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Discussion on Comprehensive Utilization and Ecological Management of Coal Gangue

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Abstract

Coal production will continue to increase year by year, and the amount of waste discharged will also increase year by year. In addition, the amount of coal waste accumulated in the past is quite huge. In order to implement the concept of ecological civilization in the new era, reduce the atmospheric, water, and ecological environmental problems caused by the accumulation of coal gangue in the region, solve the safety and environmental risks of existing waste disposal sites, restore the ecological and environmental functions of waste disposal sites and surrounding areas, and improve the comprehensive utilization rate of coal gangue, in accordance with relevant policies such as environmental protection and resource comprehensive utilization, and the requirements for the construction of a "waste free city" in Shenmu City, Combining the actual needs of creating a "waste free enterprise". Therefore, the comprehensive utilization and ecological management of coal gangue has become an urgent and urgent social issue that needs to be studied and solved.

Keywords

Coal Gangue; Comprehensive Utilization; Ecological Governance.

1. Research Background

Coal gangue is a solid waste discharged during the coal mining and washing processes. It is a type of black, colorless rock with lower carbon content and harder hardness than coal that accompanies the coal seam during the coal formation process. Its main components are A2O3 and SiO2, as well as varying amounts of Fe203, CaO, MgO, Na2O, K2O, P2O5, SO3, and trace rare elements (such as vanadium, titanium, and cobalt), accounting for approximately 10% of coal production. The coal gangue discharged during the coal mining and washing process accumulates into a waste dump, which poses great harm to the environment, encroaching on land, affecting ecology, and damaging the landscape; The leaching water (acidic water) from the waste disposal site pollutes underground water sources and rivers, endangering crops and aquaculture; Due to the presence of iron sulfide and carbon containing substances in coal gangue, it can also spontaneously ignite and emit a large amount of smoke and dust, seriously

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polluting the atmosphere, damaging human health, inhibiting plant growth, and corroding building structures; There are also hidden dangers of explosion and collapse accidents in individual coal dumping sites, posing a serious threat to the safety of mining areas.

China is not only a major coal producer in the world, but also a major coal consumer. At present, the cumulative amount of coal gangue stacked over the years in China is about 4.3 billion tons, with over 1600 large-scale coal gangue hills occupying approximately 10000 hectares of land. In 2004, the coal production reached 100 million tons, and based on a low gangue discharge rate of 10% of the coal production, the discharge of coal gangue reached 100 million tons that year. In the future, coal production will continue to increase year by year, and the amount of waste discharged will also increase year by year. In addition, the amount of coal waste accumulated in the past is quite huge. Therefore, the comprehensive utilization and ecological management of coal gangue has become an urgent and urgent social issue that needs to be studied and solved.

Land resources are an important natural resource of the country, and their development and utilization effectively support various production and construction projects. However, in production and construction, land damage and ecological environment deterioration have also been caused by excavation, occupation, collapse, pollution, etc. As the pace of economic construction continues to accelerate, the number of damaged land will continue to increase. In order to implement the basic national policy of cherishing and reasonably utilizing land and effectively protecting cultivated land, standardize land reclamation activities, take rectification measures for damaged land, make it available for use, and improve the ecological environment of the construction area. According to the Regulations on Land Reclamation, the principle of "whoever damages, whoever reclaims" is implemented for land reclamation. According to this principle, enterprises and individuals that cause land damage should unconditionally assume the obligation of land reclamation. Reclamation obligors must comply with national policies and carry out land reclamation work well. The implementation of this measure is not only necessary for the rational use of land and the promotion of sustainable utilization of land resources, but also for increasing the area of arable land, alleviating the contradiction between people and land in the project area, and promoting the socio-economic development of the project area.

In order to implement the concept of ecological civilization in the new era, reduce the atmospheric, water, and ecological environmental problems caused by the accumulation of coal gangue in the region, solve the safety and environmental risks of existing waste disposal sites, restore the ecological and environmental functions of waste disposal sites and surrounding areas, and improve the comprehensive utilization rate of coal gangue, in accordance with relevant policies such as environmental protection and resource comprehensive utilization, and the requirements for the construction of a "waste free city" in Shenmu City, Based on the actual needs of creating a "waste free enterprise", research is conducted on the comprehensive utilization of coal gangue in the waste disposal site of Heilonggou Coal Mine, and ecological management is carried out on the waste disposal site.

2. Main Works

The main construction content of the project includes comprehensive utilization of coal gangue and ecological management of the project.

(1) Comprehensive utilization of coal gangue

The comprehensive utilization of coal gangue refers to the excavation of the existing coal gangue in the disposal site of Heilonggou Coal Mine layer by layer, and the washing and processing of the cleaned coal gangue. The calorific value is reduced from 1600 kcal to 500 kcal, reducing the possibility of re ignition. The waste gangue after recycling carbon resources is

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used for land remediation and ecological restoration. Mainly including transporting (excavating) coal gangue, surface blocking, carbon source washing, gangue crushing and backfilling, and subsequent ecological management.

① Transportation (excavation) of coal gangue: Use mechanical equipment such as bulldozers and hauling trucks to transport it to designated temporary parking points for carbon source washing.

② Surface blocking: Block the excavated coal gangue pit slope to prevent collapse.

③ Carbon source washing: Design a mobile and environmentally friendly coal gangue washing equipment with an annual processing capacity of 1.4 million tons. The entire carbon source washing process is set up according to self circulation, with gangue used to fill collapsed areas or original gangue pile tunnels, and other products used for production and utilization, all achieving comprehensive utilization.

④ Crushing and backfilling of waste rock and subsequent ecological management: Crushing and backfilling of waste rock after carbon source washing to the ecological management area, thereby completing the ecological management of the project.

(2) Project Ecological Governance

The ecological governance of the project refers to the treatment of the land to be reclaimed after the excavation of coal gangue and the rectification of the existing waste disposal site, mainly including solidification and mixing, paving of gangue, retaining, drainage, soil reconstruction, greening, and reclamation projects.

① Solidification mixing: Mix 1 ton of coal gangue with 10L of solidification agent for 48 hours, and conduct sampling inspection to ensure that the leaching water (acidic water) from the waste disposal site does not pollute underground water sources and rivers, endangering crops and aquaculture. Afterwards, backfill from the temporary storage yard to the waste disposal site.

② Paving gangue: According to the national regulations for the treatment of waste disposal sites and in combination with actual situations, construction machinery such as excavators and bulldozers are used to pave the gangue. If there is a need for stacking gangue, 33 ° and 35 ° slopes need to be formed, divided into sections, and ultimately formed into slopes. The upper layer maintains the flatness of the overlying soil layer, improving water and fertility retention.

③ Retaining wall: To prevent the collapse of the waste disposal site, retaining walls should be built if necessary.

④ Drainage: In summer, there is often rainstorm, and the waste dump has a large catchment area. After the rainwater is collected, it is easy to wash the loess covered on the waste rock, or even wash out a trench several meters deep. In order to protect the coverage and sealing effect, the construction of the waste dump berm and the construction of drainage ditches on the slope are necessary. In addition, rainwater should be collected and discharged through drainage ditches.

⑤ Soil structure reconstruction: Conduct a study on the physical and chemical properties of coal gangue and soil in the local mining area to form an adaptive plan for local soil reconstruction. The key points are filling engineering (soil stripping, crack filling, surface soil disposal, surface soil backfilling and leveling) → land leveling engineering (areas not suitable for plant growth, coal gangue excavation areas) → land plowing (all reclamation areas) → soil fertilization (increasing the fertilizer required for planting vegetation).

⑥ Ecological governance and reclamation greening include:

A. Forestry reclamation. Selection of tree species: The main tree species planted in the waste disposal site are shrubs, supplemented by trees. Tree species should be selected with strong resistance to stress, strong adaptability, strong adaptability and tolerance to adverse site

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factors such as drought, barrenness, salinity, pH value, toxicity, etc. At the same time, they should also have a certain resistance to adverse atmospheric factors such as dust pollution, sulfur dioxide, and high temperature. In addition, special attention should be paid to selecting fertile soil tree species with nitrogen fixation ability. It is best to choose the cultivation time of digging pits in autumn and planting trees in spring, which can accelerate the weathering of gangue inside the pits and facilitate the survival of trees. It can also be planted with mud dipped in roots, with a high survival rate.

B. Animal husbandry reclamation. Generally, it is carried out on a waste dump that has not been leveled or slightly leveled. The land preparation should be carried out six months in advance to ensure that the surface gangue is fully weathered, making it easy to plant. Grass seeds should be selected to adapt to planting, which is the key to the success of animal husbandry reclamation. The most ideal forage for reclamation should be a type of grass that is easy to sow and plant, has a high survival rate, rich seed sources, easy to raise seedlings, and has many methods. It is suitable for planting for a long time, has strong germination and reproduction ability, strong seedling vitality, fast fertilization response, and strong drought resistance.

3. Necessity of Construction

Coal gangue is a rock that is sandwiched in coal seams and associated with coal. It is the waste discharged during the coal mining and preparation process. There are three main ways of its generation: (1) the gangue discharged during the process of entering the wellbore and roadway; (2) In the process of coal mining and coal roadway excavation, due to the inclusion of gangue in the coal seam or the cutting of part of the roof and floor of the coal seam, the raw gangue contained in the coal transported to the ground. (3) The washing waste generated by the coal washing plant and a small amount of manually selected waste sorting.

The chemical composition of coal gangue is similar to that of clay, and it can be used for road construction, production of sintered and non sintered bricks, concrete products, masonry mortar materials, and lightweight aggregates such as ceramic particles; Some coal grinding stones have high silicon content and can be used as siliceous raw materials, such as cement raw materials; Its composition and properties are important basis for selecting utilization pathways and guiding production.

Coal gangue, as an industrial waste with solid, liquid, and gas hazards, not only wastes resources and occupies a large amount of land, but also pollutes water sources, soil, and surrounding air, seriously affecting the ecological environment of mining areas and the safety of residents' lives and property.

The harm of coal gangue mainly manifests in: (1) occupying land, stacking coal gangue near the wellhead, occupying a large amount of living and construction land, forest land, etc; (2) Polluting water sources, coal gangue contains harmful elements such as Cu, Zn, Pb, etc. The dissolution of rain and snow causes an increase in the content of harmful elements in the water, hardening the water quality in the mining area, and polluting the water source; (3) Polluting the soil, coal gangue also contains toxic heavy metals such as Ga, Ti, Sn, Co, etc., which immerse in the soil and cause soil pollution; (4) Polluting the air, coal gangue spontaneous combustion emits a large amount of harmful gases such as CO, SO, SO, NOx, and smoke, seriously polluting the air quality; (5) The instability of the dumping site causes gravity disasters, and the stability of the coal gangue piled up in the dumping site is constrained by factors such as the shear strength characteristics of the pile foundation and the characteristics of the pile itself. Under conditions such as rainfall, gravity disasters are easily triggered.

Therefore, effective treatment and comprehensive utilization of coal gangue can turn waste into treasure and harm into profit. Many comprehensive utilization methods have been developed both domestically and internationally. The basic principle is to distinguish and utilize coal

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gangue based on its properties, and combine various utilization methods to form a certain development scale and comprehensive utilization system, thereby achieving the best economic benefits and improving the environment and living conditions of residents in mining areas.

4. Purpose and Significance

By carrying out vegetation reclamation and greening the environment, the ecological management of coal gangue is combined with ecological construction and environmental pollution control in mining areas, promoting dynamic balance and virtuous cycle of ecology, forming a combination of development and remediation, and coordinating development with the environment. Efforts should be made to achieve the synchronous improvement of ecological management of coal gangue and the economic, social, and environmental benefits of the mining area, in order to achieve sustainable development of the mining area. Enhancing people's awareness of mine environmental protection during the development of mineral resources has a significant social image window effect, and has a profound impact on current and future social significance. By improving the geological environment and increasing the forest coverage in the project area, a stable and highly productive ecosystem has been formed, creating a living space for wild animals and plants.

After the implementation of the design project, the ecological greening project can reduce soil erosion, effectively protect nearby cultivated land and the growth of forests and grass, expand the forest area, and have significant direct economic benefits; At the same time, the improvement of the surrounding environment after the implementation of the design project can enhance the local external image, improve the investment environment, provide strong support for the social and economic development planning of the surrounding area, drive local economic development, and have significant potential long-term economic benefits. Taking the comprehensive utilization and transformation of waste disposal sites as an opportunity, we will promote the construction of green mines in an integrated manner, and integrate the concept of green development throughout the entire production process of mines, laying a solid foundation for high-quality development.

The guiding ideology of ecological management of coal gangue in mining areas: By means of vegetation reclamation and greening the environment, the ecological management of coal gangue is combined with ecological construction and environmental pollution control in mining areas, promoting dynamic balance and virtuous cycle of ecology, forming a combination of development and management, coordinating development with the environment, and striving to achieve synchronous improvement of coal gangue ecological management and economic, social, and environmental benefits in mining areas, To achieve sustainable development in mining areas. The governance significance mainly includes:

① Ecological management of coal gangue can achieve the effect of reducing land occupation.

② Ecological management of coal gangue can reduce air pollution and groundwater pollution in mining areas.

③ The comprehensive utilization of coal gangue can not only turn waste into treasure, but also help change the "dirty" image of coal and coal mines, making the coal industry an industry that does not or does not produce "public hazards". Around the comprehensive utilization of coal gangue, coal mines have formed new industries, extended the existing industrial chain, and embarked on a path of sustainable development.

④ The comprehensive utilization of coal gangue is one of the promising successor industries and has become a key development focus for many non coal industries in mining areas, promoting industrial transfer and labor employment in mining areas.

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