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Application of RCO Treatment on Automobile Coating Drying Waste Gas

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ABSTRACT

With the increasingly serious environmental problems, China has adopted more and more strict industrial production emission policies. Haze pollutes the weather and limits the production of polluting enterprises have seriously affected the normal production process of the factory. The pollutants discharged in automobile manufacturing process are increasing, and the environmental pollution caused by automobile coating needs to be solved urgently. Because a large amount of solvent-based paint is used in the production process, the pollution caused by volatile organic compounds is difficult to avoid. RCO is a new technology in the field of automobile coating waste gas treatment. Application of RCO in automobile coating waste gas treatment is studied.

1. Introduction

In the automobile industry, the most seriously affected is the automobile painting workshop. In order to deal with the environmental problems of exhaust gas pollution and reduce the unit cost of products in order to save energy consumption, Ensure the normal production of enterprises and improve the level of economic profit margin.

2. Automotive Industry Overview

China's pollution of the automobile industry has been from only paying attention to development to equal emphasis on development and environment, and to three stages of development that must be environmentally friendly. The production of substandard automobile production has been shut down and restricted, which seriously restricts the normal development of automobile industry. On the one hand, the exhaust gas pollution is serious, on the other hand, the energy consumption is amazing, which has become the key point of energy saving and emission reduction in automobile industry[1]. The main components of automobile painting exhaust gas are benzene volatiles and other organic compounds. At present, the emission reduction of automobile painting exhaust gas is mainly realized by updating spraying materials, improving spraying technology and improving spraying equipment to realize the green environmental protection of automobile painting process. Over the past decade, with the increasing severity of environmental problems, China has introduced a number of emission standards for automotive spray paint. For example, in Shanghai, enterprises with non-methane total hydrocarbon emission concentrations of more than 30 mg/m3 and volatile organic compounds per unit coating area of more than 35 g/m2 are not allowed to put into production, thus promoting the improvement and re-planning of the treatment system for automotive paint gas, while the treatment of volatile organic compounds depends on the consumption of electricity and natural gas, and the energy saving pressure is enormous.

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3. Automobile Painting Exhaust Gas Treatment System

Due to the production characteristics of large amount and low concentration of automobile painting exhaust gas, the original treatment method of automobile painting exhaust gas is to discharge directly into the atmosphere, and then limit the chimney height and emission rate. Now it is necessary to limit the density index of toxic and harmful exhaust gas. According to the latest automobile painting exhaust gas treatment requirements, automobile painting exhaust gas treatment system came into being. The final purpose of automobile painting exhaust gas treatment system is to meet certain emission concentration standards and meet the requirements of production laws and regulations and industry standards[2]. According to the composition and treatment principle, the automobile painting exhaust gas treatment system mainly includes three parts: the filtration system, the concentration system and the combustion system. The function of the second part is to treat the characteristics of low density and large displacement of automobile painting exhaust gas. In order to improve the treatment effect and reduce the treatment cost, the exhaust gas of automobile painting is concentrated by the concentration system, and the maximum reduction volume is 1/25 of the original volume. After burning automobile painting exhaust gas, the highly polluting volatile toxic and harmful substances are decomposed and purified to meet the emission standard and then cooled down[3].

4. RCO Equipment Working Principle

4.1 Start-up Phase

When you press the start button, the system automatically enters the clear program. Power valves EV06 and EV08 open immediately EV04EV05, EV02. Closure of EV03 and EV07, The fan F1 and F2 start at a frequency controlled by the frequency converter 40 Hz. RCO total purge time of the equipment is 12 minutes. During work, EV01, EV04, EV02, EV03 switch valve automatically switches between two sets of beds every 3 minutes, And according to the PLC procedures alternately blowing. EV05 will automatically turn off after 30 seconds of each sync, And the backblow line will be cleared at the same time[4].

After pre-blowing, the equipment will be in a "ignition temperature rise" state. At this point, EV01, EV02, EV03, EV04, EV05 automatically switches and executes at fixed intervals and in sequence. Burners automatically detect whether the high and low pressures of LPG are within the set values of 2.5 to 5.0 mbar. If normal, it will automatically ignite and run at full power (fire). At this point, the fan F1 and F2 operate at full power. As the valve switches, the temperature of catalyst bed and heat storage bed increased alternately. As the temperature of the catalyst chamber rises to 330°C, Exhaust valve EV07 open, a new air valve EV08 closed, the exhaust gas is gradually introduced into the catalyst bed, the catalyst burner began to ignite. If due to equipment failure or inadequate detection conditions resulting in "ignition failure ", the device will automatically enter the "half blow sweep" program, for 12 minutes, then re-ignite the burner to start normal operation.

4.2 Normal Working Phase

As the temperature of the catalyst bottom chamber rises to 330°C, The device enters a "catalyst activation" state, Exhaust valve EV07 open, a new air valve EV08 closed, And EV01, EV02, EV03, EV04, EV05 at constant time intervals and in order. It will switch and use automatically. From the bottom A the regenerator bed, fully exchange heat with the regenerator, and then into the catalyst bed A. the temperature is higher than the ignition temperature and starts to rise. The catalytic reaction passes through the combustion chamber, Access to catalyst bed B, for catalytic reactions And then into B. regenerative bed The heat exchange with the circulating bed B stores the heat carried by the catalyst bed day and the oxidized exhaust gas in the circulating bed B[5].

Bed inversion interval is set according to the concentration of organic matter in exhaust gas and the heat generated after decomposition, and written into the PLC program. The inverted bed spacing should not only save combustion fuel, but also consider the ability to adjust the temperature of the regenerated bed according to the actual working conditions. Usually set to 2-5 minutes, the device is set to flip the bed every 3 minutes.

When the interval reaches 3 minutes, the switch valve automatically opens the intake valve B (EV02), closes the intake valve A (EV01), closes the exhaust valve B (EV04), and then opens the exhaust valve A (EV03). which flows from the bottom of the B of the organic waste gas regenerator bed, fully exchanges heat with the regenerator, and then enters the catalyst bed B. and the catalytic reaction begins at a temperature higher than the ignition temperature. Through the combustion chamber, it enters the catalyst bed for the catalytic reaction A, and then enters A. regeneration bed which heat exchange with the heat storage bed A and store the heat carried by the oxidized exhaust gas in the catalyst bed A and the heat storage bed A. Under normal working conditions, the two groups of beds alternately treat exhaust gas.

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4.3 Completion Status

When you press and operate the stop button, the equipment will be in the "air supply stop" state. At this point, Exhaust valve EV07 closed, a new air valve EV08 open. Fan is controlled by PLC program, and enter the low frequency running state. Automatically, the program detects whether the temperature of the two sets of regenerators is below 200°C. If the temperature is higher than this temperature, please repeat purge and cooling. The temperature enters the shutdown procedure. Follow the PLC security closure procedure, Will automatically shut down the burner, Close blower F2, EV01, through pneumatic valve EV02, EV03, EV01, of EV04 and EV05 closed pneumatic valves EV02, EV03, EV04 and EV05, The device will return to its initial state[6].

4.4 Other Working Conditions

If the catalyst bed and combustion chamber temperature is below 330°C, the burner will automatically ignite and operate at low power. The new air valve EV08 will automatically open and automatically dilute the VOC gas concentration to reduce the system temperature if the temperature of the catalyst bed is higher than 400°C, if the catalyst bed temperature is too high for the recommended protection temperature 480°C of the catalyst support product, the exhaust valve will be closed based on EV08 opening EV07, and the signal will be sent to the drying chamber control system to open the exhaust valve. It opens and the exhaust gas is discharged directly to the RCO equipment. Rapid cooling in the operating temperature range.

5. Energy Saving and Emission Reduction Technology for automobile Spraying

All kinds of optimization measures and improvement measures are needed to reduce the pollution and energy consumption in the process of automobile atomization, especially through the transformation of energy saving and emission reduction in the process of automobile atomization. Technological advances are gradually passing through highly polluting, high-energy processes, such as the use of phosphorus-free detergents to reduce environmental impacts, and the use of non-carbon fluorinated refrigerant to reduce ozone layer damage. By using phosphorus treatment processes (such as zirconia conversion membranes) to simplify and optimize phosphorylation processes, chromium-free passivation processes or direct passivation processes are used to reduce the consumption and pollution of passion energy. By optimizing the process, appropriate integration can be made to reduce energy consumption and pollution[7]. For example, by optimizing the process, spraying the intermediate coating immediately after the sealing PVC and combining the two drying processes can not only save equipment investment, but also reduce energy consumption and reduce exhaust emissions at the same time. After electrophoresis, the pollutants in the wastewater are usually purified. By concentrating the wastewater and sending it back to the ultrafiltration tank, the pure water can be reduced and the sewage discharge can be reduced. After conversion, spray paint to reduce investment. Consumption and sewage treatment costs will be recovered immediately. With the continuous development of automobile industry, the price and status of automobile will gradually decline. In the process of automobile spraying, the original top layer, middle layer and bottom layer spraying can completely cancel the intermediate spraying process after optimizing and improving the quality of electrophoretic structure process. The original two-layer function is achieved by improving the material on the electrophoretic film. In the replacement of highly toxic materials with harmless or less destructive materials (for example, the replacement of highly irritating and hazardous materials), energy saving is achieved while improving the process, and an increase in emission reduction of aromatic solvent coatings can be considered. At present, European standards require the automotive spraying industry to use water-soluble rather than solvent-based, China must also start to promote the work. It is necessary to start the research and development of related processes and materials as soon as possible, while reducing emissions, such as coating curing techniques, may be difficult to save energy.

Compared with traditional solvent-based coatings, the successful development of energy-saving powder coatings can reduce pollutant emissions, but the curing process requires higher energy structure, and the appearance is based on solvent, it is not as uniform as the coating and needs further improvement. The focus of improving the current automotive spray energy and emission reduction process is to optimize, merge or cancel some optional processes in the automotive spray process. Some processes are optimized by improving and adjusting the energy saving and environmental protection of materials. In the future, much progress needs to be made in simplifying and reducing automotive sprays. Promote simple spraying vehicles, reduce unnecessary style and gloss requirements, simple, economical and environmentally friendly, and reduce vehicle life in general due to low pollution and low energy consumption of existing vehicle spraying processes. Form a new energy-saving fashion[8].

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6. Conclusion

With the continuous updating of technology, especially the development of new materials, the content of toxic and harmful substances in the exhaust gas of automobile painting will be continuously reduced, and the related treatment technology will be continuously improved under the stimulation of environmental protection policy.

References

[1] Chai Yuan, Chen Ziqi, Study on Energy Saving and Emission Reduction Technology of Automobile Coatings [J]. China Science and Technology Innovation and Application ,2017(14):128.

[2] Cao Xiaogan. on Energy Saving and Emission Reduction Technology of Automobile Coatings [J]. Electroplating and finishing, 32(02):67-69.

[3] He Quan. Preliminary Study on Energy Saving and Emission Reduction of Automobile Coatings Equipment Manufacturing ,2020(06):230-231.

[4] Zhang Zhen, Wang He. Analysis on Energy Saving and Emission Reduction Technology of Automobile Coatings [J]. Heilongjiang Science,2010,7(24):32-33.

[5] Fan Guiping. Study on Energy Saving and Emission Reduction Technology Based on Automobile Coatings [J]. Science and Technology Vision,2018(13):16-17.

[6] Analysis on VOCs Emission Reduction Approach in Automobile Painting Industry Ren Yong, Jia Li. Environmental impact assessment,2015(04).

[7] Study on B1:B2 Construction and Application of New Vehicle Coatings Technology [J]. and Liu Jihua, Zhang Dongmin, Rong Yong Gong. Shanghai paint, 2019(03).

[8] Cai Xiaoli, Zhai Liupeng. Energy Saving and Emission Reduction Technology for Automobile Coatings Modern Coatings and Coatings 21(3):46-48.

DOI: https://doi.org/10.30564/frae.v3i3.2659