Research Progress of Humic Acid Fertilizer on the Soil

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Abstract. Humic acid fertilizers are currently widely used in agricultural production, soil remediation and environmental protection. The application of humic acid fertilizer in the soil can not only optimize the soil structure and increase the utilization rate of fertilizers, but also promote the growth of crops, thereby achieving the effect of increasing yield and income. In the repair of contaminated soil, humic acid fertilizers can fix heavy metals and degrade organic pollutants. Based on this, in order to promote the efficient application of humic acid fertilizers in soil, the application of humic acid fertilizers in soil improvement and remediation of contaminated soil was explored.

1. Introduction

Soil is the material foundation on which human beings depend for survival and development. The overall level of organic matter content in arable land in China is low, soil nutrients are insufficient, soil degradation, soil erosion, salinization and other problems are increasingly serious, which directly threaten human life. The study of soil quality is urgent. In order to improve the soil quality of cultivated land, it will change from the raw soil with poor physical structure and weak water-holding and fertilizer-preserving ability to high soil organic matter content and good structure through a rapid aging process. Soils with strong activities of animals and microorganisms and strong ability to supply crops with water and nutrients. The use of organic green fertilizers has become the key to the restoration of land productivity and the key to the sustainable development of regional agriculture.

Soil is the material basis on which human beings depend for survival and development. The overall level of organic matter in cultivated land in China is low, and soil nutrients are insufficient. At this stage, soil salinization, soil erosion, and soil pollution are becoming increasingly serious, which has accelerated the rate of soil degradation in China and directly threatened people's daily lives. Therefore, the improvement of soil quality is urgent. Humic acid is a type of macromolecular organic matter formed by the remains of animals and plants through microbial decomposition, transformation, and complex geochemical processes. It is widely used in industry, agriculture, and environmental protection. With the in-depth study of humic acid, the scope of use of humic acid products has become wider and wider. China’s soil quality is declining, soil erosion and desertification are serious, and soil
pollution and other problems are getting worse. In order to improve land utilization and promote China's agricultural development, a series of deep-level improvements must be made to the soil so that the land can continue to be used by humans, thereby establishing high-standard farmland. Humic acid has broad development prospects and high application value in soil improvement and soil remediation. Based on this, the research on humic acid fertilizer in soil, application in remediation of contaminated soil.

2. Application of Humic Acid Fertilizer in Barren Soil Improvement

Humic acid fertilizer refers to a fertilizer that can be used to provide nutrients to crops based on humic acid, humate, fulvic acid, and fulvic acid extracted or activated. At present, humic acid fertilizers are widely used as important green, organic and environmentally friendly fertilizers. Humic acid can be divided into native humic acid, regenerated humic acid and synthetic humic acid according to its formation and source. Native humic acid, also known as natural humic acid, is a naturally occurring humic acid; regenerated humic acid refers to humic acid generated by natural weathering or artificial oxidation; synthetic humic acid is also known as artificial humic acid, which is a humus processed by human acid. Practice has proved that humic acid fertilizer can not only promote plant growth, but also improve fertilizer utilization rate and improve soil.

2.1. Optimize soil structure

Humic acid fertilizer can improve the physical properties of the soil and the ability of the soil to regulate water, fertilizer, and air heat. The humic acid hydroxyl group and carboxyl group in the fertilizer undergo polymerization reaction with the calcium in the soil, which reduces the soil bulk density, increases the porosity, and has good permeability, achieving the effect of improving the soil structure [1]. The colloid in humic acid and the calcium in the soil combine to form flocculent gels, which can achieve the effects of loosening soil, increasing air permeability, enhancing water storage capacity, and optimizing soil aggregate structure [2]. The use of humic acid in arid white sandy soil and red sticky soil can reduce soil bulk density and increase soil porosity, providing possibilities for the rational use of reserved cultivated land resources in China.

Humic acid can improve the chemical properties of the soil. Humic acid has similar structure and properties to the natural macromolecule humic acid that constitutes soil organic matter. It is used in saline-alkali soils and can adsorb soluble salts in the soil, hinder harmful cations, and reduce soil salt concentration and saline-alkali soil pH.

2.2. Improve fertilizer utilization

China's fertilizers are high-yielding but not efficient enough, and the average utilization rate of fertilizers is less than half that of developed countries. Therefore, improving fertilizer utilization rates is an important breakthrough in agricultural production. Humic acid fertilizer has outstanding performance in improving fertilizer utilization rate, and can achieve the functions of increasing nitrogen, dissolving phosphorus and promoting potassium, and can effectively adjust the reasonable proportion of nutrients in the soil.

Urea is one of the most widely used nitrogen fertilizers in farmland, which can promote the lush growth of stems and leaves of crops, and the leaves are thick green. Urea in the soil is decomposed into ammonia by urease for absorption by plants, but a large amount of ammonia cannot be completely absorbed by plants and may be lost or fixed by minerals during the entire process. In the past, denitrification was also performed under anaerobic conditions, which led to the loss of nitrogen fertilizer. Humic acid can improve urea fertilization effect by stabilizing urease [3].

Phosphate fertilizer can promote the growth of crop root system, enhance the ability of crops to resist cold and drought, meanwhile, it can increase the number of spikes and full grains. However, available phosphorus is easily lost. Humic acid fertilizers can promote the absorption of phosphorus by plants and reduce the fixation of available phosphorus in the soil. Humic acid can activate the
insoluble phosphorus in the soil, increase the soluble phosphorus in the soil, or directly react with the phosphate fertilizer.

Potassium fertilizer can promote the robust growth of crops, enhance the ability of crops to resist stress, and promote the formation of sugar and starch. However, fast-acting potassium is easily lost. Humic acid can prevent potassium ions from being lost with water in sandy soil and highly soluble soil, it can also prevent the fixation of potassium by sticky soil, increase the amount of exchangeable potassium, and increase the potassium silicate and potassium Minerals such as stone have a corrosive effect, thereby increasing the content of available potassium in the soil and increasing the utilization rate of potassium fertilizer.

Compared with the same amount of ordinary fertilizer, humic acid fertilizer can increase the natural circulation reduction ability of the nitrogen element by about 1/3, reduce the fixed loss of available phosphorus by nearly half, and reduce the loss rate of available potassium by 1/3. Xu Quanhui et al. [5] studied the effect of active humic acid organic fertilizer on rice yield and nutrient absorption, and concluded that humic acid organic fertilizer can significantly increase the phosphorus absorption of rice. Sun Huanqing et al. [6] studied the effect of potassium humate on the soil fertility of Huangguan pear, and concluded that potassium humate significantly increased the soil humus content and available nitrogen, phosphorus, and potassium content, but it did not affect the total nutrients in the soil. It is clear.

2.3. Promote plant growth
Yao Yanyan [7] studied the effect of humic acid water-soluble fertilizer on the fertility of pepper and found that humic acid can not only enhance the disease resistance of peppers tested, but also increase the number of peppers tested. He Lijie [8] studied the effect of humic acid water-soluble fertilizer on pakchoi and found that pakchoi leaves have a thick green color, strong growth and increased yield. Zhao Xingjun et al. [9] studied the effect of humic acid fertilizer on morphological characteristics of cucumber seedlings in greenhouse significantly better.

Humic acid fertilizers can be well absorbed by crop roots, which can improve the emergence rate and survival rate. At the same time, it can also promote the growth and development of crop roots, promote the development of plant roots, and then enhance the ability of crops to absorb water and nutrients. Humic acid can reduce the evaporation of water by reducing the opening of stomata on the leaves, so that plants and soil can maintain more water and enhance plant resistance. The soil buffer solution prepared by humic acid can adjust the pH of the soil and make the crops grow better under the appropriate pH conditions. Humic acid can increase the oxidase activity and metabolic activity in plants, and can stabilize the enzyme activity in the soil, especially hydrolytic enzymes such as urease, sulfatase and phosphatase (such enzymes are important the nutrient supply of green plants has an unshakable position). Although humic acid fertilizer can stimulate plant growth and metabolism, improve the quality of agricultural products, and enhance plant resistance to stress, it is related to the concentration of humic acid and the molecular weight of humic acid. Therefore, the rational application of humic acid is also the focus of future humic acid fertilizer research.

3. Application of Humic Acid Fertilizer in Remediation of Contaminated Soil
Humic acid has adsorption, complexation, and redox effects, so it can interact with metal ions, oxides, hydroxides, minerals, organic matter, and toxic active pollutants in the environment. The restoration of soil by humic acid fertilizer is also mainly manifested in the adsorption, precipitation, and redox effect of soil organic pollutants, and participates in the biogeochemical process of the carbon and nitrogen cycle in various ways, changing the man-made pollution in the soil in different ways thing.

4. Conclusion
The increasingly serious problems of soil degradation and soil pollution restrict the sustainable development of China's agricultural ecological environment, and humic acid has great potential for application in improving soil and improving soil fertility. In order to make humic acid fully play a role
in the soil, in the future application of humic acid fertilizers should choose a suitable fertilization ratio, correctly distinguish between organic matter and humic acid, pay attention to humic acid activation and control the effective content of humic acid. At present, humic acid is used in soil improvement and restoration the application in the field is in its infancy, and theoretical research should be strengthened to clarify the internal mechanism of the interaction between humic acid and heavy metals and organic pollutants, so as to effectively play the role of humic acid in improving and repairing soil.

5. References

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