

The Application of Microorganisms in Ecological Restoration of Desertification

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Abstract: In view of the serious soil pollution and ecological damage in China, microbial remediation is proposed. By introducing the basic situation of microorganisms, the research progress of microorganisms in remediation and treatment of typical contaminated soils, such as heavy metal pollution, organic pollution, salinization and desertification, was reviewed. At the same time, some suggestions on the problems and shortcomings of microbial remediation of soil were put forward in order to provide reference for soil ecological remediation in China. This paper reviews the research on desertification and its ecological restoration with the library as the background. From the aspects of scientific development trend, ecological environment degradation and the reality of restoration research, several core issues in desertification and ecological restoration research are discussed: vegetation process research, ecological water process research, landscape process research, and environmental assessment.

1. Introduction

Desertification refers to land degradation in arid, semi-arid and sub-humid arid regions, including climate change and human activities. One billion people worldwide are directly threatened by desertification. Their harm covers one third of the land area, causing an annual economic loss of \$42.3 billion. Therefore, desertification control has attracted more and more attention from the international community because of its unique contribution to the environment and sustainable development of human society. With the intensification of population, environment and food conflicts, the rational development of reserve resources and the sustainable development of land resources is one of the important contents of desertification prevention and control research. Although China has made great achievements in the prevention and control of desertification, some practical technical achievements have played an important role in production practice. However, with the concept of environmental and economic sustainable development, it is urgent to coordinate the relationship between man and nature and land carrying capacity, prevent wasteland expansion, reverse and restore desertified land, and improve land productivity.

Soil is an important part of desertification ecosystem, and its ecological environment plays an important role in establishing a stable desert ecosystem. Therefore, the study of soil ecological restoration is an intrinsic mechanism for exploring the ecological interaction between the various components of the desertification ecosystem. It is of great theoretical significance to study the landscape pattern, functional structure and regional distribution of desertification ecosystem, sustainable land use and different types of desertification ecological restoration. The types of desertification optimal control technology.

2. Current Situation of Kubuqi Sandy Land

Kubuqisha is located in the northern margin of the Ordos Plateau in Inner Mongolia, located in the northern latitude of 40.21'30" to 40.22'30". East longitude 109. 50'30"109. 51'50", which belongs to the arid and semi-arid climate zone in the middle temperate zone, has obvious continental monsoon climate characteristics. The annual average temperature is 6.1 C, the annual extreme maximum temperature is 40.2 C, and the extreme minimum temperature is 134.5 C. The annual sunshine duration is 3142h, and the annual accumulated temperature (> 10 C) is 377.4 (?) The

annual average wind speed is 3.3 m/s, the maximum instantaneous wind speed is 30 m/s, the days of gale above grade 8 are about 27 days, and the days of sand blowing are about 58 days. The annual average precipitation is 240-306 mm, and mostly concentrated in July, August and September. The annual average evaporation is 2448mm, which is 8 times of the precipitation. The relative humidity is 55%, and the frost-free period is 130-140d. The average relative height of the dunes is 5m and the density of dunes is 0.35. Vegetation coverage is 30% to 60%. The natural vegetation is mainly sandy plants, mainly including sand rice, *Elymus*, *Salsola*, *Sophora alopecuroides*, *Astragalus*, *Artemisia* and *Leymus*. Artificial vegetation includes *Salix*, *Tamarix* and *Caragana*. The soil types are mainly aeolian sandy soil and salinized meadow soil. The site types mainly include mobile sand dunes, semi-fixed, fixed dunes and inter-mountain land.

3. General situation of test area

The experimental area is located in Twelve Liancheng City, Erdos City, Chinese Academy of Agricultural Sciences, Grassland Research Institute, Chinese Academy of Agricultural Sciences. The annual average temperature is about 6 1100 m, the minimum temperature is 32.3 C, the maximum temperature is 38.3 C, the annual average precipitation is about 310 mm, the annual evaporation is 2130.2 mm, the surface evaporation is strong, the humidity is 0.4, the frost-free period is 156 days, the local sunshine resources are relatively large. The annual sunshine duration is 3159h, the sunshine rate is 71%, and the total sunshine amount can reach 597.76kJ/cm, of which 4-9 account for 63% of the annual sunshine. The days of gale are big, the wind speed is big, the average wind speed is 3.3m/s, the average days of more than 8 days are 22.9d. The characteristics of plant community composition in different sandy land are *Artemisia asphaerocephala*, *Inula salsoloides* and *Agriophyllum quarrosum*. In semi-fixed sandy land, *Artemisia ordosica*, *Salsolacollina*, *Corispermumelonga-tum*, *Lespedeza davurica* and *Ixerischinensis* are the main species. Fixed sandy land is dominated by *Artemisia ordosica*, *Artemisia abiepharolepis*, *Bassiadasphylla*, *Salsolacollina*, *Lespedeza davurica*, *Astragalus melitoides*, *Corispermelongatum* Setum and *Sargassum vividis*.

4. Materials and methods

4.1 Soil Sample Collection Test

Through field investigation, the distribution of biological crust was determined, that is, there was no crust in active sandy land, no crust in semi-fixed sandy land and no crust in semi-fixed sandy land. There is no crust in fixed sandy land, no crust in fixed sandy land, algae crust in fixed sandy land and moss crust in fixed sandy land. In each sample area, three sampling points are selected as contours. Soil samples were taken from different soil layers (0-5 cm, 5 cm, 30 cm, 60 cm), and then packed in sealed bags and brought back to the laboratory. Soil samples from the three sampling points were evenly mixed in a sterile room, and litter, roots and other debris were picked and stored in a refrigerator at 4°C. Soil samples collected in 2017 summer, autumn and winter were analyzed in the laboratory.

4.2 According to the characteristics of the selected strains

The growth of *Penicillium italicum* Wehmer, *Mucor racemosus* Fres., *Bacillus subtilis*, *Streptomyces flavus*, *Streptomyces grayi* S. *griseus*, nitrogen fixing bacteria, phosphorus-solubilizing bacteria and potassium-solubilizing bacteria were selected as sand-fixing microorganisms. The screening of optimum proportions of strains needs further experiments.

The concentration of *Penicillium chrysogenum* was 6.4g/L, the concentration of *Mucor pilus* was 15.55g/L, and the concentration of *Bacillus subtilis* was 9g/L. The inoculation time of *Penicillium malicillium* was October 15th, and the mucor and hay The inoculation time of *Bacillus* was November 7th, which may be due to the short inoculation time of *Penicillium maltensis*, which is lower than that of *Mucor* and *Bacillus subtilis*.

The diameter of the inoculation container is 15 cm, and the inoculum size is 0, 50 ml, 100 ml,

150 ml, 200 ml, 250 ml.

4.3 Algae screening section

Fine sand-fixing algae were screened out: *Microcoleus vaginatus*, *Scytomema jalinicum* and *Phormidium tenue*. In June, firstly, the bathing seeds were cultured on BG-11 medium in the Dalat Banner Base of Inner Mongolia Academy of Forestry Sciences (temperature 25 +2 C, light intensity 60uE/m².s, PH=7.1) (BG-11 formula is shown in Table 1). After the concentration reached a certain amount, the 50L white barrel was used for aeration and expansion culture, and the inoculum amount was 2 to 10%. When the concentration reached a certain amount, it was in a small culture tank capable of accommodating 1.3 tons of the medium. The three algae liquids were mixed and cultured in a ratio of 4:3:3, and finally cultured in an open runway circulation culture tank capable of holding 54 tons of medium for 10 to 15 days, and when the concentration reached 0.2 g/L, the field was carried out. Sprayed, sprayed to a concentration of 6g / m². A total of 54 tons of desert algae were cultivated this year, and 100 mu was controlled. After spraying, a crust that has begun to take shape has been formed.

5. Result analysis

Microorganisms are most sensitive to the environment. In the process of soil formation, due to changes in the ecological environment, their diversity will inevitably be significantly affected, and their number, composition and activities will be changed. Different types of sand geological types, vegetation composition, and seasons in the Kubuqi sandy land directly affect the number and group changes of microorganisms. According to the above experiments, it is proved that microorganisms play a vital role in the ecological restoration of desertification, which may organize the expansion of land desertification.

6. Problems in soil remediation and management of microbial fertilizers

6.1 Research progress on microbial fertilizer and soil pollution restoration

At present, the ecological restoration and pollution control of soil in China is still in its infancy, especially the research on microbial remediation of soil remediation is still in its infancy. Due to different types of soil pollution in China, environmental pollution characteristics such as heavy metal pollution, organic pollution, salinization and desertification are different. In different types of contaminated soils, the difficulty of microbial remediation management is different, leading to the research and development of microbial fertilizer management. There are relatively few studies on the management of heavy metal pollution and organic pollution. In the actual production and application process, microbial fertilizers are still used as additives or improvers of soil fertility, ignoring the impact of microbial fertilizers on ecological restoration and pollution control. Therefore, it is necessary to study the remediation and remediation of heavy metals, organic pollutants, salinization and desertification by soil microbial fertilizers. At the same time, we should actively explore the ecological restoration function of microbial fertilizer, promote the rapid coordinated and balanced development of microbial fertilizer in soil ecological restoration, and further improve the overall framework of ecological restoration.

6.2 Soil Microbial Fertilizer Species and Seed Deficiency Rehabilitation

Microbial fertilizers can effectively control heavy metals in soils polluted by heavy metals. If the pollution of heavy metals in soil exceeds the standard, the influence of microbial fertilizer on heavy metals in soil will be significantly reduced. In recent years, with the progress and development of microbial technology, the research on *Rhizobium* leguminous symbiotic bacteria has been used to screen various heavy metal resistant *Rhizobium* bacteria at home and abroad, but the problem of heavy metal pollution is still difficult to solve. In view of the control of soil organic matter pollution, microbial remediation of soil organic contaminated by Pesticide-Degrading bacteria and soil bioremediation has been studied, but microbial remediation of soil organic contaminated by Pesticide-Degrading bacteria is rare. Some foreign companies have developed fertilizers to enhance

microbial remediation of soil organic contamination based on specific soil organic contamination. Significant results have been achieved in the treatment of soil oil contaminants. There is a significant lag in this regard. The research on microbial fertilizer to repair soil salinization is mainly concentrated on the coastal saline-alkali land and saline-alkali land in northeastern China. China has a large area of salinization and various types of salinization. In most areas, the degree of salinization is too high (or the soil pH is relatively high). Therefore, it is necessary to strengthen the research on the anti-pollution performance of microorganisms and screen out microorganisms with strong anti-pollution ability. At the same time, for different types of soil pollution, special microbial fertilizers should be developed to repair and control various types of soil pollution to solve the problem of soil environmental pollution remediation.

7. Conclusion

With the acceleration of the prevention and control of ecological environmental pollution in China, the state has promulgated policies on environmental control such as "Water Ten" and "Atmosphere Ten". In particular, the "Top Ten Soils" related to soil remediation will be introduced in the near future. In the next few years, soil remediation will become a huge environmental project. As a kind of fertilizer, microbial fertilizer plays an irreplaceable role in soil ecological restoration, which can degrade organic pollutants, reduce soil salinity, restore soil moisture and fertilizer. Further strengthening the research and application of microbial fertilizers in soil ecological environment restoration and management will be another important development direction of microbial fertilizers. At present, microbial fertilizer has gradually become the main force in agricultural production and forestry cultivation. However, its role is mainly aimed at the needs of agricultural and forestry production and planting, reducing the use of chemical fertilizers and pesticides, reducing damage to the soil environment, and having little impact on agricultural production and forestry planting. Ecological restoration of non-cultivated soil. In order to fundamentally solve the problem of soil ecological environment in China, microbial fertilizer should be applied to soil pollution control and ecological restoration in the whole country, and the ecological effects of microbial fertilizer should be fully exerted. Therefore, in view of the status quo of soil ecological environment in China, it is imperative to strengthen the research and application of microbial fertilizer in soil ecological restoration and management, which has important research significance and practical value for soil environmental management and restoration in China.

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