ISSN: 2414-1895 DOI: 10.6919/ICJE.202110_7(10).0046

Distribution of Heavy Metal Content in Reclaimed Soil of Construction Land

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Abstract

Soil heavy metal pollution is a key problem threatening the urban ecological environment. Whether the land quality after homestead reclamation can meet the planting standards needs to be considered, especially the heavy metal content of the soil, which is greatly affected by human life and production activities. The content of Cr, Ni, Cu, Zn, As, Cd and Pb in the soil was determined by the experimental plot and soil samples were collected. The heavy metal pollution in the soil under different management methods of poplar was analyzed by single factor pollution index method and Nemerow comprehensive pollution method. There were two trends of heavy metal content with the increase of soil depth: one was gradually decreasing, the other was first decreasing and then increasing, and the minimum value was obtained at the depth of 20–40 cm. The Cd pollution in the test area was light pollution, which was the main source of ecological risk. The order of management measures for soil heavy metal pollution remediation effect was natural growth, fertilization, irrigation. The research can provide scientific reference for the remediation of heavy metal pollution in the reclaimed soil of abandoned homestead.

Keywords

Homestead Reclamation; Poplar; Stand Management; Heavy Metal Distribution.

1. Introduction

With the intensification of urbanization and industrialization, the replacement of old and new housing and the increase of demand for improved housing have resulted in the existence of a large number of abandoned homestead sites, which not only caused the waste of land resources, seriously threatened the red line of 1.8 billion mu of cultivated land, but also affected the overall style of towns or rural areas. Therefore, the reclamation of abandoned homestead is the key to solve the above problems. However, it needs to be considered whether the land quality after homestead reclamation can meet the planting standards, especially the heavy metal content of soil which is greatly affected by human life and production activities.

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Soil heavy metal pollution refers to the phenomenon that human activities introduce heavy metals into the soil, resulting in the content of harmful elements exceeding the background value and causing soil pollution [1]. Relevant studies have shown that about 16.1% of soil samples contaminated by heavy metals in China exceed national secondary quality standards [2]. After heavy metal elements enter the ecosystem cycle through dust deposition, storm runoff, sewage irrigation and other ways, they not only affect the land quality and the growth quality of food crops [3-5], but also disturb the soil structure, change soil properties, and damage the stability of soil environment [6, 7]. Heavy metal elements are difficult to degrade, highly active and highly cumulative, and may have serious effects on animal and human health at very low concentrations. Soil heavy metal pollution has become an environmental problem that cannot be ignored in the process of urbanization and industrial and agricultural development [2, 8-10]. In this paper, poplar trees planted for 2 years after homestead reclamation were used as experimental objects to explore the distribution of heavy metal elements in soil after homestead reclamation through different management measures.

2. Materials and Methods

2.1 Overview of the Study Area

The experimental plot is located in the Project Department of Lanchi Avenue, Weicheng District, Xianyang City, Shaanxi Province (108°50 '38 ", 34°23' 26 "). The average temperature is 14.7℃, the average wind speed is 2.1m/s, the air relative humidity is 63%, the frost-free period is 228 days, and the average annual precipitation is 443 mm. In April 2018, vegetation restoration of abandoned homestead in the project area began. After the abandoned house site was cleared and leveled, common fast-growing landscape poplars were used as restoration vegetation, and the planting density was 1 meter row spacing and 0.5 meter tree spacing, with a total planting area of about 46 mu. The management measures of poplar forest are respectively applying farm manure + irrigation area (hereinafter referred to as "fertilization"), irrigation and natural growth.

2.2 Sample Collection.

In September 2020, ring knife was used to collect soil samples of poplar woodland under three management modes. The sampling method was five-point sampling method, and three groups of samples were set up at each site, and samples were taken at different depths of 0-20cm, 20-40cm, 40-60cm, 60-80cm, and 80-100cm, with a total of 225 samples. After removing gravel, plant roots, etc., the samples were taken back to the laboratory and placed in a cool place to dry naturally.

2.3 Index Measurement

The heavy metal elements in soil were determined by inductively coupled plasma mass spectrometry (ICP-MS).

2.4 Data Processing

Office Excel 2016 was used for parameter calculation, heavy metal content distribution map and calculation result map were drawn, and Arcgis 10.2 was used for location map of experimental plot

3. Results

The depth distribution of heavy metal elements in soil under different management modes is shown in Figure 2. The mean values of heavy metal contents in soil under irrigation conditions are as follows: Cr(80.71 mg/kg), Ni(42.02 mg/kg), Cu(43.89 mg/kg), Zn(92.59 mg/kg), As(14.94 mg/kg), Cd(0.21 mg/kg), The average contents of heavy metals in soil decreased by 7.23%, 10.28%, 22.44%, 6.49%, -1.49% and 9.78%, respectively, under fertilization condition, and by 9.13%, 12.65%, 30.95%, 10.76%, 6.78% and 14.85%, respectively, under natural growth condition.

With the increase of soil depth under irrigation, except for As, the contents of other heavy metals in soil decreased first and then increased, and the minimum value was at 20-40cm depth. Under fertilization conditions, the contents of Cr, Ni, Cu and As in soil decreased with the increase of soil

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depth, while the contents of Zn and Cd decreased first and then increased, and reached the minimum value at 20-40cm depth. Under natural growth conditions, the contents of Cr, Ni, Cu and As decreased first and then increased with the increase of soil depth, and reached the minimum value at 20-40cm depth. The contents of Zn and Cd did not show a uniform rule with the increase of soil depth.

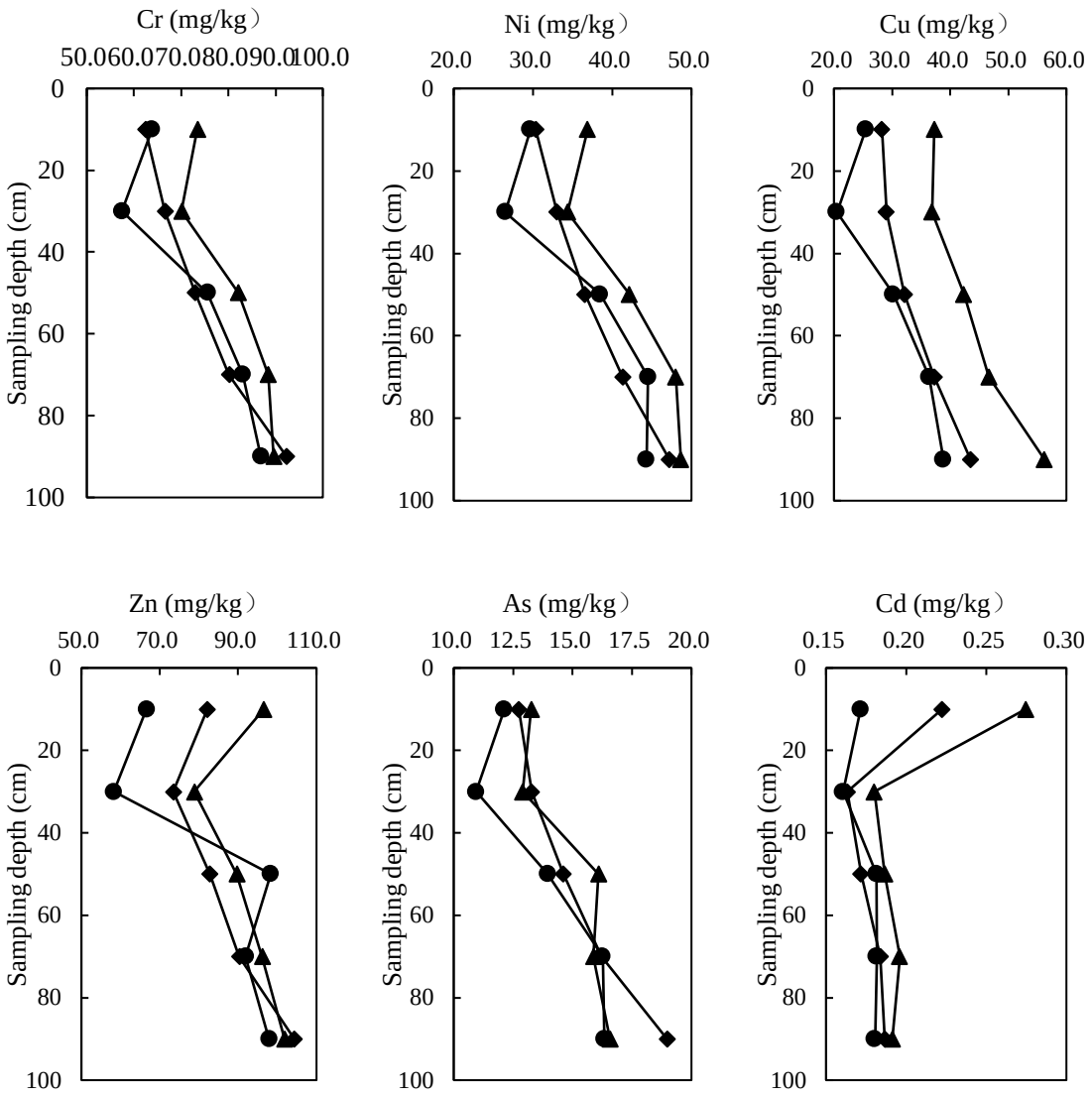

Fig. 1 Distribution of heavy metal content

4. Conclusion

Were compared and analyzed, this research through the establishment of experimental district of xianyang in shaanxi province of different management measures for green land soil Cr, Ni, Cu and zinc, seven distribution of heavy metals As, Cd, Pb, got the conclusion As follows: with the increase of soil depth, the heavy metal content change trend to decrease gradually, or increase and decrease after first get the minimum value in 20-40 cm depth. Cd in the experimental plot is light pollution and moderate harm, which is the main source of ecological risk.

Acknowledgments

This work was jointly supported by the the Scientific Research Item of Shaanxi Provincial Land Engineering Construction Group (2020-NBYY-04).

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