## Opinion Article

## Coal Gangue Resource Utilization- A Overview

**Abstract:**

The resource utilization of coal gangue remains difficult problem for China and an international problem. China’s coal gangue is mostly used for landfill, gangue backfill, roadbed paving, power generation and building materials, etc. However, international research and application in the field of coal gangue has more advanced technology and programs than domestic, the utilization rate of coal gangue is also higher, but there are also high costs, high treatment costs and other issues. Strengthening sectoral policy coordination and improving the precision and synergy of support policies. This study provides an overview of the Coal Gangue Resource Utilisation in China. The current problems and programs are identified and proposed for the better development of coal gangue resource utilization.

**Keywords:** gangue; solid waste; resource utilization

**Introduction**

Coal gangue is a kind of black rock with low carbon content accompanying the process of coal formation, and it is a general solid waste produced after coal is washed [1]. China is a large coal-producing country, with the coal mining intensity increasing year by year, the production of coal gangue is also increasing, but the utilization rate of coal gangue is extremely low, most of the coal gangue is disposed of as general solid waste in landfills, while only a very small part of it is used for effective resource utilization. This paper analyses and summarizes the ways of coal gangue resourcefulness through some domestic research results in recent years.

#### 1. Analysis of the current situation of the use of coal gangue at home and abroad

The resource utilization of coal gangue is both a difficult problem for China and an international problem. Earlier years, China issued the "Management Measures for Comprehensive Utilization of Coal Gangue", and after gradual revisions, norms to guide the healthy development of the rational use of coal gangue resources industry [2]; and then issued the "Comprehensive Utilization of Coal Gangue Technology Policy Points", which clarifies the gangue used for roadbase, power generation, cement batching, construction materials, resourceful backfill and harmless application of the guidance; in 2021, issued the "Guidelines on the Comprehensive Utilization of Bulk Solid Wastes" is even more explicit on the comprehensive utilization of coal gangue. "Fourteenth Five-Year" large solid waste comprehensive utilization of the guiding opinions "is clear on the resourceful use of coal gangue to indicate the direction of development [3].

China's research and application of coal gangue started late, and the resource utilization in coal gangue is also less [4]. China's coal gangue is mostly used for landfill, gangue backfill, roadbed paving, power generation and building materials, etc. With the increase in coal prices, most of the coal gangue is landfilled as general solid waste.

Foreign research and application in the field of coal gangue has more advanced technology and programs than domestic, the utilization rate of coal gangue is also higher, but there are also high costs, high treatment costs and other issues. France in the field of coal gangue use in the forefront of the world, France will be easy to spontaneous combustion of coal gangue crushing and level division, adding anti-erosion, corrosion, high temperature resistance, sunscreen binder, and will be made into materials used for road slopes, parks and places with landscaping [5]. The comprehensive utilization rate of coal gangue in western countries represented by the United States and the United Kingdom has now exceeded 90%. Poland Czestochowa University of Technology uses nitrogen adsorption method, the natural and washed gangue modification treatment, and then developed a new material used in municipal wastewater treatment, the organic matter in the water body and some harmful ions play a strong adsorption effect [6]. In addition, gangue is also used in many related technical fields, which is currently limited in practical application due to its high cost.

#### 2. Problems faced by China's current coal gangue resourcing

In China, there is a regional problem in the distribution of coal gangue. Part of the demand for gangue is small but the production is large; but in the lack of resources in the eastern region, it is just the opposite. If the gangue and related products are transported to the eastern region will greatly increase the cost, not cost-effective.

There is a lack of relevant normative requirements for the pre-treatment of coal gangue classification. Complex composition of coal gangue, even if the same mine emissions of coal gangue, its physical composition is sometimes different, the use of different ways. Some enterprises at the same time discharge gangue, gasification slag and other solid waste, due to the lack of relevant standards and norms required, without carrying out the pre-classification of different types of coal gangue or coal gangue and other solid waste mixed stacking, to the back end of the classification and resourcing has brought great difficulties.

The introduction of supportive policies and restrictive policies are contradictory, although many regions strongly support the resourceful use of coal gangue, but not for the resourceful use of coal gangue projects clear priority allocation of energy consumption or exemptions and other incentives. This leads to the gangue preparation of building materials and other projects are included in the "two high" or restricted industries for management, resulting in the use of resource projects difficult to land. And the implementation of policies in various regions is insufficient. Although the state encourages the use of energy-saving and environmentally friendly new wall materials, but the traditional resources to prepare building materials, such as solid bricks, clay brick products are still prevalent. This leads to the low market competitiveness of the gangue resource utilization products, the market space is small, which in turn leads to the difficulty of establishing and approving new projects, hindering the development process of coal gangue resource utilization.

#### Program measures related to the use of coal gangue resources

Strengthen the co-ordinated layout of the coal gangue resource utilization project, co-ordinate the deployment of coal gangue resources according to the local industrial development goals, build a gangue-related product industry chain, reduce transport costs. Establish and improve the product standards of coal gangue resource utilization, strengthen the leadership of the technical standards of coal gangue, fundamentally eliminate the doubts of the consumer market on the safety of coal gangue resource utilization products, and improve its market acceptance.

Front-end pre-treatment of coal gangue provides an important guarantee for the full amount of resource utilization. Each region should pay attention to the front-end pretreatment of coal gangue, and introduce relevant policies to support it. According to the local conditions, the development of coal gangue pretreatment procedures, according to different ways of use to carry out the corresponding centralized pretreatment. Pre-treatment of coal gangue can extract useful minerals: coal, pyrite, soap earth and so on. Can also produce chemical products: alumina, polymerized aluminium, alum, silica, water glass, etc. and can be used for ceramics, chemicals, paints, aerospace, paper, zeolite kaolin. The residues left over from the production of chemical products can also be used to extract rare earth elements. Pretreatment for the production of building materials and other materials is often seen in engineering materials, such as bricks and tiles; cement; blocks; lightweight aggregates (ceramic granules), refractory materials, ceramic materials, cast stone, molding sand and sand, gangue cotton, silica-aluminium alloy wear-resistant materials, inorganic materials. It can also be directly utilized after pretreatment, such as for roadbed and foundation; soil conditioner (pesticide carrier); land making and field making; coal additive (for bonding); filling (coal replacement and subsidence area); ecological soil, etc.

Strengthening sectoral policy coordination and improving the precision and synergy of support policies. (1) It is recommended that the state based on the "National Encouragement of the development of major environmental protection technology and equipment catalogue" "national industrial resources comprehensive utilization of advanced and applicable technology and equipment catalogue," "industrial structure adjustment guide directory" "construction project environmental impact assessment classification management directory" and other key access bases, the establishment of the comprehensive utilization of coal gangue project technology and equipment breakdown management list, and the traditional building materials industry to implement the management of the differentiation. (2) It is recommended that the state formulate the energy saving, carbon reduction, emission reduction and other standards for the comprehensive utilization project of solid waste as soon as possible, to solve the problem of difficulty in establishing and landing the comprehensive utilization project of coal gangue. [7]

#### 4. coal gangue resource utilization vision

The current problems and programmes are identified and proposed for the better development of coal gangue resource utilization. I believe that after the introduction and implementation of relevant policies, the gangue can be practically applied to various related fields, and its utilization rate will be improved again. Thus reducing the waste of resources, to do with the concept of environmental protection.

## References

[1] XU Lei, ZHANG Hua, SAN Shuxun. Geochemical behaviour of trace elements in coal gangue [J]. Xi'an: Coalfield Geology and Exploration, 2002, 30(4): 1-3.

[2] ZHOU Shuangxi, CHEN Yimin, ZHANG Wensheng. Chemical and temperature complex activation of gangue and its gelling properties [J]. Nanjing: Journal of Southeast University (Natural Science Edition), 2005, 35(S1): 172-176.

[3] Gao Lingfeng. Characteristics of coal gangue components and analysis of current status of resource utilisation[J]. Jiangxi coal science and technology,2022(04):233-235+238.

[4] Yan Guojin, Wang Chunhua. Research on the preparation of cordierite-based porous glass ceramics from coal gangue [J]. Chongqing: Mining Safety and Environmental Protection, 2009, 36(6): 31-33.

[5] Cui Zengdi,Sun Henghu. Preparation and properties of gangue tuff-like paste filling material［J］. Beijing: Journal of Coal, 2010(6):896-899.

[6] LIU Guoqiang, WU Jianguo, WANG Chenyang, et al. Research on the current status of coal gangue resourcing technology [J]. Maanshan: Modern Mining Industry, 2021, 37(10): 130-132.

[7] CHANG Jiwen,DU Genjie,DU Jianlei,SHI Xiaoli. Current situation, problems and suggestions of comprehensive utilisation of coal gangue in China[J]. China environmental protection industry,2022(08):13-17.