

Study on Soil Quality Evolution and Control Mechanism in Coal Mining Subsidence Area

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Abstract: Coal is an important energy source for China's heavy and light industries, chemical industries and other industries. However, the current overexploitation of coal seriously damages the surface structure, resulting in a decline in soil quality. Coal mining causes fragile ecological environment, surface subsidence and cracks, reduces the quality of soil activity and seriously destroys the balance of the whole ecosystem. Therefore, through summarizing the current situation of coal mining subsidence area, it is found that coal mining subsidence area leads to the decline of soil quality. Based on this, by analyzing current problems in coal mining subsidence areas, it is proposed that relevant policies such as soil remediation measures and soil compensation mechanism should be formulated from the government's point of view, and the implementation of the plan should be ensured through cooperation with enterprises and mass supervision, with a view to providing useful reference for the treatment of other coal mining subsidence areas in the future.

1. Research background

1.1 Literature review

Wang Xinjing, Yang Yaoqi and Gaoyang used grey relational projection method, combined with analytic hierarchy process to determine evaluation factors, and established an evaluation model of soil quality evolution in coal mining subsidence area. The analysis showed that the negative impact of coal mining on soil chemical properties was greater than that of physical properties, so as to provide relevant reference for subsequent treatment of coal mining subsidence area (Wang et al, 2013). Huang Kai, by explaining the contradiction between man and land in mining areas in China, discusses the quality of soil after reconstruction under the technology of land reclamation in mining subsidence areas. The results show that the current land reclamation technologies include non-filling and filling to reconstruct soil nutrients and water content, which are different from natural agricultural soils (Huang, 2014). Shi Peili, Zhang Yuxiu and Hu Zhenqi found that the ecological environment in the sandy area of Western China was relatively fragile. Coal mining aggravated soil collapse, surface cracks, and soil moisture, nutrients, vegetation death and biodiversity destruction. This paper analyzed the impact of coal mining on the soil in the sandy area of Western China in recent years, and put forward remediation measures for soil environmental damage in the future. Prevention and Control of Coal Mining Subsidence Area in Sandy Area and Ecological Restoration Provide Multivariate Theory and Technical Support (Shi et al, 2017). Du Huadong, Zhao Xiaoguang and Zhang Yong take the coal mining subsidence area of Yushenfu sand covered area as the research object, and use the field survey and other methods to study the evolution characteristics of the physical and chemical properties of the soil in the coal mining subsidence area in different years. After a series of research data, the response and evolution mechanism of the physical and chemical properties of the surface soil in the coal mining subsidence area are obtained, and the improvement measures are put forward (Du et al, 2017).

1.2 Research purposes

The scale of subsidence area formed by coal mining in China is gradually expanding, and surface subsidence occurs in some areas. Coal mining subsidence also affects the trend of collapse in surrounding areas. Overexploitation of coal destroys the balance structure of soil internal mechanics,

and the surface lacks supporting force, resulting in surface cracks and collapses. Moreover, coal mining subsidence area destroys soil internal structure, soil nutrient loss, soil quality seriously declines, affecting the nutrient elements needed for animal, plant and crop growth(Zhang et al, 2014). Based on this, this paper summarizes the current situation of coal mining subsidence area and analyzes the relevant elements of soil quality in the subsidence area. It is found that the coal mining subsidence area seriously affects the soil quality and ecological balance, involving the effects of soil moisture, desertification and nutrients, and puts forward the prevention and control mechanism of coal mining subsidence area. Politics and law should play a leading role in formulating relevant policies and mechanisms, alleviating the contradiction of ecological environment in coal mining subsidence areas, effectively maintaining the ecological environment balance in coal mining subsidence areas, and restoring the land damage caused by coal mining subsidence areas. Therefore, it is hoped that it will provide reference for all walks of life to restore the ecological environment of coal mining subsidence area and improve soil quality in the future.

2. Evolution of soil quality in coal mining subsidence area

As an important mineral resource, coal plays an important role in China's energy structure. Coal also plays an important role in people's daily life, which can be used as fuel, metallurgical, chemical and other industrial raw materials. Coal plays an important role in heavy industry, light industry, energy industry, chemical industry, transportation industry and so on. It is called “real grain” of industry. As one of the countries with the richest coal resources in the world, China has abundant reserves, wide distribution and excellent coal quality, which provides strong conditions for the industrialization of China and other parts of the world(Yao et al, 2012).

In the process of coal mining, neglecting the mining of symbiotic and semi-living minerals not only wastes resources, but also causes environmental pollution and damages the original ecosystem due to random storage. Among them, coal is overexploited, which destroys the internal structure of the crust and causes surface subsidence. Subsidence reduces land revenue, resulting in damage to surface water facilities and deterioration of the ecological environment. Coal mining subsidence area destroys landform and landscape, pollutes water and soil environment, and causes casualties. It causes huge economic losses and seriously threatens the safety of residents' lives and property. Vegetation degradation and withering, serious surface cracks, soil erosion and other causes desertification in coal mining areas, which causes changes in soil elements and microbial community structure, and a serious decline in productivity. The emergence of various problems has led to a sharp decline in soil quality in coal mining subsidence areas. The decline of soil quality not only affects the growth of plants and animals, but also affects the ability of farmland planting and reduces the harvest of crops.

3. Effects of coal mining subsidence on soil ecology

3.1 Effects on soil water content

As the source of life, water plays an important role in the internal ecosystem of soil. Soil water content affects soil water replenishment and water holding capacity. Some coal mining areas are mostly located in areas with poor soil quality, and their water resources are relatively scarce. After coal mining, the groundwater level declined and the amount of soil water recharge decreased seriously. Surface cracks and land subsidence caused by construction result in the decrease of soil water content. The decrease of soil moisture content, surface subsidence in coal mining area and pavement collapse cause frequent accidents. The decrease of soil water content will seriously affect groundwater reserves, resulting in enthusiasm and regional water shortage.

3.2 Effects on soil desertification

Coal mining affects soil moisture content. Infiltration and evaporation are closely related to soil machinery. Soil mechanical composition refers to the state of soil coarseness which is shown by mixing different size and size of soil particles in one piece. Soil mechanical composition affects soil

moisture, heat and air movement, as well as nutrient transformation and soil structure. Coal collapse will change the mechanical composition of soil, which will lead to more serious soil desertification. The increase of porosity between soil particles is the most direct form of soil desertification, which leads to the loss of soil nutrients and water in the mining area.

3.3 Effect of soil nutrient and enzyme activities

Soil quality accounting standards are soil total nutrients and available nutrients and soil physical and chemical characteristics. One of the criteria to judge the ecological function of soil is the status of soil nutrients. Coal mining subsidence area not only causes surface subsidence and soil cracks, accelerates water evaporation, but also causes soil nutrient leakage along with surface runoff. Coal is an important energy source for China's heavy and light industries, chemical industries and other industries. However, the current overexploitation of coal seriously damages the surface structure, resulting in a decline in soil quality. Soil enzymes, as sensitive indicators of soil ecosystem, originate from the corpses of plants and animals in soil, and play an important role in material circulation and energy conversion.

4. Prevention and control mechanism of soil destruction in coal mining subsidence area

4.1 Speed up legislation to reduce soil damage

The government should strengthen the legislation on the ecological environment in coal mining subsidence areas and confirm the compensation mechanism so as to alleviate the continued destruction of soil. Firstly, the government should standardize the complete license documents of coal mining institutions to prevent them from refusing to bear legal responsibility after causing ecological damage. Secondly, after the surface subsidence caused by coal mining, the relevant laws clearly stipulate the compensation after the destruction of the ecological environment. With a clear subject and compensation rights and responsibilities, to prevent the individual illegal mining, to prevent unclear responsibility and responsibility shift and other issues occur. Finally, the government should formulate the reward and punishment mechanism of compensation for ecological environment damage in mining subsidence area. By forcing the main body of coal mining to recognize its own responsibility through “backward force”, it not only punishes the main body of serious damage to the ecological environment, but also compensates for the damage caused to the ecological environment.

4.2 Formulating compensation scheme to rehabilitate ecological environment scientifically

After the destruction of the ecological environment, it is impossible to repair itself in a short period of time, so personnel are required to maintain it. Therefore, in view of the mining subsidence area, it is necessary to conduct in-depth investigation, analyze and understand the operation mode of the mining subsidence area in detail, as well as the possible damage to the ecological environment in the future and the ecological environment that needs to be repaired. According to the problem of coal mining subsidence area, the scope and intensity of compensation are determined, and a feasible ecological environment compensation scheme is formulated. Moreover, the government should formulate the basic plan of coal mining subsidence area according to the urban construction plan and territorial planning, and design a scientific and reasonable treatment plan for the subsidence area. At the same time, based on the control scheme, the ecological compensation scheme is formulated. The subsidence areas requiring ecological compensation should be stipulated, and the corresponding regional responsible persons and compensation subjects should be clarified to ensure the real and effective implementation of the compensation scheme.

4.3 Implementing compensation mechanism and strengthening ecological environment

The restoration of ecological environment can not be separated from the strong support of the government and the masses. The establishment of compensation scheme supervision mechanism can effectively promote the rapid restoration of ecological environment in coal mining subsidence area. Implementing the compensation mechanism for ecological environment, on the one hand, can

determine the punishment mechanism for the implementation and investigation of the main responsibility, on the other hand, can also involve the masses and public opinion. With mass supervision, we can better ensure the implementation of the compensation mechanism and create a good environment for supervision. The implementation of compensation mechanism can not be separated from the support and guarantee of the government. Therefore, the relevant government departments should strengthen contacts and increase investment in the compensation mechanism of ecological environment. For coal enterprises, the government can actively cooperate, provide loans and other ways to improve the enthusiasm of enterprises in the process of ecological environment compensation, become the main body of compensation.

5. Conclusion

China's resources are rich and diverse, covering all regions. The coal resource stock ranks third in the world, providing a continuous supply of coal for China's industrial development. However, the current excessive coal mining has led to large-scale subsidence of surface soil and surface cracks. The soil nutrients in the coal mining subsidence area are losing continuously, the water content decreases in a large area, the vegetation withered and died successively, and the soil microorganisms are disappearing day by day. Finally, the ecological environment structure is destroyed, and the desertification of the surface is serious, and the problem of desertification is becoming increasingly prominent. Based on the current situation of coal mining subsidence areas in most areas of China, problems such as soil desertification, soil water content reduction and soil nutrient loss are common in subsidence areas. Combining with the impact of coal mining on ecological environment and the related research on soil at home and abroad, this paper puts forward the mechanism of soil prevention and control in the face of coal mining subsidence area in China, in order to provide effective remediation measures for coal mining subsidence area and reference for future treatment process.

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