Study on the Reclamation and Ecological Reconstruction of Abandoned Land in Mining Area

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Abstract. Land is the basis of human existence and an important foundation for social development [1]. Due to its vulnerability and particularity, the land in the mining area has attracted much attention in the ecological environment protection work. With the development of mineral resources, it will inevitably cause damage to the environment and land. Open-pit mining, mining waste accumulation, ground collapse, etc. have produced a large number of mine wasteland, which has severely damaged the ecological environment of the mining area. The reclamation of abandoned mine land in China started late, and there is still a big gap compared with the international level. Therefore, it is necessary to fully excavate the production potential of mine wasteland, increase the utilization intensity of mine wasteland, improve the regional ecological environment, and promote the healthy and sustainable development of the regional national economy. This article summarizes the research status of abandoned land reclamation in the mining area and the impact of the polluted land in the mining area on the surrounding ecological environment, so as to put forward a sustainable development path from the perspective of the sewage discharge system of the mining area, mine reclamation, and soil remediation around the mine.

1. Research status at home and abroad
In the late 1950s, the reclamation areas of some countries have been systematically greened; in the 1960s, many industrial developed countries accelerated the formulation of reclamation plans and reclamation engineering practices, and reclamation entered the era of scientific reclamation; The reclamation technology has gradually formed a multi-disciplinary, multi-industry, multi-departmental and collaborative system project. Many companies consciously incorporate land reclamation into mining design, construction, and production processes. From the late 1980s to the 1990s, the theoretical research on the reconstruction of land use value in mining areas is also at a climax. In recent years, the more active research areas and the main research results achieved include: the impact mechanism of mine mining on the land ecological environment and ecological environment restoration
research; the application of remote sensing and GIS in land reclamation; biological reclamation and erosion resistance without cover soil; Reclamation process; comprehensive consideration of mine reclamation and mining area water resources and other environmental factors; clean mining process and ecological protection of mine production [2].

At present, domestic scholars' research on mine land reclamation is mainly from the aspects of reclamation objectives, technologies, models, influencing factors, and management levels. Influential factors and other aspects have been usefully explored, and these research results have played a positive role in promoting land reclamation in China. Despite the gratifying achievements in the technology of mine waste land reclamation in China, the current rate of mine land reclamation in China is still not high. To solve this problem, we must first clarify the potential of mine land reclamation in China. Although there are many relevant literatures on the research of land potential, it is only limited to the single potential research of cultivated land consolidation and rural settlement consolidation. There is very little research on the potential of mine waste land reclamation. Systematic research on its potential. In summary, the current basic research on reclamation potential is mainly focused on the sources of land reclamation potential and the analysis of the degree of land damage. In terms of the source of land reclamation potential, the source of regional land reclamation potential and the source of land reclamation potential due to earthquake damage are analyzed. For example, Chen Li et al. [3] used Lucheng City in Shanxi Province as an example to conduct a supplementary survey and analysis of the land reclamation potential and found five major components of the city’s land reclamation potential. Yang Jin et al. [4] comprehensively considered and analyzed the reclamation potential of the land damaged by the Wenchuan earthquake from the factors of slope, soil quality, source of guest soil, basic conditions of transportation and water conservancy, number of lost population, and input cost. In the evaluation of the degree of destruction of abandoned land in mines, an evaluation method of the degree of destruction of abandoned land in mines and evaluation criteria for the grade of damage of different types of damaged land are proposed.

Generally speaking, China has made some progress in the research of mine land reclamation. However, due to the late start of reclamation of mine waste land in China, reclamation theory is far behind practice, repeated reclamation projects, light theoretical research, reclamation regulations are not perfect, reclamation funds are difficult to implement, and few scholars are engaged in reclamation and are involved. The field is narrow, and there is still a big gap compared with the international level.

2. The impact of mineral exploitation on the ecological environment of the mining area
In the process of mining, there are a lot of ecological and environmental problems, mainly in four aspects: aggravating soil erosion, heavy metal pollution in the surrounding soil, easy collapse of the mined area to increase the risk of geological disasters and water environment damage.

2.1. Increase soil erosion
In addition to the influence of natural factors, human factors are more obvious than soil erosion. The mining of minerals, the improper use of land in the mining area, the destruction of the original vegetation growing on the ground, the landform of the mining area is in a low-pit state and the slope is large, and the erosion of rain will definitely cause serious soil erosion. Due to the artificial implementation of construction projects in the mining area, such as the basic construction facilities, residential areas and industrial and mining construction required by the mining area, it has an inducing effect on soil erosion.

2.2. The water environment is damaged
As people's demand for mineral resources continues to increase, water resources have been polluted to varying degrees during the mining of ores, which has seriously affected people's daily water use, vegetation growth, and the stability of ecosystems [5]. On the one hand, the mining area pollutes the surrounding soil to indirectly pollute the surrounding surface water and groundwater. On the other
hand, the toxic and harmful water after the mine washing and the domestic sewage in the mining area are arbitrarily discharged without treatment, and penetrate into the underground to directly pollute the water resources.

2.3. Heavy metal pollution in the surrounding soil
Heavy metal pollution to the soil is one of the common problems around the mining area. During mining, waste sulfides, chromium, lead, mercury and other toxic and hazardous substances enter the soil through the leaching effect of long-term rainwater. Under natural conditions, the soil is difficult to repair itself. Bio-carbon, calcite and other methods can reduce the pollution of heavy metals in the soil. Some heavy metal elements have a significant effect on the growth of plants. It is not as good as copper elements when they exceed a certain range, which leads to a reduction in the yield of wheat and rice; soil contaminated with mercury will adversely affect the photosynthesis of plants; lead on the soil The enzyme activity has a significant effect. With the increase of lead concentration, the enzyme activity gradually decreases, etc. These heavy metals have different degrees of negative effects on plants in different ways.

2.4. Goaf is easy to collapse, increasing the risk of geological disasters
Collapse in the mined-out area refers to the ground collapse caused by the underground excavation to form a space, resulting in the instability of the upper rock and soil layer under its own weight. Supporting measures are usually taken underneath the mining area. After the mining is completed, the mining area will be renovated such as landfill and landscape construction. However, at present, there are many mines that have not undergone mine management after mining, and are prone to collapse, resulting in the destruction of surface facilities such as roads and buildings, which directly adversely affects the spatial pattern around the mine and even causes serious economic losses [6].

3. Land reclamation technical methods in mining area
Land reclamation is a complex technical project with comprehensive, systematic, regional and diverse characteristics [7]. At present, China's research on land reclamation in mining areas is mainly focused on the protection of agricultural land, and the objects of land reclamation in open-pit mining areas are mainly excavated, occupied and polluted land [8]. The land reclamation in the mining area is mainly based on the collapse of the mining area and the treatment of waste slag. According to past practical experience, the collapse method mainly uses the leveling method, deep digging method and solid material filling method. The leveling method is mainly aimed at the subsidence area without water accumulation, that is, the area where the subsidence is shallow and has not reached the regional groundwater level. The shallow digging method is mainly used in areas with deeper subsidence areas, easy to form water in the area, and better water quality. The areas with deeper subsidence will continue to be dug deep, filling the areas with shallower subsidence. The region was transformed into an aquaculture area in the later period. The main filling materials of the solid filling method are coal gangue and fly ash, especially in coal mines. These two filling materials are not very useful and occupy a large area, causing a certain degree of pollution in the mining area. It can save land and reduce the cost of reclamation in mining areas. Based on the risk that some fillers will cause secondary pollution of the soil, some scholars have proposed land reclamation techniques such as sanitary landfilling, crack filling, terraced land subsidence, and contour ditch planting [8-9]. In some soil erosion areas, engineering techniques such as building fish scale pits, building silt dams, building pools, and dams can be applied.

4. Ecological reconstruction of abandoned land in mining area
The remediation of abandoned land in the mining area is a big plan for the construction of ecological civilization. The ecological reconstruction of the land in the mining area runs through the entire process of the mine development, including the ecological reconstruction of the open pit, dump, tailings, gangue yard and subsidence area. Soil removal and overburdening are the key links in the
ecological reconstruction of the mining area. During the implementation process, it is often necessary to move and cover the soil to the tailings pond and waste rock yard in order to further implement other restoration work such as vegetation restoration.

The ecological reconstruction of the land in the mining area has limitations. The type, scale, geological conditions and climate of the mineral are all factors that determine its service value. Integrate the ecological design of vegetation landscape in the mining area, so as to "divide the land according to local conditions and adapt to the time" scientifically and rationally divide the land use in the mining area, refine different functional blocks, and integrate the landscape design into the ecological reconstruction of the mining area to use plants. Landscape is the key planning direction. While the original vegetation is maximized, the ecological functionality of the plant species in the mining area will be expanded. Choose suitable vegetation according to the regional climate and the characteristics of the damaged soil. In order to avoid the waste of cost and the impact of the growth of the original vegetation, we must prevent the introduction of vegetation that is not suitable for environmental growth.

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