown in *Table 8*.

**Table 8.** Comparison of soil remediation time and cost

Terrain	Repair time (days)				Repair cost (10,000 yuan)			
	Chemical elution	Cement kiln disposal method	Phytoremediation	The method in this paper	Chemical elution	Cement kiln disposal method	Phytoremediation	The method in this paper
A mountain country	1	1.5	1	0.5	1.3	1.2	1.4	0.9
Plain	0.5	1.5	1	0.5	1.5	1.6	1.6	1.1
Plateau	2.5	3	2.5	1	2.6	2.4	2.4	1.5
Basin	2	2.5	2	1	1.6	1.9	1.8	1.1
Hill	1.5	1.5	1.5	1	1.4	1.6	1.6	1.2

Analysis of the data in *Table 8* shows that the method in this paper has the shortest time and the lowest cost to repair the five topographies.

## Discussion

Heavy metal pollution refers to the fact that the content of heavy metals in soil is much higher than its background value, which leads to the deterioration of the original function of the soil. The main pollution in urban soils comes mainly from human activities. Heavy metal wastes are produced in heavy industries such as metal smelting and processing, fur and products processing, glass manufacturing, printing and dyeing, electronic component manufacturing and other light manufacturing industries, as well as in the process of garbage disposal in people's daily life and medical activities.

Based on the above-mentioned environment, this paper firstly constructs the index system of soil environmental carrying capacity and the standard of soil remediation, and uses the method of curing remediation to fix the heavy metal pollution in soil. According to the above experimental results, we can see that:

*Figure 3* shows that when five topographies are restored by four different methods, only the proposed method can get the highest score of soil bearing capacity. Because of the sparse vegetation and serious soil erosion in the plateau area, it is more difficult to repair the heavy metal contaminated soil. Therefore, the land carrying capacity score of the proposed method in the plateau topographic area is only 80 points. *Table 7* shows that chemical leaching method, cement kiln treatment method and phytoremediation method are not effective in soil remediation, and the content of contaminated elements in the remediated soil still exceeds the standard, while the method in this paper has the highest remediation ability in all methods, and the content of contaminated elements in the remediated soil does not exceed the standard.

Through the analysis of the above data, it can be seen that the moire method effectively improves the traditional method, and can effectively repair various forms of heavy metal pollution elements in the soil.

## Conclusions

The main characteristics of heavy metal pollution in urban soils are long duration, concealment, hysteresis and irreversibility. Based on the index system of soil environmental carrying capacity, the evaluation method and grade of soil carrying capacity are obtained, and the soil environmental carrying capacity is assessed. The evaluation results are taken into account and the technology of solidification and remediation is used to remediate urban heavy metal pollution. Metal contaminated soil makes the remediated soil have a certain strength, which is conducive to rational utilization and disposal in the subsequent commercial development. At the same time, EDTA leaching solution used in the proposed method can remove various forms of heavy metal contaminated elements very well. Using the proposed method to solidify and treat soil not only can control soil pollution, but also can play a solid role in the soil, making the foundation more solid. Therefore, the proposed method has the best effect on remediation of heavy metal contaminated soil.

Although the method in this paper is effective, more environmental factors should be considered, such as water, weather and so on. In the future, this paper will focus on the influence of these factors on the remediation of heavy metal pollution in soil.

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