Study on Dust Control Technology of Coal Port

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Abstract: The port loading and unloading mainly includes ten leading commodities such as coal, iron ore, container, food, liquid chemical industry and petroleum, including coal, iron ore, grain and other stocks with light qualification, which are often placed in the storage and transportation links during the loading and unloading process, such as stamping, storage yard, ship unloader, etc., and the location of the unloading point of the transportation belt, etc., will be accompanied by serious dust pollution, especially in the windy season. The diffusion and diffusion of port dust in the atmosphere is the main cause of the pollution of suspended solids. In order to further improve the ambient air quality of Rizhao City, avoid the harm of dust to the production personnel and unnecessary loss of equipment and facilities, the environmental protection department has studied the port dust control technology to realize the rationality, safety and economy of production.

1. Introduction

Dust pollution endangers the atmosphere and surrounding environment, causes environmental disputes and damages the corporate social image[1]. There are also security issues. Combustible dust has the risk of fire and explosion; high dust concentration, poor visibility, affecting vision, walking and driving may cause danger. Dust pollution is often accompanied by serious economic losses. The cavitation loss of raw materials and its recovery and cleaning affect the performance of mechanical and electrical equipment. Port dust pollution is a worldwide public hazard, which brings many problems.

2. Hazards of Dust Pollution

2.1. Injury to Human Body

Dust contains organic particles and inorganic particles. It is a kind of mixed dust. In the environment, long-term pollution of dust, especially in dust less than 5 microns, respiratory system diseases are inevitable for employees[2]. Long term excessive intake will cause various lung diseases, allergies, exogenous allergic alveolitis. Production and operation personnel, such as simple non-specific respiratory stimulation, are often exposed to dust, chemicals and biological factors, such as human skin, respiratory system, heart, liver, kidney and other systems, which have stimulation, sensitization and biological effects, especially pneumoconiosis is very harmful to human health.

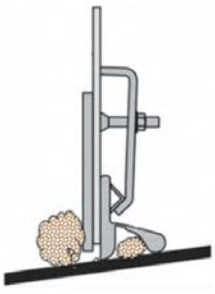

Figure 1 Double layer coal spill prevention and dust control device

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2.2. Explosion Caused By Dust

Bulk cargo transportation in ports is mostly in closed or semi closed silos, in tents and closed belt corridors, dry as dust, and fully mixed with air to form a certain concentration of suspended aerosol state. In case of fire or electric spark, the mixed gas may produce dust explosion, which will cause great damage and loss to people and property.

3. Generally Speaking, Port Dust Pollution Includes

Materials are stacked, loaded, unloaded and transported in the open air, which is characterized by local dust, long duration, wide range of influence and serious dust. In most ports, conventional measures such as covering and watering are mainly adopted for dust control[3]. According to the different properties of the materials that produce dust, according to the causes of dust pollution and the characteristics of the materials, the comprehensive control and characteristic control measures are adopted to control the dust.

3.1. Dust Suppression Solution for Vehicle Room

In view of the problem of coal dust escaping during the operation of the dumper, the dry fog system of the dumper is improved[4]. The spray nozzle of the original dry fog system is arranged on the tipping side of the dumper, but in the actual operation project, there is also the problem of dust escaping from the non tipping side of the dumper. In order to solve this problem, the dry fog system was reformed. Install the pipe nozzle on the non tipping side of the dumper. In this way, there is dry fog around the dumper funnel to minimize the dust emission.

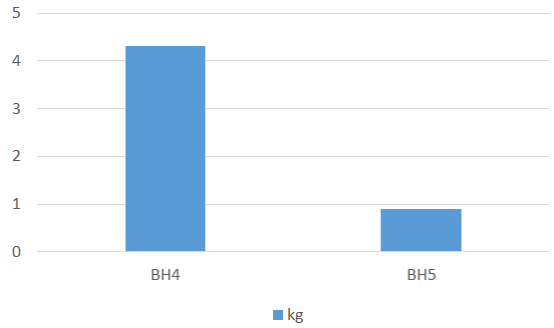

Figure 2 Comparison of ten thousand tons coal falling volume of BH4 and BH5 belt transportation lines

The original dust remover in the car dumper room is an old dry bag type dust remover. Due to the high humidity of the air in the operation site, it is easy to block the bag of the dust remover, and the actual use effect is poor. In view of this situation, the main body of the dust remover is transformed into the wet electrostatic precipitator of the coal transfer system by using the original air duct and fan[5]. The wet electrostatic precipitator of the coal transportation system is mainly composed of a pre pretreating device, a spray system, a positive and negative pole electric field system, a water level control system, a water supply system, a thermal insulation system, a whole machine control system and a sewage discharge device[6]. The basic working process is: the air containing coal dust is sent to the pre-treatment device through the air duct[7]. The device transmits the air containing coal dust to the water tank through the nozzle, so as to make the water fully contact with the dust in the air. Through this step, 80% of the large particle dust can directly fall into the water tank, and the remaining 20% of the fine dust is mixed with the water mist, passing through the pipeline It is delivered to the wet electrostatic precipitator to make the fine dust firmly adsorb on the water film through the effect of electric field. The flushing water flows into the ash hopper at the lower part of the dust remover. After treatment, the mud is discharged to the lower belt to realize recycling.

3.2. Accurate Watering for Material Operation

Due to the large drop in stacking operation, dust pollution is very easy to occur. Mainly through the sprinkler installed at the head of the stacker, spray water while stacking to reduce dust. At present, the operation mode of constant water spray is mainly adopted, which can not be adjusted according to the moisture content of coal and the change of weather and wind speed. In this way, excessive or insufficient water spray will occur, which is likely to cause waste of water resources or dust pollution due to insufficient water spray. In order to achieve accurate sprinkling, it is necessary to monitor the moisture content of coal and the wind speed of the stacking site in real time[8]. Through the installation of microwave moisture meter on the pit belt of the dumper, the real-time monitoring of coal moisture content on the belt is realized at the same time of unloading operation. At the same time, anemometer is installed in the storage yard to monitor the wind speed of the stacking operation site in real time. The test results are fed back to the sprinkler control system at the head of the stacker, and the system determines the amount of water sprinkled according to the settings in the database. The water sprinkled is adjusted by controlling the opening and closing of the electric valve of the sprinkler line. This realizes the closed-loop control of the water sprinkled in the stacker operation, and avoids the waste of water resources caused by the excessive water sprinkled or the dust pollution caused by the insufficient water sprinkled Problem, achieve accurate watering.

3.3. Coal Leakage Transformation of Ship Machinery

During the operation of the ship loader, there is coal leakage in the guide chute of the cantilever belt conveyor. In rainy days or in the case of transporting sticky coal, the back coal leakage of the cantilever belt conveyor is particularly serious, which requires a lot of manpower and material resources for special cleaning and collection, and has a certain impact on the environment. After a long-time investigation on the site, it is found that the coal leakage and dust generation of the loaders are mainly concentrated in the material transfer of the tail car and the cantilever leather return belt[9]. According to the investigation, there is a device for using the boom to drop coal for recovery on the loaders of foreign projects, but it can't realize the full-automatic recovery. It needs to be cleaned manually. At present, there is no automatic coal recovery device for the boom of loaders in China, all of which are cleaned manually.

Install the full-length material receiving plate under the fixed arm of the ship loader, install the coal storage funnel, material chute and accessories at the tail of the boom belt conveyor. After the coal leakage is collected by the material receiving plate, it will fall back to the coal storage funnel during the boom pitching process. In the horizontal position, the boom can open the gate of the coal storage hopper. Through the recovery chute, the coal can be cleaned and dropped at the head of the BM belt conveyor to realize the automatic cleaning of the coal accumulation,[10]. In order to prevent frozen coal or sticky coal from falling off and recovering automatically in winter, a vibration motor is set on the side wall of the funnel, and two small vibration motors are set under the coal receiving plate to assist in cleaning the sticky coal. At the same time, a monitoring camera is set above the coal receiving plate and the funnel respectively, so as to observe the coal storage situation and clean up in time.

Serious coal spilling occurs at the hopper of the head of the original ship's tail car. Due to the small size of the funnel at the tail car, when there is a large flow situation, the materials will fall on both sides of the funnel, and a chute can be added under the head to recover the spilled coal. Make a recycling chute to connect with the original tailcar funnel, and make holes under the funnel to recycle the scattered coal into the original chute. If limited by space, the angle of recycling chute is limited. To prevent coal accumulation, a vibration motor can be installed under the chute. The boom head of the ship loader adopts a first-class drum cleaner, which has poor cleaning effect, resulting in serious coal sprinkling on the boom return belt. Therefore, a set of easy to disassemble sweeper is added to the boom head drum. Furthermore, two sweepers are arranged at the head drum of the tail car to ensure the cleaning effect. Compared with the traditional scraper sweeper, it has the advantages of high mechanical strength, good wear resistance and high temperature resistance, high cleaning precision, convenient installation and advantages.

3.4. Improvement of Dust Control at the Head of Belt Conveyor

In the process of coal port loading and unloading operation, a large number of coal dust and slime remained on the surface of the belt conveyor, a large part of which fell on the ground at the turning point of the head of the belt conveyor, causing certain pollution to the surrounding environment. At the same time, due to the environmental protection requirements, the water spray is increasing, the humidity of coal is large, and in winter, the spilled slime freezes on the ground, which causes great hidden danger to the site cleaning and safety. To solve this problem. A set of collection and transfer device for coal spilled on the head of belt conveyor is designed. Add a dust collection box at the lower part of the hopper at the head of the belt conveyor. The dust collection box and the funnel outlet are provided with an upper and lower retractable sealing device to realize seamless connection and ensure no leakage in the dust collection process. A special support is installed under the dust collection box, and the heavy box and the empty box are replaced by the modified tractor, so that the collected scattered coal dust can be treated intensively, and the site environment is kept clean and comfortable. It can also be used in winter to reduce the environmental pollution caused by dust at the head of belt conveyor.

4. Dust Recycling

At present, some ports collect tens of tons of coal dust every day through various equipment and facilities. How to deal with it is particularly important. If it is not handled correctly, it is very easy to cause pollution to the surrounding environment. Generally, the coal dust cleaned in the port area is stored nearby and then loaded directly. As the coal collected is mainly pulverized coal, secondary dust will be generated in windy weather, and dust pollution is very easy to be generated in shipping operation. How to properly deal with the collected coal dust can not only achieve the goal of environmental protection, but also can be reasonably recycled. It is an urgent problem to be solved, so a coal dust treatment workshop has been set up in the port to compress the coal powder into coal blocks, then store and ship it. It will have a good effect.

5. Conclusion

In the past two decades, with the rapid growth of national economy, the sales and transportation of coal presents a prosperous scene. The state and local governments have successively invested and built a number of coal terminals in Huanghua port, Qinhuangdao port, Tianjin port, Caofeidian port, Jingtang Port and other places to ensure the safety of energy needed for national economic development. However, on the other hand, the drift and diffusion of pulverized coal dust generated in the process of coal port loading and unloading in the air with the wind constitutes one of the main components of air particle pollution in coastal port cities, and becomes the source of dust pollution in surrounding cities. With the continuous improvement of environmental protection requirements in Beijing Tianjin Hebei region, it is urgent to solve the problem of dust pollution in coal port.

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