

Study on Atmospheric Environmental Problems and Countermeasures in Shanxi Province

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Abstract: The Nineteenth National Congress emphasized the concept of "winning the battle of defending the blue sky". The outstanding atmospheric environmental problems in Shanxi Province seriously restrict the construction process of beautiful Shanxi Province and affect the construction of ecological civilization in China. In view of this, this paper studies and analyses the existing atmospheric environmental problems in Shanxi Province and the causes of the atmospheric environmental problems combs the impact of atmospheric environmental problems on nature, society, and human beings. We combines with the development of Shanxi Province itself, from strengthening propaganda, establishing and perfecting relevant environmental laws and regulations, strictly implementing the proposed measures and norms for the prevention and control of atmospheric pollution, developing circular economy, controlling gas emission sources and dust production sources, intensifying afforestation and other aspects to put forward countermeasures to improve the atmospheric environment in Shanxi Province.

1. Introduction

Shanxi Province is located in the Loess Plateau, where the ecological environment is relatively fragile. It is also a key province in the national poverty alleviation and development work. There are two concentrated areas with special difficulties. The production model of "high input, high consumption, and high emission" has been used to develop local economy for a long time, but this fairly extensive development mode has brought serious ecological and environmental problems to Shanxi Province, especially the atmospheric environmental problems. The Nineteenth National Congress emphasized the idea of winning the Blue Sky Defense War. Under this background, Shanxi Province has made positive efforts in dealing with environmental problems and achieved certain results, but there are still many problems. At present, there are few studies on the atmospheric environment in Shanxi Province, which seriously restricts the construction process of beautiful Shanxi Province. Therefore, it is necessary to study and analyze the atmospheric environmental problems in Shanxi Province and put forward corresponding countermeasures.

2. Atmospheric Environmental Problems in Shanxi Province

2.1 Large amount of atmospheric pollutants

According to the statistics of Shanxi Statistical Yearbook 2018, the emission of waste gas in Shanxi Province in 2017 was 3632 billion standard cubic meters, sulfur dioxide was 2522 364,000 tons, and nitrogen oxide was 2999 439,000 tons. Compared with other provinces and municipalities in North China, it is second only to Hebei Province, far higher than Beijing and Tianjin. From a national perspective, Shanxi Province's air pollutant emissions are also at a high level.

2.2 Composition of atmospheric pollutants is complex

The main components of air pollutants in Shanxi Province are PM_{2.5}, O₃, and PM₁₀. The days of PM_{2.5} as the main pollutant account for 40.9% of the total days of pollution, the days of O₃ as the main pollutant account for 44.9% of the total days of pollution, and the days of PM₁₀ as the main pollutant account for 14.3% of the total days of pollution. There are many other pollutants. Like CO, SO₂, NO₂, etc.

2.3 Poor ambient air quality

According to the 2008 Shanxi Environmental Annual Report, only Datong, Lvliang, Xinzhou and Shuozhou are the four regions with the proportion of excellent days (excellent rate) of more than 60% in Shanxi Province, and the period with high excellent rate is only concentrated in April, September and October. The months with high proportion of heavy pollution days concentrated in January, February, November, and December. In recent years, the trend of changes of important atmospheric indicators in Shanxi Province has shown a downward trend as a whole (see Figure 1), but it is still not optimistic.

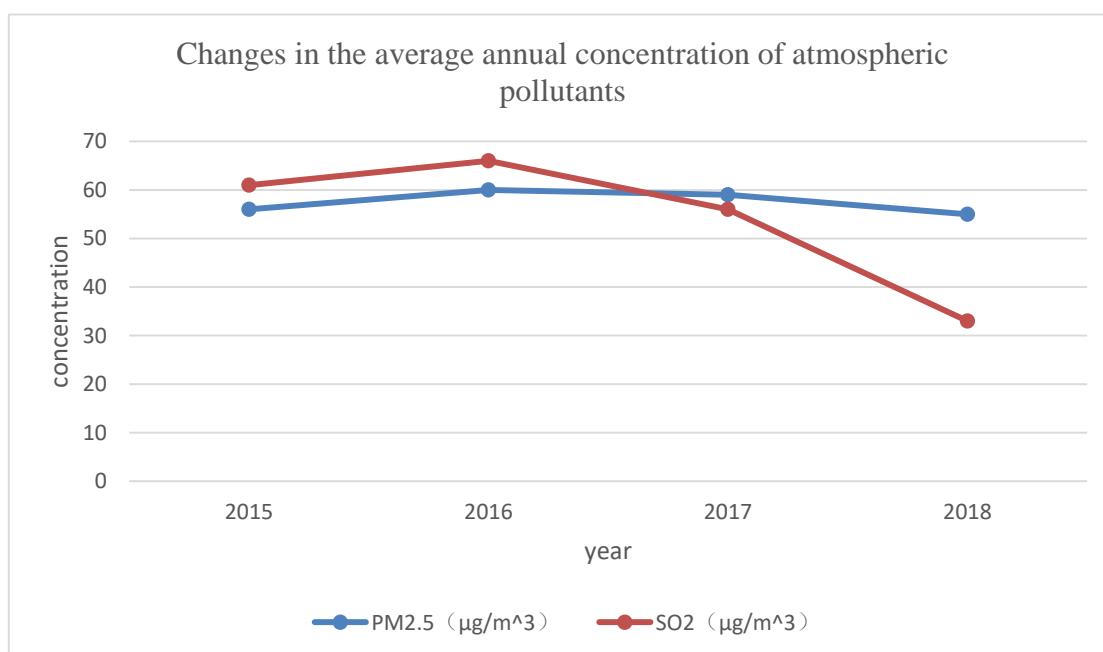


Figure 1 Data Source: Annual Report of Shanxi Environmental Air in 2018

2.4 Significant differences in air quality among provinces and regions

There are significant differences in the air quality in different regions of the province. First, the number of days of heavy pollution in the whole year varies. In 2018, the number of days of heavy pollution in Taiyuan reached 11 days, while in the areas like Shuozhou and Datong, it was 0 days. Compared with 2017, the total number of days of heavy pollution in the province showed a downward trend, but with some exceptions, such as Yangquan and Jincheng, the number of days of heavy pollution in 2018 increased by 3 days and 4 days respectively compared with 2017. The pollution of Linfen is the most serious in all regions of the province. The days of heavy pollution in 2017 and 2018 have reached 35 and 27 days respectively. The bad air condition in Yuncheng is second only to Linfen, reaching 21 and 16 days respectively. Only a few areas have good ambient air conditions, such as Datong, Jincheng, and Lvliang, compared with other areas in the province, the air conditions are relatively good. (See Table 1)

Table 1 Days of Heavy Pollution in Shanxi Province

| City | Days | |
|----------|-------------|------------|
| | 2017 (year) | 2018(year) |
| Taiyuan | 16 | 11 |
| Datong | 0 | 0 |
| Yangquan | 12 | 15 |
| Changzhi | 7 | 8 |
| Jincheng | 16 | 20 |
| Shuozhou | 8 | 0 |
| Jinzhong | 10 | 3 |
| Yuncheng | 21 | 16 |
| Xinzhou | 14 | 12 |
| Linfen | 35 | 27 |
| Lvliang | 2 | 0 |

Secondly, according to the Shanxi Environmental Status Bulletin in 2017, the average number of days to reach the standard of 11 prefectural-level cities in 2017 is 200 days. Among the 11 prefecture-level cities, Datong has the highest number of days to reach the standard, which is 301 days, followed by Luliang, Shuozhou, and Xinzhou, which are 245 days, 242 days and 213 days respectively. Taiyuan, Jincheng, and Yuncheng had 175, 166 and 161 days respectively, and Linfen had the lowest number of days, 128 days. (See Figure 2)

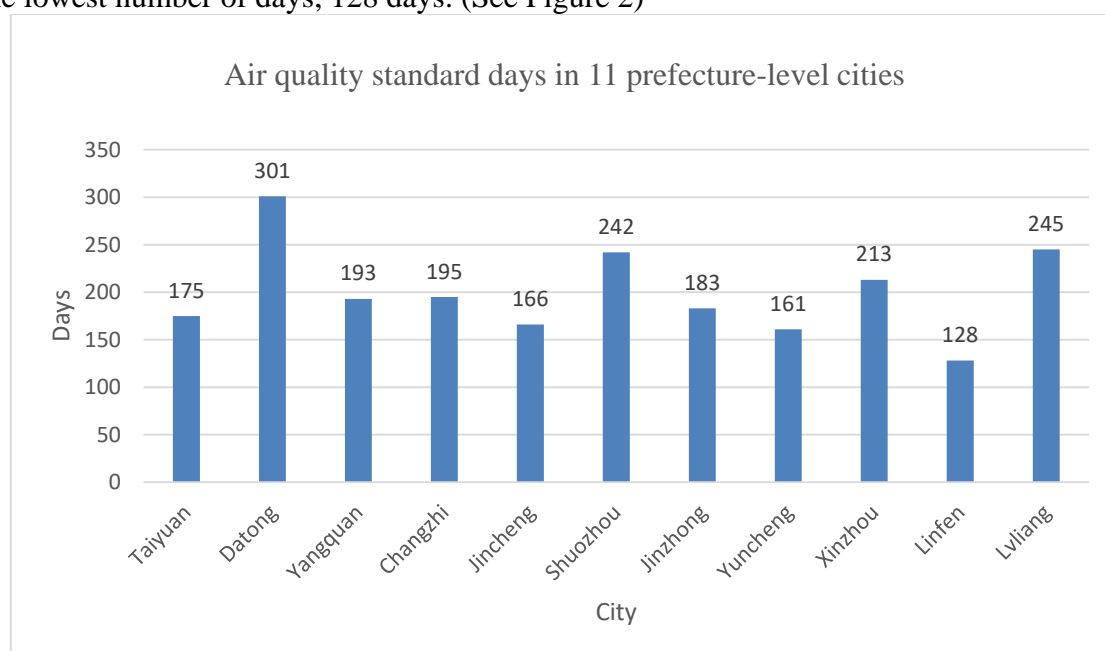


Figure 2 Air quality standard days in 11 prefecture-level cities

3. Reasons for Atmospheric Environmental Problems in Shanxi Province

3.1 Natural factors

Because Shanxi Province belongs to the Inland province, surrounded by mountains, the sea breeze is difficult to affect Shanxi and it has formed a strong continental climate. At the same time, because of the cold air mass in Inner Mongolia, the winter is long and cold. Therefore, residents in Shanxi province need a lot of heating to maintain their basic needs in winter, and coal combustion is the main heating source, which produces a large number of gas pollutants, and ultimately forms the atmospheric environmental problems.

3.2 Historical factors

Shanxi Province is rich in coal resources. It has relied on coal resources to develop the local economy for a long time and has made great contributions to the national economic growth. A large proportion of electricity supply in Beijing and Tianjin comes from Shanxi Province, which accounts for more than half of the total annual power generation in China. Depending on coal-fired power for steelmaking, the steel industry was once the pillar industry in Shanxi Province and an important part of Shanxi's economic growth. In recent years, although Shanxi Province has implemented the strategy of transformation and leapfrog development, the steel industry is still the backbone of Shanxi's economic development. Overexploitation of coal and combustion of a large number of coal, coupled with low quality of coal, will produce a large number of harmful pollutants in the combustion process, thus affecting the atmospheric environment.

3.3 Economic factors

The economic development of Shanxi Province is relatively backward. First, the funds for environmental protection are insufficient. In 2017, Shanxi Province spent 3.287 billion yuan on environmental protection, of which 2.408 billion yuan was dedicated to the prevention and control of air pollution. Compared with other provinces in the whole country, insufficient investment in air pollution prevention has resulted in the lack of motivation for air pollution prevention and control, which makes it difficult to solve the problem of air environment. Secondly, due to the lack of financial support, the coal-to-gas conversion project is only implemented in some areas, and it is not fully covered in the whole province. Some residents in rural areas still burn loose coal for heating, which is also an important and indispensable factor of atmospheric environmental pollution.

3.4 Cognitive factors of residents

In our country, Shanxi Province belongs to the underdeveloped areas, and its opening degree is limited. The residents' ideological awareness is relatively closed. They do not have a very good understanding of the severity of coal combustion pollution. They do not have a strong sense of environmental protection and environmental responsibility. Especially in remote rural areas, residents often use incineration methods to treat domestic waste and do not have corresponding prevention and control equipment. In addition, agricultural production will lead to the abuse of pesticides and fertilizers, which will cause damage to the atmospheric environment.

4. Impact of air pollution

In recent years, the energy economy of Shanxi Province has suffered tremendous blow due to the decline of international energy demand and price, exhaustion of resources and the development of the new energy revolution. At the same time, various environmental problems are emerged, especially the atmospheric environmental problems, which have irreversible impact on all aspects.

4.1 Increased probability of respiratory infectious diseases and other diseases, endangering human health

People need to breathe to keep alive. According to health data, a person breathes about 20,000 times a day and inhales 150-200,000 cubic meters of air. Air is a necessary substance for human daily life. Toxic substances in the atmosphere enter the human body with human breathing, causing damage to human respiratory system, blood circulation system, and digestive system. The harm of air pollutants to human beings is mainly manifested in respiratory diseases, infectious diseases and irritation of eye and nose mucosa.

4.2 Increased haze

According to the national air quality ranking in 2019, several cities in Shanxi Province, Linfen, Jincheng and Lvliang, ranked in the bottom 50.

There are two main hazards of haze: one is the harm to human body, the increase of infectious diseases, heart and blood vessels, lung injury; the other is the harm to traffic and life, affecting

traffic safety and living environment.

4.3 Harm plants and destroy vegetation coverage

The emission of sulfur dioxide and fluoride will directly damage the vegetation, destroy the leaves of the vegetation, and cause plant wilting. Pollutants in the atmosphere into the biological chain of the ecosystem will eventually pose a threat to the human body.

4.4 Climate deterioration

Smoke particles are emitted from factories, power welding, automobiles, and heating equipment, which make the air very turbid and block the sunlight, thus reducing the solar radiation reaching the ground and hindering plants from absorbing carbon dioxide and releasing oxygen.

Over industrial cities, a large amount of waste heat emitted rises into the air, resulting in a meteorological heat island effect.

4.5 Secondary pollution

Pollutants through various atmospheric effects produce serious secondary pollution, such as photochemical smog, reduced visibility, acid rain and so on, which will directly threaten human life and safety but also lead to serious traffic accidents. In the No. 1 Dispatching Order for Heavily Polluted Weather in 2018, it was notified that the peak concentration of PM_{2.5} hours in a heavily polluted weather process in Shanxi Province may reach 200-300 micrograms/cubic meters, and the concentration of SO₂ may reach 1000 micrograms/cubic meters. The Chinese Air Pollutant Emission Standard stipulates that the concentration of SO₂ should be controlled at about 45 micrograms/cubic meters.

5. Control measures of air pollution

Environment is the home on which human beings live. In recent years, with the exploitation of resources, economic development, and people's strong demand, Shanxi Province has paid more and more attention to environmental governance. Although Shanxi Province has made a lot of efforts in environmental protection, great achievements have been made in controlling environmental deterioration and improving urban air quality. However, the air pollution in Shanxi is still serious, and the air quality level in the country is in a backward state, which can not meet the relevant national standards. The countermeasures are as follows.

5.1 Strengthen propaganda, raise people's awareness of environmental protection and jointly control air pollution

Nowadays, with the development of mass media, people's ability to obtain news has been greatly enhanced. Therefore, shooting short films to spread the spirit of prevention and control of environmental pollution to the whole province is a method. By shooting environmental protection propaganda videos, people can understand the focus of the province's work, so as to achieve the effect of internalization in the heart and externalization in the line.

5.2 Establish and improve relevant environmental laws and regulations to regulate the emission behavior of various types of enterprises

Strictly abide by the emission limits of 33 kinds of atmospheric pollutants stipulated in the Law of the People's Republic of China on the Prevention and Control of Air Pollution. The average emission concentration of pollutants in the exhaust canister of treatment facilities shall not exceed the prescribed limits. Atmospheric pollutants shall not be discharged through the exhaust canister without organization. Standard monitoring points shall be established.

5.3 Strictly implement the measures for prevention and control of Air Pollution

During the 13th Five-Year Plan period, Shanxi put forward a number of measures to prevent and control air pollution, including: first, to increase the capacity of air pollution transport corridor cities

to eliminate excess production, and then to extend it to other urban areas; to promote the relocation of enterprises with hopeless and serious pollution within the built-up areas of cities; to ban illegal "small scattered pollution" enterprises; strive to achieve negative growth of coal consumption in cities with total coal consumption control.

5.4 Standardize the development of energy industry and develop Circular Economy

5.4.1 Eliminate backward production capacity, clean up and rectify construction projects in industries with seriously excessive capacity.

In order to improve environmental pollution, accelerate energy conservation and emission reduction, and cope with global climate change, Shanxi Province must eliminate backward production capacity, which is determined by the current situation in the province and the global situation. We should adjust the structure of industries with excessive capacity, restrain duplicate construction, strengthen the role of tax leverage, strictly implement laws, regulations and technical standards on environmental protection, energy conservation, clean production, and product quality, and create a market environment benefiting to the withdrawal of backward capacity.

5.4.2 Promote the use of clean energy.

The installation of solar power generation and well network wind power generation will be established to reduce the proportion of thermal power generation and solid waste such as coal slag from coal incineration. At the same time, the emission of waste gas pollutants including sulfur dioxide, particulate matter, fluoride and so on will be reduced. In addition, it can also slow down the mining speed of mineral resources in Shanxi Province and save resources.

5.4.3 Industrial enterprises stagger production time.

Especially in the winter heating period, in order to reduce the haze weather, the operation mechanism of individual enterprises to stop operation or take turns is adopted.

5.5 Strengthen air monitoring, control exhaust gas emission sources and dust production sources, focusing on the centralized emission of pollutants during heating period.

At present, there are many chemical enterprises and energy processing enterprises that discharge waste ash into the atmosphere, resulting in very serious consequences.

Construction and road transportation will produce a lot of dust, which will aggravate air pollution. Therefore, dust removal sites, such as construction sites, cinder dumps, and desertified land, implement some valid method, such as closed dust removal, filter dedusting, electrostatic precipitator, water spraying or spraying, biological film and dust suppression, etc., to reduce dust in the air and clean the atmosphere.

5.6 According to the plan of Shanxi Province, we should intensify afforestation and increase the vegetation coverage of the whole province.

Although, in recent years, Shanxi Province has paid attention to afforestation and greening projects. However, according to the statistical data of 2016, Shanxi Province ranks 22nd among 32 provinces in China, with only 18.03% vegetation and 70% vegetation coverage in Taiwan Province. Therefore, accelerating desertification transformation and vigorously planting afforestation projects should continue to advance. By greatly increasing the vegetation coverage and improving the ecological environment of Shanxi, the economic development speed and economic benefits of Shanxi can be improved, and the economic transformation and upgrading can be accelerated.

6. Conclusion

To sum up, the air pollution in Shanxi Province is still very serious, so promoting the implementation of various measures should be put on the agenda as soon as possible, and should continue. Shanxi Province should change its economic structure of mineral resources exploitation, speed up the transformation of economic development mode, improve the quality and efficiency of

economic development, and build a healthy, efficient and harmonious new Shanxi.

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