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Analysis of Soil Pollution Status in Different Land Use Types

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Abstract

To alleviate the contradiction between the increasing demand for land resources and the living environment in the process of land use, conducting soil environmental investigation and analysis on land resources with exploitable conditions has become an effective way to ensure the full utilization of land resources.Conducting soil pollution investigation and research, analyzing soil samples, and other means to comprehensively grasp the soil environmental conditions of the project area can provide data support for the implementation of the project's clean soil engineering and ecological construction, and provide strong support for the early design and later implementation of the project.

Keywords

Land Use; Soil Pollution; Soil Exploration; Pollution Status.

1. Introduction

Located at the intersection of the Qianhe River and the Weihe River, Baoji Qianweizhihui District carries the "new urbanization construction". With the dual task of "ecological urban construction", clean soil and water resources are the foundation for the development of new cities. Soil is an important component of urban ecological environment system, closely related to the life and physical and mental health of urban residents. However, with the rapid development of Baoji City, the urban soil has been seriously polluted and become the largest reservoir of heavy metals and organic pollutants due to the high concentration of population, traffic congestion, highly developed industry and unprecedented prosperity of business. At the same time, the heavy metals stored in urban soil are not easy to be degraded by microorganisms and can accumulate in the soil. Under appropriate environmental conditions, such as oxidation Reduction potential, the accumulated heavy metals can be re released into the groundwater or used as a new source of pollution. Therefore, the analysis and evaluation of soil pollutants is the first step in urban soil pollution control and remediation.The land improvement project of the Qianwei River is an ecological comprehensive improvement project based on the background of new urbanization construction. The project planning highlights the wetland landscape, preserves the ecological characteristics of the wetland, and maximizes the maintenance of the natural landscape of the wetland area. The project construction will be based on the Pure Land Project, with the ecological construction of the "Two Rivers and Four Banks" as the premise, with intelligent communities, commercial centers, and educational facilities as the guarantee, and with exhibition centers, science and technology innovation ports, and cultural and tourism projects as the industrial support, to build a green and ecological living environment. Therefore, conducting soil pollution investigation and research, analyzing soil samples, and other means to comprehensively grasp the soil environmental conditions of the project area can provide data support for the implementation of the project's clean soil engineering and ecological construction, and provide strong support for the early design and later implementation of the project.

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2. Research Status of Soil Pollution in Baoji City

Previous researchers have conducted extensive research on soil pollution in Baoji city: Wang Lijun used the Geological Accumulation Pollution Index and Potential Ecological Risk Index to evaluate the pollution status of heavy metals in urban street dust, urban soil slopes, and sediment of the Baoji section of the Wei River in Baoji. The results indicate that the urban street dust in Baoji is mainly polluted by heavy metals such as Cd, Hg, Pb, Zn, etc. Compared to the pollution caused by heavy metals, the urban soil in Baoji and the sediment in the Baoji section of the Wei River are mainly polluted by heavy metals in urban street dust (Wang Lijun, 2008). Li Xiaoping et al. used the Tessier continuous speciation analysis method to classify the forms of heavy metals Pb, Zn, Cd, Cr, Cu, and Sb in the soil of urban industrial areas, and measured their respective forms using ICP-OES. The results showed that the heavy metals Zn, Cd. Cr, Cu, and Sb in the urban soil of Baoji Industrial Zone were mainly in the residual form, while Pb was mainly in the iron oxide bound form. Among the percentages of various forms, the exchangeable form of heavy metal Cr was the lowest (Li Xiaoping et al., 2015). Taking soil samples collected in Baoji urban area as research objects, Zhang Jun et al. measured the content of heavy metals (Cd, As, Cu, Pb, Zn, Cr, Mn and Ni) with Inductively coupled plasma mass spectrometry (ICP-MS, It is 8.2 times and 3.8 times the background value of soil in Shaanxi Province, and the average values of Cu, As, and N also exceed the background value of soil in Shaanxi Province. Cd and Zn are heavily polluted in the upper soil of urban areas. The total pollution load index (PLIzone) of heavy metal areas in the surface soil reaches 1.36, indicating mild pollution. Cd, Cu, and As are mainly "anthropogenic sources" caused by industrial and agricultural activities, Zn and Ni are "anthropogenic sources" caused by traffic emissions, and Cr, P, and Mn are mainly "mixed sources". Soil texture and distance from railways are the main influencing factors of soil heavy metal pollution (Zhang Jun et al., 2019). In summary, according to the criteria of the Third National Land Survey Land Classification, the land use status of the Qianwei Zhihui area can be mainly divided into 8 categories: water and water conservancy facility land, transportation land, cultivated land, industrial and mining storage land, commercial land, forest land, residential land, and grassland. The pollution sources of different land use types vary, and through long-term accumulation, the differences in the types and contents of main pollutants will become increasingly apparent.. Combining land survey data and soil sampling analysis data, evaluate the degree of soil pollution in different land types in the Qianwei Zhihui area, and provide scientific basis for tracking, preventing, and repairing soil pollution in the research area.

3. Introduction to the Project Area

The project area is located in Baoji, Shaanxi Province, with geographical coordinates between E106 ° 18 '-108 ° 03' and N33 ° 35 '-35 ° 06'. The core area of the project area is about 330 hm2, and the climate belongs to the warm temperate semi humid climate zone. The annual Sunshine duration are 1860~2250 h, and the annual average temperature is 7.6 ℃~12.9 ℃. The average annual precipitation ranges from 590 to 900 mm. The project area flows through the Wei River, with an average flow rate of 173 m3/s. According to the Satellite imagery map and interview information, the historical use of the plot in the project area is known. The landform of the development project area in the Qianweizhihui area belongs to the first terrace of the Alluvial plain of the Weihe River, and the terrain is flat. The land use in the project area mainly includes farmland, wetlands, rivers, roads, etc. Since 2017, construction land has gradually increased. Due to the large scope of general exploration in the project area and the involvement of multiple departments, industries, and enterprise units in production and operation, detailed general exploration work will be carried out in different zones and stages based on land use types and production and operation conditions. Focus on conducting soil pollution investigations on non

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industrial land such as ecological land, agricultural land, forest land, and rivers in the project area.

4. Research Plan

4.1. Sample Point Layout

The research area is covered with grids of equal area, each covering an area of approximately 32 acres. In order to reduce the number of sampling points,And control the same sampling error by using an "X" shaped sample layout. The specific points in the grid take into account the national rankingSecond national land survey data, ensuring that each land type has 4-5 distribution points, while avoiding areas that are difficult to access or cannot be collected. According to the distribution statistics, a total of 40 points were distributed. Based on the on-site survey, the sampling depth is planned to be set at 25cm to collect a soil sample.

4.2. Measurement Indicators

This measurement includes 45 indicators, including 7 heavy metals: arsenic, cadmium, chromium (hexavalent), copper, lead, mercury, and nickel; 27 volatile organic compounds: carbon tetrachloride, chloroform, Chloromethane, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, dichloromethane 1,2-dichloropropane, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethylene, 1,1,1, - trichloroethane, 1,1,2-trichloroethane, Trichloroethylene, 1,2,3-trichloropropane, chloroethylene, benzene, chlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene Ethylbenzene, styrene, toluene, m-xylene+p-xylene, o-xylene; 11 semi volatile organic compounds: nitrobenzene, aniline, 2-chlorophenol, benzo [a] anthracene, benzo [a] pyrene, benzo [b] fluoranthene, benzo [k] fluoranthene, dibenzo [a, h] anthracene, indeno [1,2,3-cd] pyrene, naphthalene; Determine physical and chemical properties (8 items): pH, conductivity, oxidation Reduction potential, particle size composition, organic matter, total nitrogen, available phosphorus, and available potassium.

5. Result Analysis

5.1. Analysis of Soil Physical and Chemical Properties

This general exploration was divided into 8 areas, 48 sampling points were set up, and a total of 93 soil samples were collected. Table 2 shows the soil physical and chemical index values of each general exploration area in the project area. It can be seen that the soil pH value in the general exploration area is between 7.94 and 8.88, showing an overall alkaline state. The soil conductivity in different regions is relatively stable and varies between 10.78 and 34.83 mS/m. According to the analysis of soil texture in different regions, the soil texture is mostly silty loam, with good soil quality. The soil on the left bank of the lower reaches of the Qianhe River is sandy soil and silty clay loam.

5.2. Analysis of Heavy Metal Pollution in Soil

The content of six heavy metals in soil, including Cd, Pb, Cu, Ni, As, and Hg, is shown in Table 2. Except for As, the contents of heavy metals in the soil of the exploration area, such as Ni, Cd, Pb, Cu, Hg, and Cr6+, are all lower than the first category land screening value of the GB36600-2018 Soil Pollution Risk Control Standard for Construction Land. The average content of heavy metal As in the soil of the general exploration area is 14.64 mg/kg, which is generally lower than the first category land screening value of GB36600-2018 Construction Land Soil Pollution Risk Control Standard by 20 mg/kg, except for individual points, but does not exceed the second category land screening value (60 mg/kg). Among them, around the left bank before the Qianhe

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River flows into the Wei River, the soil arsenic content at some points slightly exceeds 20 mg/kg, but none of them exceed the control value (120 mg/kg).

Except for As, the content of heavy metals in soil, such as Ni, Cd, Pb, Cu, Hg, etc., is lower than the first category land screening value in the GB36600-2018 Soil Pollution Risk Control Standard for Construction Land. The average content of heavy metal As in the soil of the general exploration area is 14.64 mg/kg, which is generally lower than the screening value of Class I land in the GB36600-2018 Construction Land Soil Pollution Risk Control Standard by 20 mg/kg, with a relatively low overall exceeding level, mainly in the 25-50 cm soil layer, and has not yet exceeded the screening value of Class II land. Most of the volatile and semi volatile organic compounds in the soil have not been detected, and a small number of detection indicators have not exceeded the screening value for Class I land use in the GB36600-2018 Soil Pollution Risk Control Standard for Construction Land. This means that the overall environmental quality of the soil is good, and in general, the risk of organic pollution can be ignored. All land within the scope of this general exploration can be directly used for development and construction as second-class land for industrial, logistics and warehousing, commercial service facilities, and transportation roads.

5.3. Analysis of Soil Nutrient Status

According to the soil nutrient grading standard, the content of Soil organic matter in the surface layer of the general exploration area is mostly at or above a very rich level, and it tends to decrease from the surface layer to the deep layer as a whole. The total nitrogen content of the soil in the region is at a very rich level; The average content of available phosphorus in the soil is 10.6 mg/kg, which is generally at a moderate level, with some areas at a rich to very rich level; The average content of available potassium in the soil is 132 mg/kg, which is generally at a moderate level. Overall, the soil nutrient content in the 0-25 cm area is the highest. According to the soil nutrient grading standard in China, the content of Soil organic matter in the surface layer is mostly at or above the rich level, and it tends to decrease from the surface layer to the deep layer as a whole. The total nitrogen content of the soil in the region is at a very rich level, the available phosphorus content of the soil is at a medium level as a whole, and individual regions are at a rich very rich level; The soil available potassium content is generally at a moderate level. The soil quality in the area meets the requirements of Class I land use in the "Soil Environmental Quality Construction Land Soil Pollution Risk Control Standard (Trial)" (GB 36600-2018), and in general, the pollution risk can be ignored. The survey shows that the overall level of soil nutrient content is high, meeting the basic nutrient needs for plant growth in subsequent ecological greening or agricultural land development.

Due to the general survey indicating that the heavy metal As in soil in some areas exceeds the first class land use screening value of GB36600-2018 Construction Land Soil Pollution Risk Control Standard. If it is used as a community park or children's park in residential or park green spaces during the development and construction process of the project area, it is recommended to conduct detailed general exploration of the exceeding points and the surrounding soil environmental quality, and conduct in-depth analysis of the surrounding land use history and potential pollution, To identify the scope, source, and risk level of heavy metal As pollution in soil, if the risk level is unacceptable, corresponding measures should be taken for remediation before development to ensure the smooth implementation of relevant engineering projects. This study focuses on the National Wetland Park of the Qianwei River and conducts a general survey on the water and soil environment quality of non construction land in the project area. It is recommended to conduct a thematic survey and evaluation of land use, ecological function, and biodiversity of the wetland park in the next stage, and propose practical regulatory measures based on its ecological protection requirements and the construction goals of this project.

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