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Analysis of the Direction of Air Pollution Control and the Current Status of Treatment Technology

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Abstract:

Atmospheric pollution is becoming more and more serious, and there is an urgent need to reduce greenhouse gas and pollutant gas emissions in order to meet the needs of the dual-carbon target. Therefore, this paper aims to explore how to use low carbon emission technology and green energy to reduce pollutant gas emissions in industry and agriculture, while further analyzing how to find a coordinated development in the process of urbanization to reduce the emission of pollutant gases such as carbon and sulfur. Low carbon emission and digitalization and intelligent joint can effectively control the emission of pollutant gases, the effective use of clean energy can greatly reduce the emission of pollutant gases, and most of the green energy will not cause other environmental pollution. By improving the desulfurization technology existing problems such as high cost, low efficiency, easy to cause secondary pollution, and increase efforts to develop new energy vehicles, especially fuel cell vehicles is an important direction for energy saving and reducing gas emissions in the future. The analysis in this paper can provide the future direction of how to control air pollution and how to improve the existing control technology, which is important for air pollution control.

Keywords: Low carbon emissions, green energy, desulphurization, urbanization.

1. Introduction

Atmospheric pollution poses a serious threat to ecosystems and human health, not only destroying the growth environment of plants and animals, but also inducing a variety of acute and chronic diseases and even causing death. Among them, greenhouse gases such as carbon dioxide(CO_2) aggravate global warming, causing glacier melting, sea level rise, species extinction and ocean acidification; sulfur oxides emissions lead to acid rain, altering the pH of water quality and indirectly affecting human health through the biological chain. Today's large-scale use of primary energy has exceeded the ecological carrying

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capacity. Therefore, there is a need for effective control and management of air pollution.

The current technology of controlling pollutant gas emissions is relatively mature, but still needs to be improved. Nie Wei proposed that by improving management and planting technology and establishing the corresponding model, this method can reduce carbon emissions to a certain extent [1]. However, it consumes time as well as manpower Ouyang Xue analyzes the characteristics of Xi'an public transport operation and the current pollution situation, and points out that by improving the quality of vehicle oil, further improving the refining technology, and reducing the sulfur content of diesel fuel, the sulfur-containing tailpipe emissions can be effectively reduced [2]. However, it cannot solve the problem fundamentally and the cost is high. As well as pre-combustion desulfurization, such as heavy oil desulfurization, fluidized bed desulfurization, flue gas desulfurization and other methods [3]. But there are problems such as low efficiency, high cost, easy to cause secondary pollution and other problems that still need to be solved.

The purpose of this paper is to study the use of low carbon emission technology and intelligent combination in the agricultural and industrial fields to develop the reduction of carbon emissions and construction waste combustion treatment of pollutant gas emissions, through which the intelligent reduction of energy consumption can also be effective in reducing carbon emissions. Focus on improving some of the problems of today's desulfurization technology, so that it is more perfect to meet the current needs. The development of new energy vehicles, so that new energy to open up the field of development. In addition, the vigorous promotion of new energy vehicles can effectively reduce carbon emissions and eliminate sulfur-containing exhaust, which not only reduces the use of fossil fuels but also has a huge inhibiting effect on carbon and sulfur emissions.

2. Basic Overview of Air Pollution and Sources of Pollution

Atmospheric pollution is roughly divided into four categories according to the scope of its impact: localized pollution, such as the direct impact of smokestack exhaust; regional pollution, such as pollution of the atmosphere in industrial zones and their vicinity; wide-area pollution, such as the Beijing-Tianjin-Hebei region; and global pollution, which involves atmospheric pollution on a global scale. Global air pollution includes the greenhouse effect, ozone layer depletion and acid rain. The focus of this paper is on carbon and sulfur emissions, which are related to air pollution and acid rain.

The sources of atmospheric pollution are divided into natural and anthropogenic sources. Natural sources are those that release pollutants into the environment from natural causes, such as volcanic eruptions, biological decay, etc.; anthropogenic sources are those that produce atmospheric pollutants as a result of human living activities and production activities. Theoretically, the air pollution caused by natural sources will be regulated by the earth itself, so that the ecological balance will be automatically restored, but man-made pollution has exceeded the carrying capacity of the environment, so it can be considered that air pollution is mainly caused by human activities.

Anthropogenic sources of pollution come from a number of sources, including fossil fuel combustion, fertilizer use, agricultural emissions, motor vehicle tailpipe emissions, and other pollutants generated in industrial production activities. Through the major air pollutant emissions by sub-industry in China in 2014, it can be seen that the electric power and heat production and supply industry emits sulfur dioxide(SO_2)as high as 621.2×104t/a. The CO_2 emissions from the electric heater and water industry accounted for 46.6% of the total CO_2 emissions in China [3].

With the development of urbanization and the increasing standard of living of the people, the number of automobiles has risen, which has led to a rise in the amount of exhaust gas emitted. The components of automobile exhaust mainly include seven substances, including carbon dioxide, nitrogen oxides, and particulate matter (this section only discusses the relationship between automobile exhaust and carbon emissions). As of the end of June 2024, the number of motor vehicles in the country reached 440 million, and the increase in tailpipe emissions has further exacerbated carbon emissions.

Construction levels have also risen significantly, and the rise of various factory manufacturing industries has contributed to environmental pollution. Specifically, the construction land carries large-scale material and energy consumption activities, which generate a large amount of carbon emissions; a large number of industrial production processes occur on the construction land, and the industrial processes such as lime, cement and glass production are important sources of carbon emissions; in addition, the construction land also carries a large number of industrial, urban life and other waste, and its incineration and landfill treatment will also generate carbon emissions [4].

3. Combination of low-carbon emission technology and intelligence

In the process of air pollution control, low-carbon emis-

sion technology plays an important role as a key means to reduce pollutant and greenhouse gas emissions.

In the management of air pollution, low-carbon emission technology plays an important role. As an important source of carbon emissions in China, the emission reduction of agriculture is of non-negligible significance to atmospheric governance. Reducing carbon emissions by optimizing agricultural production methods has a positive effect on air pollution management. Agricultural carbon emission sources mainly include fertilizers, pesticides, electric energy consumption, straw burning and so on. Digital agriculture reduces the use of chemical fertilizers and pesticides and reduces agricultural carbon emissions through precise fertilization and application techniques. For example, with the use of sensors and data analysis, fertilizers can be precisely placed according to soil fertility and crop needs. Promote the comprehensive utilization of straw to avoid carbon emissions from straw burning. For example, straw can be converted into biomass energy or organic fertilizer to realize the recycling of resources.

As an important strategy for the development of modern agriculture in China, digital agriculture is of great significance for improving the quality, efficiency and competitiveness of agriculture as well as accelerating the development of agriculture with high quality and low carbon [5]. Although the development of digital agriculture has been incorporated into the national strategy, there are still shortcomings in its development drive.

In the literature on digital agriculture, its development is categorized into four first-level indicators. It is worth noting that among the four first-level indicators, the composite development level of digital agriculture development dynamics scored relatively low, which indicates that more attention should be paid to and sustained enhancement of the driving force for the subsequent development of digital agriculture [6].

In the industrial sector, for every 1% increase in industrial intelligence, total carbon emissions will increase by 0.147%. For every 1% increase in industrial intelligence, carbon productivity increases by 0.85% on average. From the viewpoint of carbon productivity, industrial intelligence has an obvious inhibitory effect on carbon emissions [7] . Taking the green and low-carbon construction of large-span loess long highway tunnel as an example, the low-carbon construction technology system covers the three technical dimensions of intelligent decision-making informatization platform construction, rapid construction process innovation, waste resource recycling and intelligent control of environmental impacts to reduce energy consumption, accelerate the construction efficiency and reduce carbon emissions [8]. For enterprises, energy saving and carbon reduction are also essential, Daikin Group established an energy management system to effectively track the data of the whole plant, analyze the carbon reduction, and reduce the $CO_2$2921t cumulatively during the period of 2020-2023 [9]. China's industry is still in the early stage of intelligence, and the development of industrial intelligence still promotes total carbon emissions. However, at this stage, the carbon reduction potential of the development of industrial intelligent technology is great.

4. Control of sulphur oxide pollution

Sulphur oxides are emitted into the atmosphere and combine with water vapour to form acids such as sulphurous acid and sulphuric acid, which fall to the ground with precipitation to form acid rain. Acid rain enters the water circulation system and changes the pH of water bodies, affecting water quality and thus destroying the balance of the entire water cycle. Acid rain will lead to soil acidification, affecting the growth of plants, which are the basis of the biological chain. Damage to plants will further affect the animals that feed on plants, destroying the entire biological chain. In addition, acid rain also corrodes buildings and damages the human respiratory system and skin, among other things.

Pre-combustion desulphurization can effectively reduce the formation of sulfur oxides, and through the research and development and application of highly efficient desulphurization, denitrification, dust removal, volatile organic compounds treatment and other technologies, as well as exploring ways to recycle and utilize the potential resources in the exhaust gases, such as sulfur yellow recycling and the use of residual heat, it can significantly reduce the emission of pollutants and transform the wastes into valuable resources, thus realizing the double enhancement of the economic benefits and environmental benefits. Desulfurization technology mainly has four ways: physical desulfurization, mainly using physical methods to separate the elemental sulfur, applicable to some of the lower sulfur content, easy to separate; chemical desulfurization, the sulfur will be converted to other substances through chemical reactions to remove, commonly used in industrial waste gas treatment and other scenarios; biological desulfurization, the use of microorganisms to remove sulfur by metabolism, has the advantages of low-cost, environmentally friendly, etc, and is suitable for desulfurization of biogas and so on; Electromagnetic wave desulfurization, the use of electromagnetic wave energy to make the sulfur element reaction or separation, in some specific industrial production has the prospect of application. From the perspective of technological development, the existing desulphurization technologies, although relatively mature, still have many deficiencies. It is necessary to innovate

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and improve the existing technology to meet the desulfurization needs of different coal types and different working conditions. Compared with traditional physical desulfurization, electromagnetic wave desulfurization has the advantages of low energy consumption and high efficiency, but at this stage, the equipment applicable to electromagnetic wave desulfurization is not mature enough, and the operation cost is high and prone to secondary pollution. The biological desulfurization technology is from a single pollutant to multi-pollutant synergistic treatment, from high energy efficiency to green low-carbon technology, in the coal chemical acid gas desulfurization biological desulfurization technology desulfurization efficiency, stable operation, after treatment of the emission of exhaust gas fully meet the requirements of the relevant national standards [10]. In the future, biological desulfurization will become the core supporting technology for industrial green transformation. The research of innovative desulfurization technology also faces the challenges of technology transformation and industrialization. It is necessary to strengthen the technical research as well as the technical and economic evaluation so that the new technology can be widely applied.

5. Combination of new energy and fuel cell vehicles

The development of urbanization leads to the increase of motor vehicle emissions, for example, in Taiyuan city, among the four types of public transportation, the cab has the largest emissions, i.e., the emission reduction effect is most significant after pure electrification, which is promoted to the whole country to reach 36,432,700 t per year. Since the number of buses is larger than the number of cabs in Taiyuan city and the whole country, the emission reduction proportion is also very large among the four types of public transportation, which is promoted to the whole country to reach about 35,363,900t (Table 1) [11].

Table 1: Emission Reduction Statistics of Motor Vehicle Electrification in Taiyuan City

	Taiyuan prefecture level city in Hebei	Shanxi Province	nationwide
rental car	20.14	75.29	3643.27
town bus	15.11	61.07	3536.39
Vehicle for transportation of fresh and live agricultural products	0.11	1.08	40.46
courier	0.04	0.08	13.93

In addition to the traditional internal combustion engine energy saving and emission reduction technology, the development of new energy vehicles is a new direction, especially fuel cell vehicles, which are not only highly efficient and energy-saving, but also do not emit pollutants to produce greenhouse gases, and the application prospects are very attractive [3].

6. Conclusion

Low-carbon development is a necessary path to sustainable development, industrial production volume rises resulting in a sharp increase in carbon emissions, the development of industrial intelligence is a low-carbon emission control in the industrial field of extremely promising technology, not only can reduce energy consumption to achieve green energy saving, but also reduce management costs. Digital agriculture can reduce the use of chemical fertilizers and pesticides, reducing agricultural carbon emissions. In terms of desulfurization technology, the existing technology has shortcomings such as low efficiency, high operating costs, easy to cause secondary pollution, and other issues still need to be resolved, but the biological desulfurization technology will become the future of desulfurization on the road to a new direction. The rapid development of urbanization has increased the number of motor vehicles, in order to better reduce automobile emissions, green innovative technology is also essential. The use of clean energy can reduce the use of primary energy, most of which will not cause environmental pollution to produce greenhouse gases, is the key way to control air pollution in the future, and the combination of fuel vehicles and the development of automotive electrification spread to the country, can reach an amazing amount of carbon reduction. The development of new energy vehicles has very good future prospects; the development of this technology urgently needs to be put on the agenda. Atmospheric pollution will cause irreversible damage to nature, and we still need to actively implement carbon reduction policies. The development of new energy sources will reduce the use of fossil fuels and thus reduce the

emission of harmful gases and greenhouse gases.

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