Rehabilitation and Reuse Planning of Mine Abandoned Land

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Abstract

The rational use of land resources and the protection of ecological environment are problems that cannot be ignored in the development of human society, and the ecological environment is the development foundation on which human beings depend. In recent years, with the intensification of industrialization, the scale of exploitation of mineral resources has gradually expanded, which inevitably leads to the destruction of land resources and ecosystems. Therefore, it is particularly important for the restoration and reuse of land resources. This paper discusses many problems of geological environment in the process of mine development, puts forward the response measures of land restoration, and analyzes the extension of land function, land transformation and improvement of ecological environment, to provide reference for the restoration and reuse of land resources.

Keywords

Land resources, Pollution control, Land restoration, Recycle

Introduction

Land resources are the basis of human survival but based on the serious population pressure and the technology of resource development and utilization that still needs to be improved in China, the efficient use of land resources needs to be further explored. At present, with the acceleration of industrialization and urbanization, the utilization efficiency of land resources is constantly improving, including agricultural land is efficiently transformed into non-agricultural land and commercial land [1]. Mineral resources and the vigorous development of railways and highways also lead to large-scale occupation in large quantities. The sustainable development of population and economy and the balance of land resources have become the problems to be solved at present.

In the process of industrialization and urbanization, the utilization and pollution of land resources are inevitable. Therefore, the restoration and reuse of land resources has become a difficult problem for many countries and regions to solve at present [2]. As the material guarantee for the development of social economy and science and technology, mineral resources play a very important role in the process of industrialization. Such as coal resources in northern Shanxi and Shanxi, copper resources in Heilongjiang and Inner Mongolia, iron resources in Liaoning and Jidong, coal bed methane resources in Shanxi and so on. China is one of the few countries in the world with a complete variety of mineral resources and a high degree of mineral self-sufficiency, and the reserves of some minerals (ore groups) rank among the best or first in the world [3]. The exploitation of mineral resources has affected the environment to a certain extent, and has caused many geological environmental problems, which endanger human life and productive labor. The rational development and utilization of resources and the restoration of environmental pollution during the development process must be carried out together. The mining process not only produces environmental pollution, air and water pollution,

but also affects the natural environment of mines. After the mine is developed, it is of great practical significance to repair and reuse the polluted land.

Geological environmental problems in mining area

Ground subsidence and cracks

Due to the mining of minerals, the ground collapses, and the process is slow and irregular, so it is not easy to find it in advance, and there are obvious collapse pits on the ground. Subsidence events are typically sudden, concealed, and may be accompanied by audible sounds or minor tremors. The main reasons for the collapse are shallow burial depth and unreasonable mining. Collapse pits are generally oval with different depths, as shown in Figure 1.

Figure 1. The ground collapsed in the mining area.

Ground fissures will also occur in the subsidence area, and their occurrence and trend are also irregular. The occurrence of cracks makes rainfall penetrate the stratum, which brings hidden dangers to the safety of mineral production, as shown in Figure 2.

Figure 2. Ground cracks in the mining area.

Natural environment and ecological damage

In the process of mining development, many waste rocks will be produced, which need to be processed and piled up, so a large area of natural areas will be occupied and destroyed. The occupation of land by waste rocks destroys the vegetation on the surface of the land, resulting in poor vegetation, which in turn leads to the imbalance of small-scale ecosystem. At the same time, due to the influence of other natural factors such as rainfall, landslides and mudslides are more likely to occur, resulting in secondary disasters [4].

Abandoned my safety hazards

Most mines are dug deep underground, and there will be holes exposed on the ground, inclined shafts and vertical shafts. If mine shafts are not properly backfilled and sealed after abandonment, it will bring great risks to people, animals and wildlife.

Relocation of Wasteland

Due to the large-scale development of mineral resources, some areas have collapsed, which has caused the destruction of people's living environment and even caused the destruction of houses, farming and traffic roads. When necessary, people in the area need to be relocated and resettled. After the relocation, residents abandoned land and damaged houses and facilities occupied a lot of land, which not only caused certain economic losses, but also brought adverse effects on the restoration of the abandoned land [5,6].

Land restoration measures

The restoration of mine geological environment mainly includes three parts: goaf, production area and relocation waste land.

Goaf

The mined-out area is formed because the resources in the mining area have been exhausted after long-term and large-scale mining activities [7]. Mining in mines generally excavates deep-buried areas with veins, which will produce many tunnels and mined-out areas. After being abandoned for a long time, it

will collapse inside, so it is generally difficult and impossible to backfill the whole of mine. Generally, the conventional treatment method is to drill holes and fill mud to protect the surrounding natural areas, roads, rivers and so on.

Through the feeding hole, the waste rock and slag extracted from the mining area can be put into the mine hole and pressed with cement slurry to improve the support strength and prevent the ground from collapsing. After the grouting process is completed, the soil layer will be covered and compacted within its scope, which will be equal to the surrounding surface environment [8]. Finally, it will be afforded and cultivated to restore the original vegetation coverage.

Production area

In general, the abandonment of mine holes requires plugging the main auxiliary shaft and air shaft, backfilling raw materials are mined waste rocks, and a retaining wall is built around the hole of the mine, and then backfilling is carried out. After backfilling, it needs to be compacted to ensure the backfilling effect. After that, the surface of the backfill area was suddenly covered, and vegetation was planted to restore the original landform.

Most of the waste rock in the mine can be backfilled in the mine, and the rest can be used for other engineering treatment. The backfill of waste rock plays a great role, which can not only effectively use and reduce the occupation of land, but also effectively reduce the ecological environment pollution.

The composition of ore is complex, which contains many mineral components, so it is also very meaningful to greatly reduce the harm to people and animals [9].

Relocation of Wasteland

Residents' buildings and facilities relocated due to geological disasters in mining areas will affect the city appearance and landscape environment. Manual demolition can be carried out, and then the abandoned construction waste can be hauled for paving roads or backfilling collapsed areas. The abandoned area shall be bulldozed, compacted, covered with soil and planted with vegetation to restore the landform.

Repair process engineering measures

(1) Soil remediation

Nutrient elements can be put into the original land to adjust the soil nutrients, such as adding nitrogen, phosphorus and potassium fertilizers to improve the soil quality, planting vegetation that can restore the soil environment, loosen the soil and plant new species to speed up the vegetation coverage. Or directly transport soil from other places, bury the surface soil and loosen it, and plant vegetation.

(2) Water environment restoration

The process of mineral development will pollute surface water, groundwater and soil moisture to a certain extent. Better soil layer or sandy soil layer will be used for restoration, and it will be planned as woodland or cultivated land, and the subsidence pit will be larger and deeper, which can be used as fishponds or reservoirs.

Ecological restoration measures

Ecological methods and measures for remediation are to use some special vegetation to absorb and precipitate heavy metal substances in soil, reduce the biological flow of such heavy metal substances and effectively prevent them from flowing into the water environment system, thus causing the expansion of pollution and reducing the harm to human beings and the natural environment.

For example, the research group of Wu Longhua, a researcher at Nanjing Institute of Soil Science, Chinese Academy of Sciences, has carried out indoor and outdoor experimental research for many years by using zinc and cadmium hyperaccumulator plants screened and identified by the research group. Sedum plumbizincicola is a Zn-Cd hyperaccumulator and a new species of Sedum. For four consecutive years, Sedum Alfredia was used to continuously absorb and repair farmland soils with different levels of zinc and cadmium pollution [10]. With the increase of repair times, the absorption of cadmium and zinc on low-pollution soil by plants

showed a decreasing trend, as shown in Figure 3.

Figure 3. Growth trend of ore-bearing landscape in mining areas.

Land reuse planning

Extension of land functions

Land has different quality grades, so different quality grades of land can be used for different purposes. According to the different quality grades, the corresponding planning and utilization methods are put forward and the planning is reasonable.

At the same time, according to the land use situation, the land use method is adjusted, and the land use is divided into agricultural land, forest land and living and industrial construction land according to the use.

Land Transformation

According to the landform characteristics of the restored land, the abandoned mine land will be built into a regional agricultural industrial park, and the land will be used reasonably and scientifically according to different production objectives, and the protection of the ecosystem will be improved, making the land planning and layout more reasonable.

Ecological environmental improvement

The purpose of land restoration is to restore the original landform environment and ecosystem to the maximum extent, and making detailed land planning schemes is an important part of this process. Attention should be paid to systematicness, sustainability and ecological resilience in the planning process. It can effectively improve the ecological environment in the polluted area and realize the goal of ecological restoration.

Through scientific and rational planning, the restoration and sustainable development of the ecosystem can be achieved, laying the foundation for future ecological security.

Conclusion

The damage of land resources and ecological environment caused by the development of mine resources is discussed, and the restoration measures of abandoned land in mines are emphatically expounded.

The restoration work for abandoned mine land is outlined, including mined-out areas, production areas, and relocated abandoned land., which mainly includes three parts: mined-out area, production area and relocated abandoned land. Combined with the geological environment, the corresponding geological environment restoration measures are put forward.

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Conflicts of Interest

The authors declare no conflict of interest.

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