Interaction and Research of Biological Organic Fertilizer on Agricultural Soil Geological Improvement Preparation

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Abstract. Based on the characteristics of bio-organic fertilizer material composition, the paper carried out an experimental study on the improvement of poor soil geology. Through the study of the geological background, stratigraphic characteristics and Quaternary characteristics of poor soil, and through petrification analysis, it was found that quartz in soil geology accounts for a large proportion, high silicate content, severe weathering, and insufficient fertility. At the same time, this article discusses the mechanism of bio-organic fertilizer to improve soil geology, and clarifies that the addition of sludge increases the content of soil geological organic matter, which is beneficial to increase the soil geological aggregate structure and humic acid content, and promote the optimization of geological ecosystem.

1. Introduction

Land barren salinization refers to the degradation process of soil geological salinization and alkalization caused by the combined effects of natural factors such as specific climate, soil geological structure, hydrogeology, and artificial diversion and irrigation. Poor salinization will lead to increased soil geological clay particles, easy compaction, reduced soil geological pores and permeability, and decreased soil geological nutrients and organic matter content. Therefore, soil geological brevity salinization not only restricts the sustainable use of agricultural land resources, but also has an impact on the stability of the ecological environment. Improving saline-alkali soil geology is one of the soil geological environment problems that need to be solved urgently. The commonly used improvement techniques are mainly physical, chemical, biological and agricultural engineering and other improvement measures. Saline-alkali soil geological improvers are different, and their salt absorption and alkali dissolving performance the application effect is different in different types of saline-alkali soils. Therefore, it is necessary to compare the differences in the effects of different modifiers on soil geological improvement [1].

2. Experimental design

2.1. Test materials

Plain saline-alkali soils are dominated by Suda saline and alkali, with a higher percentage of substitutional sodium. The tested soil geology was newly-reclaimed alkalinized saline soil. The pH of
the 0-20 cm topsoil mixed soil was 8.6-100.3, and the total salt content was 0.9%-2.2%. Five commonly used salt-absorbing materials were used in the experiment, namely acid rain stone, activated carbon, zeolite, rice husk, and rotten cow dung. Among them, acid rain stone, activated carbon, decomposed cow dung, rice husk, and zeolite test materials were provided by Jilin Jiqiang Technology Development Co., Ltd. Acid rain stone is a new type of salt-absorbing material modified by using zeolite as a carrier. Activated carbon, zeolite, rice husk, and rotten cow dung are traditionally used salt-absorbing materials. The amount of each material is 900 kg, and the five-test materials total 4500 kg.

2.2. Experimental design

This experiment was set up in three communities A, B, and C with obvious differences in salinity and alkalinity of the forest farm. Simultaneous implementation was started on September 25, 2013, and the area of each trial community was 5 m × 667 m. The soil quality of Area A is high-salt and low-alkali, and is divided into 5 plots on average. Each single 667 m² alkalinized saline is evenly sprayed with 300 kg of single test material such as acid rain stone, and only one of them is used for each plot. After the 5 kinds of test materials were sprayed separately, they were continuously re-raked twice, each time with a depth of 20 cm. The soil quality of Area B is low salt and high alkali, and the soil salt content and pH value of Area Care between Area A and Area B. Similarly, each area of B and C is divided into 5 plots on average, and the test materials are used in the same amount as An Area. From September 25, 2018 to September 25, 2019, the topsoil at the test site at 20 cm was sampled once a year. After soil geological sampling, pH test and EC 1:5 tests were conducted [2].

2.3. Analysis of experimental indicators

2.3.1. Analysis of mineral substances. The mineral analysis part mainly carries out X-ray diffraction analysis and scanning electron microscopy analysis on the experimental samples. The use of X-rays is mainly for phase analysis of the mineral composition of soil geological samples and organic samples, which corresponds to the chemical composition and is a further supplement to the chemical composition. Scanning electron microscopy experiments are mainly used to observe the morphology and structure of samples, as well as porosity and particle size.

2.3.2. Analysis of nutritional components. The analysis of nutrients in this part of the experiment is mainly through agrochemical experiments, mainly measuring the effective nitrogen, phosphorus, potassium, organic matter and pH value of the sample. During the experiment, the following methods are mainly used: (1) pH measurement by potentiometry, (2) organic matter is oxidized soil geological organic matter (carbon) with excess standard potassium dichromate sulfuric acid solution at 170-180°C, the remaining potassium dichromate is titrated with a ferrous sulphate solution, and the organic matter content is calculated from the amount of potassium dichromate consumed; (3) available phosphorus is leached with acidic ammonium fluoride to form ammonium fluoride aluminium fluoride and fluoride The complex of ammonium ferrite, phosphate ions are released and extracted into the solution, and the leached phosphoric acid reacts with ammonium molybdate at a certain acidity to produce phosphomolybdoheteropoly acid, when reduced with stannous chloride, Can generate blue molybdenum blue. The blue color of the solution is directly proportional to the phosphorus content, from which the organic phosphorus content can be derived; (4) exchange NH4+ with K+ on the surface of the soil geocollloid, and enter the solution together with the water-soluble K+, and the potassium in the leaching solution It can be directly measured by the flame photometer method; (5) The determination method of available nitrogen is mainly the semi-trace Kelvin method. According to the data of available nitrogen, phosphorus, potassium, organic matter and pH in soil geology, formulate the ratio of using organic matter, inorganic materials and sludge as raw materials, and the modifier based on the ratio is used to improve the soil geology. After repeated experiments, we finally summed up the improved agent and the fertility status of the poor soil after geological improvement.
After the soil geological samples were analysed by agrochemical analysis, as shown in Table 1, it can be found from the result data that the values of the soil geological samples are quite different from the second-level standards of soil geology. The effective nitrogen and available potassium in Jointing field are slightly higher, which can meet the second-level soil geological standards, but the organic matter is only 2.09%, which has not reached the second-level value (3%). Although the available potassium in Qingbai wasteland is 261.7mg/kg, which is slightly higher than the second-level value of 150mg/kg, the available nitrogen, available phosphorus and organic matter are far below the second-level standard of soil geology. So, in general, the soil geological samples selected in the experiment are typical poor soil geology and need to be improved [3].

Table 1. Soil geological nutrient composition table.

| Available nitrogen mg/kg | Available phosphorus mg/kg | Available potassium mg/kg | Organic matter% | PH (water:sample=2.5:1) |
|--------------------------|---------------------------|---------------------------|-----------------|------------------------|
| 54                       | 2.98                      | 45                        | 1.2             | 7.35                   |
| 28.6                     | 0.39                      | 55.8                      | 0.16            | 6.76                   |
| 158                      | 18                        | 154                       | 2.09            | 5.96                   |
| 75.4                     | 8.6                       | 96.4                      | 0.86            | 6.74                   |
| 43.1                     | 2.39                      | 97.9                      | 0.54            | 6.76                   |
| 49                       | 22.7                      | 261.7                     | 0.94            | 8.16                   |
| 15                       | 0.5                       | 36.7                      | 0.44            | 7.06                   |
| 18                       | 0.32                      | 72.9                      | 1.53            | 5.70                   |
| 120                      | 20                        | 150                       | 3               | ——                     |

3. Experimental study on soil geological waste improvement soil geological

3.1. Design principle of experimental scheme
The quantity of $H^+$ (or $OH^-$) substance provided by any substance without a chemical reaction is linearly proportional (proportional) to its mass. In addition, the soil geological sample preparation and the determination of the potential method did not occur significantly Chemical reaction. According to the second-level standard of soil geology, the pH value of the modifier should be controlled at about 7 (6.5-7.5), which is preferably acidic. However, among the three raw materials of the modifier, the effect of sludge on the pH value is not obvious and can be ignored. Therefore, when considering the ratio of organic matter, it is important to consider the ratio of organic matter and inorganic material whose pH value differs greatly from 7. The sludge is mainly used as a bias to adjust the two values, and the organic matter and inorganic material in the modifier are analysed. Proportioning method and specific use steps [4].

3.2. Proportion analysis of soil geological waste
Among the three kinds of soil geological wastes, the pH of sludge is relatively neutral, because it has little effect on the pH of the mixture and can be ignored. Therefore, when considering the ratio of organic matter, focus on organic and inorganic materials with a large difference between pH and 7. Because the ratio of $H^+$ (or $OH^-$) substance and its mass are linearly proportional (proportional) to any substance without chemical reaction, the experiment starts with the pH value. (1) According to the traditional method of measuring solid pH, first add 10g of organic matter to 25g of distilled water (that is, the mass ratio of organic matter and distilled water is 1:2.5), and after standing for 12 hours, use the potentiometer to measure the organic matter pH = 10.33, the pH value of raw material inorganic materials was measured by the same method = 2.58. From pH = 10.33, pOH = 14-10.33 = 3.67, that is: the amount of 10g of organic matter in the provided $OH^-$ substance is:

$$N_{OH} = 1*10^{-3.67} = 1*10^{-3.67}$$ (1)
The amount of H substance provided by 10g of inorganic materials NH is:

\[ N_H = 1 \times 10^{-PH} = 1 \times 10^{-2.58} \]  \hspace{1cm} (2)

According to the law that the amount of H\(^+\) (or OH\(^-\)) substance provided by any substance without a chemical reaction and its mass is linearly proportional (proportional to), the soil geological sample preparation and the determination of the potential method did not occur significantly Chemical reaction. Get the relationship:

\[ M = C_H \times N_H = C_{OH} \times N_{OH} \]  \hspace{1cm} (3)

\[ N_H = M / C_H, N_{OH} = M / C \]

\[ M_{H} / M_{OH} = C_H / C_{OH} \]  \hspace{1cm} (4)

Substituting the above calculated relationship between CH and COH into equation (4) yields: MH/MOH=12.3, from which we can obtain that when the mass ratio of organic and inorganic materials in the modifier is 12.3:1, the theoretical pH value of the modifier Reached 7. Because the theoretical and actual data inevitably have errors, the pH values of the modifiers were measured in the laboratory according to the following 6 ratios. The results are shown in Table 2:

| Organic matter: inorganic material | 4:1 | 6:1 | 8:1 | 9:1 | 10:1 | 13:1 |
|----------------------------------|-----|-----|-----|-----|------|------|
| pH (potentiometric method)       | 6.28| 6.63| 6.74| 6.82| 6.89 | 7.09 |

It is easy to see from the table that as the proportion of organic and inorganic materials increases, the pH of their mixture gradually increases. When the organic and inorganic materials are at 4:1, the pH of the mixture is 6.28. When the two are at 13:1, the pH has exceeded 7.0, showing a curve growth trend, as shown in Figure 1.

Figure 1. Relationship between the ratio of organic and inorganic materials and pH.

It can be seen from Figure 1 that when the ratio of organic matter and inorganic material slowly approaches 12, the pH is infinitely close to 7, which can indicate that this experiment verifies the correctness of equation (2), but in reality, the mixed soil geological waste There will be various physical and chemical changes between them, resulting in a certain error between the theoretical value and the actual value, but from the experimental results Table 2 and Figure 1, we can see that this error...
can be ignored, so according to the above analysis, we can determine when the organic matter and inorganic materials are 12.3:1, the pH value of the modifier is basically neutral (pH=7.3). Some trace elements in soil geological waste are not conducive to crop planting and growth. For example, the content of Cr+ in organic matter far exceeds the second-level standard of soil geology. In addition, the acidic soil geology helps the growth of plants and microorganisms, because in actual soil geology in the ratio of waste materials, the ratio of organic materials to inorganic materials should not be too large [5]. After this experiment, the ratio of organic materials to inorganic materials is 9:1.

4. Soil geology and result analysis

4.1. Geological X-ray transmission results

Take the same fixed value sample HJ/Y1704341, respectively pass through 125, 105, 97, 85 and 74μm standard sieve, sieve the sample after tableting to measure, examine the influence of the sample particle size on the measurement result, and the chemical reference value (S, F is the comparison value of the multiple measurement results of the carbon sulphur analyser method and the fluoride ion selective electrode method (see Table 3). The results show that the content of element S and F in the sample passing through the 85μm standard sieve is basically consistent with the chemical reference value [6].

### Table 3. Comparison table of analysis results of the same sample at different particle sizes.

| element | Particle size/μm | Chemical value |
|---------|------------------|----------------|
|         | 125 | 105 | 97  | 85  | 74  |
| S       | 4609.7 | 4879.6 | 4905.5 | 5068.8 | 6022.8 | 5057.3 |
| F       | 6406.8 | 6521.7 | 6408  | 6357.6 | 6283.8 | 6363.9 |

After the above experimental operations, the feasibility of passing the experiment is theoretically passed. After mixing, the modifier I is applied to the soil geology at a ratio of 1:5, that is, the original soil geology accounts for 5 parts in 1 sample. Amendment I account for one share, and the original soil geological quality is five times that of Amendment I. The eight kinds of barrenness were mixed with the modifier I according to the ratio of 5:1, and the eight kinds of mixture were mixed and tested by agrochemical analysis to obtain data table 4.

### Table 4. Parameters of eight mixed soil samples.

| sample      | Available nitrogen mg/kg | Available phosphorus mg/kg | Available potassium mg/kg | Organic matter (%) | pH  |
|-------------|--------------------------|---------------------------|---------------------------|-------------------|-----|
| Mountain    | 215                      | 131.3                     | 259                       | 2.18              | 5.4 |
| Tian Kan 1  | 521                      | 23.8                      | 260                       | 3.21              | 6.4 |
| Tian Kan 2  | 303                      | 253.0                     | 400                       | 3.82              | 5.7 |
| topsoil     | 165                      | 82.5                      | 258                       | 1.89              | 6.5 |
| Flat 1      | 398                      | 198.6                     | 352                       | 3.34              | 6.5 |
| wasteland   | 201                      | 172.7                     | 236                       | 2.34              | 6.6 |
| Flat 2      | 398                      | 209.0                     | 393                       | 3.04              | 6.9 |
| Tian Kan 3  | 158                      | 215.5                     | 239                       | 2.12              | 6.0 |

Combining the content of various parameters of the original soil geology and the parameters of the mixed soil sample, as shown in Table 5, the soil geological fertility has been greatly improved. As shown in 2, the soil geological changes are greatest in Tiankan 1, Pingdi 1, Pingdi 2, and Tiankan 3. Effective phosphorus and effective potassium have also been significantly improved. The overall
change of organic matter is not large, and the overall content is small. The overall pH value did not change much, except for the slight increase in the sample of Tiankan 3, the others all decreased, but they were distributed around 6.0 and 7.0.

Figure 2. Comparison of available nitrogen content in mixed soil geology and original soil geology.

Table 5. Eight mixed soil samples with modifier I before and after the test 5 Parameter comparison table.

| sample          | Available nitrogen mg/kg | Available phosphorus mg/kg | Effective potassium mg/kg | Organic matter (%) | pH value |
|-----------------|--------------------------|----------------------------|----------------------------|-------------------|----------|
|                 | Original soil            | After matching             | Original soil              | After matching    | Original soil | After matching |
| Mountain        | 54                       | 215                        | 2.98                       | 131.3             | 45        | 259          | 1.2              | 2.18             | 7.35 | 5.4 |
| Tian Kan 1      | 28.6                     | 521                        | 0.39                       | 23.8              | 55.8      | 260          | 0.16             | 3.21             | 6.76 | 6.4 |
| Tian Kan 2      | 158                      | 303                        | 18                         | 253               | 154       | 400          | 2.09             | 3.82             | 5.96 | 5.7 |
| topsoil         | 75.4                     | 165                        | 8.6                        | 82.5              | 96.4      | 258          | 0.86             | 1.89             | 6.74 | 6.5 |
| Flat 1          | 43.1                     | 398                        | 2.39                       | 198.6             | 97.9      | 352          | 0.54             | 3.34             | 6.76 | 6.5 |
| wasteland       | 49                       | 201                        | 22.7                       | 172.7             | 261.7     | 236          | 0.94             | 2.34             | 8.16 | 6.6 |
| Flat 2          | 15                       | 398                        | 0.5                        | 209               | 36.7      | 393          | 0.44             | 3.04             | 7.06 | 6.9 |
| Tian Kan 3      | 18                       | 158                        | 0.32                       | 215.5             | 72.9      | 239          | 1.53             | 2.12             | 5.70 | 6   |

5. Conclusion
As an industrial waste, organic and inorganic materials are discharged in large quantities, occupying land and polluting the environment. With the improvement of urban level, the amount of urban sludge
is increasing rapidly, which brings many problems to the treatment of sludge. At present, the main treatment method of sludge is landfill, but there are some problems in the direct landfill of sludge, especially Leachate and gas are formed during the landfill process. Leachate is a heavily contaminated liquid. If the landfill site is selected or improperly operated, it will pollute the groundwater environment. The landfill can produce methane and other gases. Measures can cause explosion and fire. Correspondingly, soil geology has severely affected the growth environment of crops and even affected agricultural production due to overloaded cultivation or severe weathering. Based on the above reasons, through the combination of theory and practice, this article systematically studied the current situation of organic matter, inorganic materials and sludge, the current situation of poor soil geology, and the experimental study of using organic matter to prepare soil geological modifiers to improve poor soil geology.

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