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Analysis of Haze Problem in Beijing-Tianjin-Hebei Region of China: Causes and Solutions

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Abstract: This paper analyzes the causes and countermeasures of severe haze in the Beijing-Tianjin-Hebei region, based on the status quo of haze in China, especially in the Beijing-Tianjin-Hebei region. This paper analyzes the causes of severe haze in the Beijing-Tianjin-Hebei region, based on the complexity and multi-factor nature of the haze problem in the Beijing-Tianjin-Hebei region, it is difficult to control. The government needs to adopt comprehensive policy measures, including strengthening the management of industrial and transportation emissions, promoting the use of clean energy, optimizing the energy structure, improving domestic pollution control, and strengthening meteorological early warning and monitoring, so as to gradually reduce the problem of smog, improve air quality, and protect people's health. It is considered that quantifying the role of anthropogenic emissions and climate change is the premise of rational control of air pollution, and it is proposed to implement stricter and more specific air pollution prevention and control policies. Some solutions are listed that require joint efforts from all sectors of society to effectively reduce the smog pollution problem in the Beijing-Tianjin-Hebei region, improve air quality and protect people's health.

Keywords: Beijing-Tianjin-Hebei region, anthropogenic emissions, climate change, air pollution, prevention and control policies

1. Introduction

Haze is made up of fog and haze, but they are very different from one another. Haze is the term for the aerosol system of dust, sulfuric acid, nitric acid, and other airborne particles that obstruct vision. The combination of fog and haze is a typical meteorological occurrence in many Chinese cities, and it is referred to as "haze weather" for early warning and forecasting purposes. The combination of certain climatic factors and human activity leads to haze. A high-density population's social and economic activities will unavoidably produce a significant amount of fine particulate matter (PM 2.5). The concentration of fine particulate matter would keep rising if the emission surpasses both the carrying and atmospheric circulation capacities [1].

China's haze issue is concentrated in big cities and industrialized areas. Coal burning, vehicle exhaust and industrial emissions are the main causes of smog. Without proper controls, pollutants and particulate matter in the atmosphere can combine with water vapor to form haze [2].

The haze has caused serious pollution to the environment. It increases the concentration of particulate matter in the air, affecting air quality and visibility. It also pollutes water, soil and plants,

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disrupting the balance of ecosystems. In the context of the rapid economic development, the haze pollution problem of various cities has become more serious, especially in the Beijing-Tianjin-Hebei region. It is undeniable that the haze weather has a direct impact on the mental health of residents, which is easy to make residents have anxiety and depression, which is not conducive to the improvement of the mental health level of residents [3].

This paper studies the status and causes of haze in the Beijing-Tianjin-Hebei region, and analyzes the preventive measures to solve the haze. Based on the analysis of various aspects, it puts forward solutions corresponding to relevant aspects and relevant objects, which have certain significance for the solution and prevention of haze in the Beijing-Tianjin-Hebei region, as well as for the solution and prevention of haze in China and around the world.

2. Analysis of the causes of serious haze in the Beijing-Tianjin-Hebei region

It was learned from the news conference of *China Meteorological Administration* in February 2013 that since the beginning of winter, haze has occurred frequently in most areas of central and eastern China, and the number of haze days is generally more than 5 days. Meteorological experts said that there are mainly three reasons for more and more heavy haze weather:

compared to previous years, China experienced weaker-than-usual cold air activity in January, with low wind speeds and significantly higher frequencies of stable atmospheric conditions in most central and eastern regions, especially in North China, where the percentage of stable air reached 64.5%, the highest level in almost a decade. This makes it easier for pollutants to build up in the near ground layer, leading to frequent hazy weather; Second, wintertime high background aerosol concentrations encourage the development of haze. Third, the near-ground atmosphere will become more stable during hazy weather, exacerbating the haze's formation and raising air pollution.

The haze problem in the Beijing-Tianjin-Hebei region is one of the serious environmental challenges facing China. The main reasons include: (1) Emissions from industrial activities: The Beijing-Tianjin-Hebei region has a large number of industrial enterprises and heavy industries, and industrial emissions are one of the main causes of smog. Many factories use traditional high-polluting production processes, which emit large amounts of pollutants such as particulate matter, sulfur dioxide and nitrogen oxides. (2) Energy consumption structure: The region has long relied on highly polluting energy sources such as coal, and activities such as coal-fired power generation, industrial production and home heating have released large amounts of pollutants, exacerbating the smog problem. (3) Traffic exhaust emissions: The Beijing-Tianjin-Hebei region has a large number of vehicles, and vehicle exhaust emissions are an important source of smog. Urban traffic congestion, aging vehicles, the use of low-quality fuel and other factors have led to increasing vehicle exhaust emissions. (4) Topographic and meteorological conditions: The Beijing-Tianjin-Hebei region has flat terrain, complex meteorological conditions, a stable winter monsoon, easy stagnation of air mass, and poor atmospheric diffusion capacity, resulting in pollutants lingering in the atmosphere, the formation of haze. (5) Rural domestic pollution: Domestic pollution in rural areas is also one of the important reasons for the smog problem, rural coal heating, domestic waste incineration, pesticide application and other activities release a large number of pollutants.

Temporal and spatial distribution characteristics of PM2.5 and PM10 concentrations that derived from air quality monitoring stations of Shijiazhuang city in the whole year of 2015 were analyzed, and the relation between fine particulate matter and each of the meteorological factors, such as wind speed, rainfall, temperature, pressure, and social economy was studied. The results showed that PM2.5 and PM10 presented a periodic trend, mainly concentrated in the autumn and winter seasons, and their spatial distribution was not balanced. The factors affecting the temporal and spatial distribution of PM2.5 and PM10 included natural meteorological elements and social economic factors. Meteorological elements were important impact factors that led to smog concentration,

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transfer and diffusion, and social and economic elements were fundamental factors affecting the frequent haze in Shijiazhuang. So, the management of haze lies in the adjustment of the energy structure [4].

3. Quantify anthropogenic emissions and climate change

Quantifying the role of anthropogenic emissions and climate change is a prerequisite for rational management of air pollution, because such quantification can provide scientific basis and data support to help governments, enterprises and the public better understand the relationship between air pollution and climate change, and formulate effective management policies and measures.

Specifically, quantifying the impact of anthropogenic emissions on climate change can be assessed through climate models and scientific studies. These models and studies can analyze the impact of greenhouse gases (carbon dioxide, methane, nitrous oxide, etc.) released by human activities (such as burning fossil fuels, industrial emissions, deforestation) on the Earth's climate system, including rising temperatures, rising sea levels, and increasing extreme weather events. These impacts not only cause direct damage to the environment, but also have a negative impact on human health, economic and social stability.

4. Implement stricter and more specific air pollution prevention and control policies in key areas

The haze control in China's Beijing-Tianjin-Hebei region is a long-term and complex process, involving measures from multiple aspects. Here are some recommended prevention measures.

For the public in the Beijing-Tianjin-Hebei region, the basic situation of haze pollution, the impact of the situation, prevention and control measures are three aspects of the cognitive "mapping" survey. The results show that most residents have a certain understanding of haze pollution, and think that energy consumption dominated by coal and vehicle exhaust are the main causes of haze pollution in Beijing, Tianjin and Hebei. Nearly 70% of residents believe that smog pollution is the most important factor affecting human health; Most residents will choose protective measures in hazy weather, and think that adjusting industry and energy structures should be the primary measures to control haze pollution in Beijing, Tianjin and Hebei. 34% of residents think that they should choose buses and bicycles as far as possible for short-distance travel. By accurately understanding the status quo of public perception of haze pollution in the Beijing-Tianjin-Hebei region, the effective path selection of haze pollution control in the Beijing-Tianjin-Hebei region is proposed from both the government and the public [5].

Haze control in China's Beijing-Tianjin-Hebei region is a long-term and complex process involving measures from multiple aspects. Here are some preventive measures.

In terms of industrial emission reduction, pollution control in industrial enterprises should be strengthened, efficient and low-emission technologies should be promoted, strict pollutant discharge standards should be implemented, and the development of high-pollution industries should be restricted. In terms of energy structure adjustment, people should reduce the dependence on coal and other highly polluting energy sources, accelerate the development and utilization of clean energy sources (such as natural gas, wind energy, and solar energy), and promote the transformation of the energy structure in a clean and low-carbon direction. In terms of traffic management, people should promote public transportation, encourage the use of clean energy vehicles, control vehicle exhaust emissions, build intelligent transportation systems, optimize traffic organization, and reduce congestion and exhaust emissions.

In terms of ecological restoration, the protection and restoration of the ecological environment should be strengthened, green landscape belts and ecological corridors should be built, and vegetation

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coverage and improve air quality should be increased. In terms of scientific and technological innovation, we should increase investment in scientific and technological research and development, promote the innovation and application of environmental protection technologies, and improve the efficiency and level of pollution control. Policies and regulations should formulate and implement more stringent environmental laws and regulations and policies and measures, strengthen environmental supervision and law enforcement, strengthen accountability, and form a long-term mechanism. In terms of international cooperation, we should strengthen cooperation and exchanges with the international community, jointly cope with global issues such as climate change and environmental pollution, share experience and technology, and build a clean and beautiful home on earth [6].

These measures require the joint efforts of the government, enterprises, all sectors of society and individuals to effectively reduce the haze pollution problem in the Beijing-Tianjin-Hebei region, improve air quality and protect people's health.

5. Conclusion

This paper analyzes the haze situation in the Beijing-Tianjin-Hebei region, and concludes that the haze problem in the Beijing-Tianjin-Hebei region is complicated and multi-factor, and it is difficult to control. The government needs to adopt comprehensive policy measures, including strengthening the management of industrial and transportation emissions, promoting the use of clean energy, optimizing the energy structure, improving domestic pollution control, and strengthening meteorological early warning and monitoring, so as to gradually reduce the problem of smog, improve air quality, and protect people's health. Quantifying the role of anthropogenic emissions and climate change is a prerequisite for rational management of air pollution, because such quantification can provide a scientific basis and data support to help governments, enterprises and the public better understand the relationship between air pollution and climate change, and formulate effective management policies and measures. Specifically, quantifying the impact of anthropogenic emissions on climate change can be assessed through climate models and scientific studies. By quantifying the role of anthropogenic emissions and climate change, the contribution of air pollution to climate change can be more clearly recognized, thus attracting the attention of the government and the public to air quality management. Haze control in China's Beijing-Tianjin-Hebei region is a long-term and complex process, involving measures from multiple aspects. Some preventive measures are listed, which require the joint efforts of the government, enterprises, all sectors of society and individuals to effectively reduce the smog pollution problem in the Beijing-Tianjin-Hebei region, improve air quality and protect people's health.

References

[1] *Huo S., Tao N., and Zhenfeng M. (2012) The characteristics of haze distribution in China and the characteristics of haze circulation in North China. S6 Atmospheric composition and weather climate change.*

[2] *Danping S., and Guoqin H. (2014) The causes, hazards and prevention measures of haze weather in China. Advances in Environmental Protection, 04:101-111. doi:10.12677/aep.2014.44015.*

[3] *Fang W., Guoli L., and Lankai G. (2021) Study on the influence of haze weather on residents' mental health: A case study of Beijing-Tianjin-Hebei Region [J]. Chinese Science and Technology Journal Database (full-text edition) Medicine and Health, (2):191-191.*

[4] *Zheng L., and Zejia C. (2017) Spatiotemporal characteristics and influencing factors of haze in Shijiazhuang City, Hubei Agricultural Sciences, 20, 056(009):1652-1657.*

[5] *Qin W., Huifeng L., and Jinghai A. (2017) Survey on public cognition of smog pollution in Beijing-Tianjin-Hebei region [J]. Journal of China Academy of Environmental Management, 27 (6): 5.*

[6] *Jun Z., Yan S., Danlin C. (2017) Public understanding of smog pollution: A survey on the residents' perception of air pollution in Haidian District [J]. Studies in Science of Science.*