

# Research on Utilization of Biomass Pyrolysis and Desulfurized Ash

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## Abstract

Coal plays the most role in Chinese energy structure. In recent years, coal combustion has caused a huge amount of serious environmental problems. This study documented the current research progress which was fused on the conversion and utilization of desulfurization ash. Biomass pyrolysis could be the most suitable method to convert the desulfurization ash into an available resource, due to the poor hydrophilicity, difficult degradation and easy deliquescence of desulfurization ash.

## Keywords

Desulfurized Ash; Biomass; Pyrolysis.

## 1. Introduction

In recent years, with the continuous improvement of environmental pollution control requirements, the emission of sulfur dioxide in coal flue gas has been effectively controlled.[1-3].China is currently generally treated with a semi-dry method, that is, a calcium compound such as  $\text{CaSO}_3$ ,  $\text{Ca}(\text{OH})_2$ ,  $\text{CaO}$  such as a desulfurizer as a medium, which is delivered as a desulfurizer as a medium. The main components of the desulfurization ash are  $\text{CaSO}_3$ ,  $\text{CaO}$ ,  $\text{Ca}(\text{OH})_2$  and  $\text{SiO}_2$ , so there is a certain degree of chemical instability. Desulfurification granularity, low density, poor hydrophilicity, difficult to degrade, easy to solve[4].The pH of the elimination of the desulfurization ash is high, high alkali, and the heavy metal content is low[5].The main disposal measures of the current desulfurification are still simple stacking, which not only occupies a large amount of land, which dust and leach have secondary pollution to the atmosphere, land, water resources, etc[6-7].

## 2. Desulfurized Ash is Used in Building Materials

Desulfurized ash is a light gray powder, similar in appearance to cement, with water content of 0.02-0.36wt.%, the bulk density is 0.85-1.0t/m<sup>3</sup>, and its true density is 2.25-2.69 t/m<sup>3</sup>. Some studies have found that desulfurized ash will harden like cement after compaction by water pressure, so desulfurized ash has the potential to replace lime powder as a composite cement and mortar substrate. Li et al.[8] added desulfurized ash to the preparation of cement in different proportions, and tested it through a large number of control experiments. Adding different proportions of desulfurized ash to the cement mineral structure changes, cement density and specific surface area, setting time and compressive strength, free expansion rate and other angles to analyze the experimental results. The results show that the desulfurization ash content accounts for about 7.0% of total material, which enhances and supplements the compressive and flexural properties of cement. Studies have found that the use of modified desulfurization ash, strengthening agent, gypsum and so on. As raw materials to prepare fillers for building materials such as hollow bricks can promote the hydration reaction of slag, and generate a spatial grid structure with certain structural strength and stable properties[9]. The

above are the main research directions of the application of desulfurized ash in the building materials industry. However, the desulfurized ash contains more than standard sulfate compounds. When these sulfate compounds enter the cement and are used to formulate concrete, they will further cause deliquescence and cause micro-expansion of cement products and concrete buildings due to the production of crystal water due to the hydration reaction. It reduces the stability of cement and concrete and brings hidden dangers to construction projects.

### 3. Desulfurized Ash for Soil Improvement

Desulfurized ash has a higher pH, and some studies address soil acidification in the South, the use of the desulfurization ash to alkaline soil conditioner, achieved good results in the experiment planted white clover Huiya, the amendment can effectively promote the alkaline hydrolysis of nitrogen, phosphorus, and potassium in the soil, and significantly promote the growth of plants[10]. Although the slight alkalinity of desulfurized ash is effective in improving acidic soil, it is difficult to control the amount of desulfurized ash, and there is no experiment to prove whether the acid soil after the improvement of desulfurization ash has potential harm to the human body, and further analysis and research are needed.

### 4. Desulfurization Ash is Used for Sewage Treatment

Desulfurized ash has the characteristics of small particle size, large specific surface area and rich in CaO and SiO<sub>2</sub>, has the research potential of preparing sewage treatment. Some studies have found that desulfurization ash ceramsite fillers are prepared by mixing desulfurization ash with clay and dewatered sludge in appropriate proportions. the removal rate of COD and total phosphorus in municipal sewage can reach more than 80%, and the removal rate of ammonia can reach more than 90% [11]. Desulfurization ash has a significant effect on sewage treatment, but due to the complex physical and chemical properties of desulfurization ash, uncontrollable reactions are prone to occur in the process of sewage treatment.

### 5. Application Prospect of Desulfurization Ash

With the increasing of environmental protection in China, the utilization of desulfurization ash has become an urgent problem to be solved. As a building material, soil improvement and sewage treatment, desulfurization ash has a limited performance. Currently, most of the research was still kept in the laboratory stage. Therefore, it is difficult to carry out large-scale industrial implementation. The annual output of biomass waste in my country is huge, and calcium-based compounds in desulfurized ash have long been proven to have a significant catalytic effect on biomass gasification. If the desulfurized ash is use as additive in biomass pyrolysis process, it can not only achieve efficient conversion of biomass, but also complete resource utilization of desulfurization ash. Therefore, studying and regulating the reaction process of co-pyrolysis desulfurization ash and biomass to prepare high-quality gas and biomass semi-coke loaded with calcium compounds can achieve the multiple purposes of converting solid waste, protecting the environment and saving investment. The development and implementation of this research is in line with my country's long-term goal of "carbon neutrality" and has broad application prospects and social value.

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