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Migration of Heavy Metals in Soil-Plants under the Action of Organic Fertilizers and Minerals

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Abstract

In pot experiments, it was found that Cu and Zn in heavy metal-contaminated soil mainly exist in the dissolved state, which are transferred from the roots to the grains, and are easily enriched in the grains. After the passivator treatment, the dissolved Cu and Zn in the MO treated soil decreased by 46.3% and 21.0% compared with the P treatment, and the residual state increased by 601.8% and 574.2%; the heavy metal Cu in the roots, stems, leaves and grains of the plants decreased by 88.3% respectively., 75.4% and 24.9%, the heavy metal Zn was reduced by 82.8%, 80.6% and 45.9% respectively compared with the P treatment. Cd mainly exists in the residual state in soil. Compared with the P treatment, the residual Cd in the soil in the MO treatment increased by 917.1%, and the Cd in the plant roots, stems, leaves and grains decreased by 82.3%, 69.6%, and 44.4% compared with the P treatment. It can be seen from the calculation of the total soil-plant total that the MO treatment effectively reduced Cd. Fixed in soil with minimal migration to plants. Pb mainly exists in a reduced state, with high potential mobility, and the passivator can convert Pb to a residual state. Compared with the P treatment, the content of reduced Pb in the MO treatment decreased by 40.8%, and the residual lead increased by 1828.8%, which had the best effect on soil passivation. No Pb residue was detected in the stems, leaves and grains of the OM treatment.

Keywords

Heavy Metals; Minerals; Soil Remediation.

1. Introduction

In the loess area of Shaanxi Province, there are heavy metals exceeding the standard in farmland remediation. The traditional single heavy metal remediation technology has a small application range and high cost, which is not conducive to plant growth. Therefore, it is clear that heavy metals in soil-plant under the action of organic fertilizer and minerals It is of great significance to carry out heavy metal pollution control to verify the migration law and verify its remediation effect. This project analyzes the influence of minerals and organic fertilizers on the migration law of heavy metals in loess through the soil column dynamic monitoring test, and reveals the internal mechanism of the migration of heavy metal complex pollution in deep soil. Combined with pot experiments, carry out research on the migration of heavy metals in plants, reveal the effect of soil-plant circulatory system on the migration and accumulation of heavy metals under the addition of minerals and organic fertilizers, and monitor soil fertility, soil structure changes and crop growth. The repair mechanism of passivating agents. It provides a theoretical basis for subsequent heavy metal pollution remediation and high-standard farmland construction.

2. Effects of Different Passivating Agents on Heavy Metal Content in Potted Soil

The toxicity, activity, re-migration, and bioavailability of different forms of heavy metals in soil show significant differences. Minerals and organic fertilizer passivators can effectively change the proportion of different forms of heavy metals in soil, thereby changing the heavy metals. The degree of element migration, transformation and its effects on plants and the environment. The content of Cu, Zn, Cd, and Pb and the proportion of each form in the CK treatment are the lowest, because it is a healthy soil, and they are all heavy metals contained in the soil itself. After adding heavy metal pollution, the two heavy metals Cu and Zn mainly exist in the dissolved state, and then transform to the residual state. The contents of dissolved Cu and Zn in P treatment were the highest, which were 217.29 mg/kg and 890.87 mg/kg, respectively. After adding passivator, the dissolved Cu contents of O, M, and MO treatments were reduced by 28.7%, 40.3%, and 28.7% compared with P treatment. Compared with the P treatment, the dissolved Zn content in the O, M, and MO treatments decreased by 2.8%, 8.2%, and 21.0%, respectively, and the residual content increased. 122.1%, 378.5%, 574.2%, OM treatment is more conducive to solidifying and stabilizing heavy metals.

Compared with CK, the polluted heavy metal Cd mainly exists in the residual state in the soil, and the other three forms are less. Compared with P, the residual contents of O, M and MO treatments increased by 217.3%, 890.9% and 917.1%, and the total heavy metal content of P treatment was 0.11 mg/kg, while the total heavy metal Cd content of MO treatment was 1.13 mg/kg, which is close to The initial concentration of Cd was 1.5 mg/kg, indicating that heavy metal Cd in soil migrated to plants after P treatment, while OM treatment could fix most of the Cd pollution in the form of residue. The heavy metal Pb in the soil treated with CK mainly existed in relatively stable forms such as oxidized state and residual state. After adding passivator, compared with P, O, M and MO treatments, the content of reduced Pb decreased by 32.9%, 39.6% and 40.8%, while the residual lead increased by 286.6%, 1474.3% and 1828.8%, respectively. the best effect.

3. Effects of Different Passivating Agents on the Accumulation of Heavy Metals in Potted Plants

The accumulation of heavy metal Cu in uncontaminated soil CK is the largest in wheat grains, followed by roots, and the content in stems and leaves is smaller, indicating that heavy metal Cu can be transported from roots to grains and enriched in grains. After adding pollution, the accumulation of heavy metals in stems and leaves was smaller. After adding heavy metal pollution, the accumulation of heavy metal Cu in P treatment increased significantly, and the root > stem and leaf > grain. The passivation agents all reduced the accumulation of Cu in all parts. Compared with the P treatment, the heavy metal Cu in the roots was reduced by 11.4%, 17.3% and 88.3% in the O, M and MO treatments, and the stems and leaves were reduced by 42.4%, 62.2% and 75.4%. The medium heavy metal Cu decreased by 13.7%, 24.8% and 24.9%. The accumulated total content of heavy metal Cu in each part was the smallest in OM treatment, and the total value was slightly larger than that in CK treatment, which effectively inhibited the migration of Cu pollution into plants. A certain concentration of Zn can promote plant growth, and the heavy metal Zn treated by CK is mainly concentrated in the grain, indicating that Zn can be transformed from root to grain. After adding pollution, the content of Zn in each part of the

P treatment was significantly increased, and it was easier to accumulate in the roots. Passivator treatment can significantly reduce the content of heavy metals in various parts and effectively inhibit the accumulation of heavy metals in roots. Compared with P, O, M, and MO treatments, the Zn content in roots is reduced by 14.0%, 52.5%, and 82.8%, and the stem and leaves are reduced by 26.8% and 26.8%. 72.5%, 80.6%, and the grains decreased by 1.3%, 35.2%, and 45.9%. After passivation in the OM treatment, the Zn content in the roots, stems, leaves and grains of the OM treatment increased by 9.71 mg/kg, 13.93 mg/kg, and 2.69 mg/kg, respectively, compared with CK.

The content of Cd in each part of CK was the smallest, which could migrate to the grain. After the pollution treatment, the Cd content of each part was root>stem leaf>grain, and the Cd content in root, stem, leaf and grain was the largest in P treatment, which was 10.5 times, 11.4 times, and 2.2 times that of CK. After adding passivating agent, compared with P treatment, the Cd content of O, M, MO treatment decreased by 56.8%, 76.7%, 82.3%, stem and leaf decreased by 30.3%, 53.3%, 69.6%, and grain decreased by 34.2%, 41.7%, 44.4%. OM treatment had the least effect on the migration of heavy metals in plants. The pollution of heavy metal Pb showed obvious bottom-end aggregation, mainly concentrated in the roots after pollution, and hardly migrated to the stems, leaves and grains. Compared with P, the content of Pb in roots of O, M and MO treatments decreased by 6.8%, 72.7%, and 93.9%, and no Pb residues were detected in stems, leaves and grains of OM treatment. Based on the migration and changes of the four heavy metals in plants, considering the growth and development of plants and the absorption of heavy metals, OM treatment can be selected as the pollution remediation agent.

4. Conclusion

Cu and Zn in heavy metal-contaminated soil mainly exist in the dissolved state, which are transferred from the roots to the grains, and are easily enriched in the grains. After the passivator treatment, the dissolved Cu and Zn in the MO treated soil decreased by 46.3% and 21.0% compared with the P treatment, and the residual state increased by 601.8% and 574.2%; the heavy metal Cu in the roots, stems, leaves and grains of the plants decreased by 88.3% respectively., 75.4% and 24.9%, the heavy metal Zn was reduced by 82.8%, 80.6% and 45.9% respectively compared with the P treatment. Cd mainly exists in the residual state in soil. Compared with the P treatment, the residual Cd in the soil in the MO treatment increased by 917.1%, and the Cd in the plant roots, stems, leaves and grains decreased by 82.3%, 69.6%, and 44.4% compared with the P treatment. It can be seen from the calculation of the total soil-plant total that the MO treatment effectively reduced Cd. Fixed in soil with minimal migration to plants. Pb mainly exists in a reduced state, with high potential mobility, and the passivator can convert Pb to a residual state. Compared with the P treatment, the content of reduced Pb in the MO treatment decreased by 40.8%, and the residual lead increased by 1828.8%, which had the best effect on soil passivation. No Pb residue was detected in the stems, leaves and grains of the OM treatment.

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