

Recycling of solid waste resources helps rural revitalization: taking Huayuan County as an example

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Abstract. Huayuan County is the first initiative of "targeted poverty alleviation", the county has vigorously developed the mining economy in the past to grow, but the ecological environment has also been seriously damaged, solid waste urgently needs to be treated. To this end, this paper proposes a treatment scheme for goaf, tailings pond and waste rock dump. It also provides guiding suggestions for waste-free mining in the future, effectively reducing the damage to the local environment, reducing the cost of solid waste treatment, and improving the economic benefits of the mine. Finally, the risks that the program may encounter are analyzed from the technical and policy aspects.

Keywords: Rural revitalization; Huayuan County; Solid waste disposal.

1. Introduction

Huayuan County, located in Xiangxi Tujia and Miao Autonomous Prefecture, Hunan Province, is a famous old revolutionary area in China, and is also the first place of "targeted poverty alleviation"[1-2], with abundant lead and zinc resources, the county has vigorously developed the mining economy in the past to grow while the ecological environment has also been seriously damaged, so the local mining industry has been stopped and the economic development is sluggish. After years of extensive mining, the mining industry in Huayuan County has caused environmental pollution, caused huge damage to the local ecological environment, and unscientific mining mining has caused huge damage to the local ecological environment, as can be seen in satellite images, and the long-term widespread use of the empty field method for mining, leaving 1,426 goaf groups with a total volume of 35.87 million m³ in the mining area, which has caused harm such as ground collapse in residential areas[3-5], and is more likely to cause geological disasters such as surface collapse and landslides from time to time. According to statistics, there are 34 waste rock dumps in Huayuan County, covering an area of 1.7 million m²; There are 34 tailings ponds still in operation, covering an area of 1.93 million m², these waste rock dumps and tailings ponds on the one hand occupy a large amount of land, so that the cultivated land area is reduced, on the other hand, the leakage caused by the accumulation of tailings and the discharge of mineral processing wastewater cause pollution to the local water source soil, heavy metal pollution occurs in the river basin of Huayuan County[6-7], and the content of heavy metals Mn, Pb, Zn, Cu and Cd in the soil of the mining area exceeds the standard, which seriously affects the lives of local residents, and in 2017, a children's blood lead accident broke out[8].

The local economy is in dire need of development. This paper proposes a set of targeted and feasible rural revitalization programs, combined with the actual local production, targeted to provide local mining companies with professional and efficient green mine construction solutions and pollution control solutions, and provide suggestions for local industrial transformation[9-10].

2. Solid waste resource recycling scheme

The core content of this study is based on the environmental problems caused by the early local mining development and the problem that the local mining industry is stopped, and a "solid waste resource recycling" scheme is proposed, which not only solves the existing problems while improving this scheme to the actual construction of green mines, and comprehensively treats the three major problems of goaf, tailings pond and waste rock dump, and the comprehensive treatment process is shown in Figure 1.

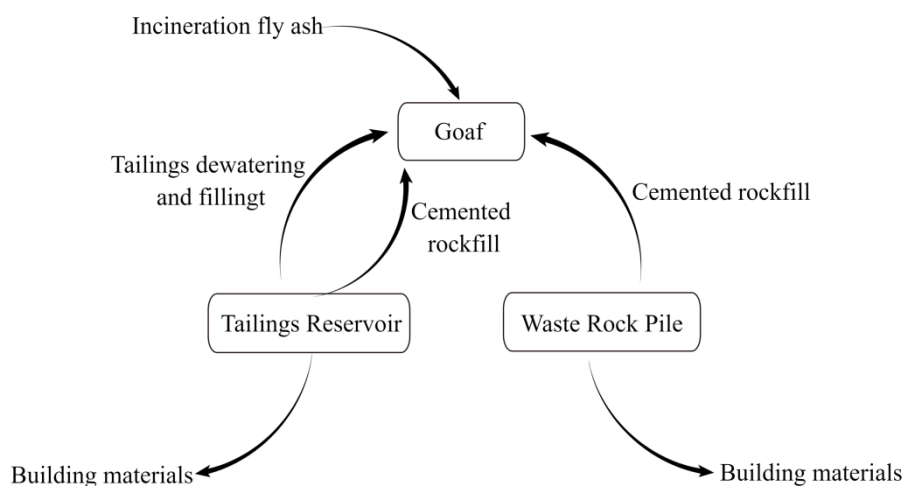


Figure 1. Comprehensive governance process

2.1. Goaf governance

Current situation: The mining and dressing industry of lead and zinc ore in Huayuan County has developed earlier, and a large number of goaf groups have been left after long-term use of the empty field method, according to statistics, the number of goaf areas in the five mining areas of Huayuan County is 1426, and the total volume of goaf is 35.87 million m³. Moreover, the management of the early civil mining was chaotic, and the goaf formed by mining was of different scales, overlapping and interconnected with each other, and the number of goafs left was difficult to count, so the actual number of goafs was much larger than the statistical number. In recent years, the Huayuan County Government has rectified the mining problem, and has made slow progress in the governance of the goaf area, and the governance standards are low, so it is urgent to deal with the potential safety hazards of the goaf.

Treatment construction plan: the treatment method of goaf mainly includes filling, caving, supporting, isolation and grooming methods, taking into account the complex situation of the goaf in Huayuan County, and the large number and the protection of the ecological environment, the goaf should be used to treat the goaf, the filling method can be roughly divided into waste rock dry filling, water sand filling, cementation filling, considering the filling effect and the utilization of solid waste resources around Huayuan County, The goaf was initially selected to be treated by two methods: cemented filling of block mortar and total dehydration filling of tailings, and as a filling scheme for new green mines

1. The essence of block stone cementation filling is to use block stone as filling aggregate, mortar filling block stone gap to cement it into a whole, compared with tailing sand cementation filling cost is low, high strength. Huayuan County has left a large number of waste stone dumps in the process of long-term mining, these waste rocks occupy a large amount of land on the one hand, on the other

hand, there is a risk of environmental pollution, the use of block stone cementation filling can break these waste stones as filling aggregates, rational use of these waste stone resources. The mortar required for cementation can be made of treated tailings and use part of the tailings.

2. Considering the environmental hazards and potential safety problems caused by a large number of tailings ponds left in Huayuan County, it is very important to reduce the discharge pressure of tailings, so the use of tailings full dehydration filling to treat the goaf problem, compared with the traditional tailings cementation filling to produce fine mud tailings is difficult to treat, tailings full dehydration filling using full-grain tailings, tailings utilization rate is high, can reduce tailings discharge pressure, but the traditional use of deep cone thickener, vertical sand silo and other solutions initial investment is large, for the economy hit hard Huayuan County is not suitable, Therefore, this project combines the scientific research results of the instructor, and plans to use the tailings full dehydration filling process to use the tailings, the modification process is first concentrated by the ordinary thickener, and then the concentrated tailings are dehydrated with a ceramic filter press to obtain dry tailings, on the one hand, it can be used as building materials, on the other hand, it can be filled into the goaf after adding cementitious materials, and the equipment used in this method is reasonably priced, effectively reduces the cost of input, has a good treatment effect, and can effectively use tailings.

In addition, this paper also proposes to make the fly ash generated after the incineration of local domestic waste into a filling slurry, which is used as a filler to fill it underground, which not only solves the problem of underground goaf but also deals with the problem caused by domestic waste incineration, so as to achieve safe, efficient, green and environmentally friendly treatment of fly ash. In line with the construction concept of green mines.

2.2. Tailings pond remediation

Current situation: Due to the early development of mining in Huayuan County, there are a large number of tailings ponds, with a total of 98 tailings ponds in the county, which not only bring environmental pollution such as leachate leakage, but also some improperly managed tailings reservoirs are at risk of dam failure, bringing huge safety risks. The Huayuan County Government is actively promoting the closure of tailings ponds and has achieved certain results, reducing the integration of lead and zinc tailings ponds to 7 and manganese slag reservoirs to 3 by the end of 2019. However, the treatment of tailings ponds in Huayuan County adopts measures of closure, soil covering and greening, which can effectively reduce the safety hazards of tailings stocks and reduce the pressure of tailings storage to a certain extent, but on the whole, the total amount of tailings storage remains unchanged, and there are still potential risks. On the other hand, Huayuan County plans to complete the closure of seven lead and zinc tailings ponds by the end of 2022, so it is necessary to choose a more reasonable way to deal with the existing tailings ponds and tailings generated by mining.

Treatment and construction plan: The comprehensive utilization of lead and zinc mine tailings mainly includes three aspects: secondary recovery of resources, filling of goaf and production of building materials, and Huayuan County can integrate three methods to treat the tailings reservoir:

1. Because the mining of lead and zinc ore in Huayuan County is relatively early, some old lead and zinc tailings can be recycled twice due to the limited technology at that time, and the valuable resource content in the tailings is relatively high. This method is mainly used to treat older tailings ponds.

2. There are a large number of goaf areas left untreated in Huayuan County and new mine mining must use the fill mining method, so the tailings can be used for the filling of goafs, and it was previously proposed that the treatment of goaf in Huayuan County adopts block cementation filling and tailings full dehydration filling. Among them, the mortar used in the cementation filling of blocks can be made of treated tailing mortar; The full dehydration filling of tailings can use full-grain tailings to improve the utilization rate of tailings and effectively solve the problem of tailings accumulation.

3. For a large number of tailings in the existing tailings pond, according to the specific conditions of the tailings pond, dry or wet mining is adopted, and can be used for construction sand after screening, in addition, lead and zinc tailings as a mineral raw material can be used as a raw material for cement and other building materials, on the one hand, it can reduce the cost of production, on the other hand, it can also consume a large amount of tailings, realize non-waste mining of mines, and promote the green development of mines.

2.3. Waste rock dump disposal

According to statistics, there are 34 waste rock dumps in several large lead and zinc mining areas such as Laohuchong, Minle, Maoer Township, Bamao Mining Area, and Limei Mining Area, covering an area of about 1.7 million m² and stockpiling about 36.63 million tons. These waste rock dumps not only encroach on the land, cause pollution, but also have great safety risks, while the treatment of waste rock dumps in Huayuan County is not obvious, and there are still a large number of waste rock dumps in the mining area to be treated.

Treatment construction plan: 1. Used as a filling material, the use of block stone cementation filling treatment goaf needs block stone as filling aggregate, if waste stone is used instead of surface quarry crushing as a block source, on the one hand, it can reduce the damage to the ecological environment, deal with a large amount of accumulated waste stone, on the other hand, it can also reduce the filling cost. Most of the particle size of the block stone required by the block cementation filling method is -300mm~+10mm, and the waste stone can meet the requirements after simple crushing treatment, so this method has strong feasibility.

2. Considering the large amount of accumulated waste stone, waste stone can also be comprehensively treated to recover resources and used as building materials, waste stone can be obtained by crushing-screening-sorting-sand washing process can obtain sand and ballast of various particle sizes, stone ballast and sand can be used as building materials.

2.4. Regional green mine construction

These treatment programs are also applied to the construction of green mines in the future, so as to achieve waste-free mining, avoid the construction of tailings ponds, waste rock dumps and other industrial sites on the ground, effectively reduce the damage to the local environment, reduce the cost of solid waste treatment, improve the economic benefits of the mine, and effectively improve the competitiveness of mining enterprises. In addition, in view of the characteristics of wide distribution of local mine resources and scattered distribution of mining rights, it is proposed to build regional mines, regional mines are for the large-scale development of multiple small scattered ore groups in the mining collection area, on the basis of resource integration, unified planning of the entire mining area, optimization of resource allocation, reasonable determination of the number and scale of mines and dressing plants in the region, and the optimization design of the development, transportation ventilation and production auxiliary system of the whole mining area, so as to build an intensive modern mine, the construction of regional mines can effectively utilize the solid waste of each mining area. It solves the problem of difficult operation of solid waste between various mining areas and further reduces the cost of solid waste treatment.

3. Program features and risks

3.1. Characteristic

(1) Adopt low-cost solid waste resource recycling methods to solve the remaining environmental problems. The existing environmental problems in Huayuan County are mainly three aspects: goaf, tailings pond and waste rock dump, and only by solving environmental problems can we continue to develop mining, and when the local mining industry is hit hard, low-cost solutions must be adopted, and the initial investment cannot be too high. This project innovatively proposes a method of recycling solid waste resources to solve this problem at low cost and high efficiency, the core of this

method is the comprehensive utilization of tailings ponds and waste rock dumps, and the use of filling methods to treat the goaf problem, for the existing tailings ponds, a small part can be recycled and comprehensively utilized, most of the tailings can be used as filling materials, the remaining tailings can be used as raw materials for building materials after treatment, and the waste rock yard can be crushed as filling materials and as building materials. The goaf adopts total dewatering filling of tailings and cementation filling of block mortar, which can make full use of the block stone generated after the crushing of tailings and waste rock in the tailings reservoir, realize the recycling of solid waste resources, and solve the remaining environmental problems at low cost and environmental protection.

(2) Build regional green mines according to the characteristics of local mineral resources. The wide distribution of mineral resources in Huayuan County, the scattered mining rights and chaotic management of the previous mining rights are one of the important reasons for the many problems in the development of local mining in the past. In view of these local problems, the project uses solid waste resources to recycle and deal with the problems that arise in the production and construction of green mines, and at the same time, it proposes to build regional mines, unified planning of the entire mining area, optimize resource allocation, so that the solid waste resources generated by production can also be well used in each mining area, so as to better realize the construction of green mines

(3) Build a mine park in combination with local characteristics. Mining relics in Huayuan County have their own unique places, in the long-term mining left a large range of large buried depth shallow goaf area, combined with this feature can be low-cost construction of the underground part of the mine park, in addition, Huayuan County in the zinc mine when a large number of mining, left a lot of huge "sinkholes" has its uniqueness and visit value, is a good tourism resources, combined with these characteristics can be at a lower cost innovative construction of a mine park with unique scenery, improve competitiveness.

3.2. Risk

(1) Technical risks

The mining and dressing industry of lead and zinc mine in Huayuan County developed earlier, leaving a large number of goaf groups after long-term use of empty field mining, and the management of early civil mining was chaotic, the goaf formed by mining was of different scale, multi-layer overlapping and interconnected, and the number of goaf left was difficult to count, so the actual goaf was much larger than the statistical number. The Huayuan County Government has made slow progress in the governance of the goaf area, and the governance standards are low, so the safety hazards in the goaf are great.

Huayuan County has developed its mining industry early, with a total of 98 tailings ponds in the county, but today, the state is not approving the establishment of new tailings ponds. These tailings stocks are exposed to environmental pollution problems such as leachate leakage, and even the risk of dam failure, which is undoubtedly a huge safety hazard.

Solid waste in the mining area of Huayuan County is stacked in the open air without planning, which not only occupies a large amount of land, but also seriously destroys vegetation. Although the Huayuan County Government actively rectifies waste-related enterprises, there are still potential safety hazards of waste residue and liquid due to too many historical problems and a wide range of pollution.

Countermeasures:

1. Considering the complex situation of the goaf in Huayuan County, and the large number and the protection of the ecological environment, the goaf is treated by the filling method, and considering the filling effect and the utilization of solid waste resources around Huayuan County, the goaf is initially selected to be treated by two methods: block mortar cementation filling and tailing sand total dehydration filling.

2. Due to the early mining of lead and zinc ore in Huayuan County, some old lead and zinc tailings have a high content of valuable resources in the tailings due to the limited technology at that time, and can be recycled twice. This method is mainly used to treat older tailings ponds.

3. There are a large number of goaf areas left untreated in Huayuan County and the new mine mining must use the fill mining method, so the tailings can be used for the filling of the goaf, which can effectively solve the problem of tailings accumulation.

4. Use waste stone as filling material, use block stone cementation filling to treat the goaf treatment area needs block stone as filling aggregate, if waste stone is used instead of surface quarry quarry crushing as a block source, on the one hand, it can reduce the damage to the ecological environment, deal with a large amount of accumulated waste stone, and on the other hand, it can also reduce the filling cost.

(2) Policy risks

Today, important progress has been made in rural revitalization, and the institutional framework and policy system have basically taken shape. The level of agricultural development has been further improved, the actions of strengthening agriculture with quality, industrial integration, characteristic agriculture, brand agriculture, science and technology, and opening up have achieved obvious results, breakthroughs have been made in the construction of agricultural and rural smart industrial systems, and the quality of agricultural supply systems has continued to improve; The economic strength of counties has been further enhanced, the gap between urban and rural residents' living standards has continued to narrow, the poor population has been lifted out of poverty under the current standards, and all poor counties have been lifted off their hats, solving the overall regional poverty. Huayuan County is vigorously developing tourism, funds and policies are tilted towards tourism, and specific rural revitalization funds and rural revitalization policies will be used in tourism-related places. At this time, the desire to resume mining is, in a way, a greater risk to the source of financing.

Countermeasures:

1. Strengthen the study of rural revitalization policies to reduce economic losses caused by improper management caused by poor understanding of policies.

2. We comply with various laws and regulations and create greater value within the legal scope of business. Make full use of the benefits and policies of college students' entrepreneurship.

3. Qualitatively and quantitatively assess the risk level of rural revitalization policy risks, and formulate corresponding countermeasures in advance.

4. Strengthen communication with relevant government departments, discuss and exchange the latest rural revitalization policies, form a healthy coordination mechanism, and organically combine rural revitalization policies with project development.

4. Conclusions

This paper solves the existing problems in Huayuan County, the construction of green mines can make the local mining re-develop, re-develop the local rich lead and zinc mineral resources, can effectively promote the development of local employment and economy, and make the local government have the economic strength to develop mine tourism, plan the road of mining rejuvenation for Huayuan County, plan solutions in advance for the problems caused by possible resource depletion in the future, and realize local rural revitalization in a comprehensive and long-term and high-quality manner.

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