Study on the Impact of Changes of Gaseous Pollutant SO$_2$ Index on Human Health in Gansu Plateau in the Past Three Years

Shangjun Liu
Department of Physical Education, Gansu Normal University for Nationalities, Hezuo Gansu 747000, China

Abstract. The literature data method, instrument measurement method and mathematical statistics method are used to track the changes of SO$_2$ in the Gansu Plateau in the past three years. The results show that the daily variation of SO$_2$ in the Gansu Plateau has a double peak, the monthly variation shows a "U" shape with high data at both ends, and the annual variation shows that the SO$_2$ index is decreasing year by year. In response to the above data changes, coping strategies are proposed from the perspective of human health.

1. Introduction
In recent years, with the rapid development of society and economy, people's lifestyles have undergone a major change. The means of transportation represented by cars have become a must-have for people's lives. However, the diversity and richness of life have caused environmental pollution to become increasingly serious. As people attach importance to and pursue health, enjoy a comfortable environment, and absorb clean air as a joint effort of individuals and society. To cope with the harm caused by environmental pollution, the state and local governments have successively introduced several related policies to jointly control environmental pollution.

2. Research objects and methods

2.1. Research Object
Impact of Gansu Plateau Air Pollutant Index on human health in the past three years.

2.2. Research methods

2.2.1. Literature method. Collecting relevant data on the impact of plateau air pollutant index on human health through library inquiry and China HowNet search, etc., to provide theoretical support for the smooth conduct of this research.

2.2.2. Instrument measurement method. An ultraviolet (UV) fluorescence spectrum SO$_2$ analyzer (model: EC9850) was used to detect the air pollutant index of the Gansu Plateau. The analysis yields detailed and real data. The EC9850 analyzer includes an optical sensor component and a basic component of an analog electronic signal preprocessor.
2.2.3. **Mathematical Statistics.** Statistical analysis was performed on the collected SO\textsubscript{2} data and corresponding results were obtained.

3. **Impact of SO\textsubscript{2} on human health**

SO\textsubscript{2} exists in the troposphere of the atmosphere and is one of the most important substances harmful to human health. High concentrations of SO\textsubscript{2} will cause air quality pollution to deteriorate, and SO\textsubscript{2} will harm human health in the form of aerosols. Up to now, there have been too many major incidents of SO\textsubscript{2} pollution in the world, causing human poisoning and even death. Because SO\textsubscript{2} is easily soluble in water, when SO\textsubscript{2} enters the human respiratory tract, it easily stays on the mucous membrane of the upper respiratory tract and generates highly corrosive sulfurous acid, sulfuric acid and sulfate, which enhances the stimulating effect on the upper respiratory tract. The smooth muscles of the upper respiratory tract and emergency response after stimulation, narrowing the respiratory tract. Bring a series of functional responses, reduce organ and bronchial cavity, increase airway resistance, in order to maintain normal breathing, the human body increases the overload of the respiratory tract, which has a serious impact on the human lung. SO\textsubscript{2} can also enter human blood, destroy human enzyme activities, and produce greater toxicity to the human body. \cite{1} For every 10 mg m\textsuperscript{-3} increase in SO\textsubscript{2}, the risk of wheezing in children increases 1.08 times. \cite{2}

There have been major air pollution incidents in history, one of which was the 1948 photochemical smog incident in Los Angeles, USA. As well as the heavy fog event in London, England 60 years ago, the concentration of SO\textsubscript{2} in the polluted air seriously exceeded the standard, causing 12,000 deaths. Subsequently, the British government began to reflect on the serious consequences of air pollution and formulated and promulgated the Clean Air Act, the world's first air pollution prevention bill. \cite{3}

4. **Changes of gaseous pollutants SO\textsubscript{2} in the Gansu Plateau in the past three years**

4.1. **Diurnal change of SO\textsubscript{2}**

It can be seen from Figure 1 that the daily change of SO\textsubscript{2} in the Gansu Plateau has a large peak period and a small peak period, from 8 am to 14 pm and 20 to 22 pm respectively. ug / m\textsuperscript{3} and 37 ug / m\textsuperscript{3}. The reasons for the analysis are mainly as follows: First, there are more vehicles during work in the morning and after work in the afternoon, and vehicle exhaust emissions are serious. Second, night life is rich, and people are active after work.

![Daily change of SO\textsubscript{2} in the past three years](image)

**Figure 1.** Diurnal variation of SO\textsubscript{2} gaseous pollutants in the Gansu Plateau in the past three years

4.2. **Monthly variation of SO\textsubscript{2}**

Figure 2 shows that the monthly variation trend of SO\textsubscript{2} concentration in 2017, 2018 and 2019 is similar, and the curve appears "U" shape, with SO\textsubscript{2} peak in January, February, November and December of each year, and the highest concentration is 73ug/m\textsuperscript{3}. In June, July and August of each year, SO\textsubscript{2} data is low, with the minimum concentration of 10 ug / m\textsuperscript{3}. In winter, the highest value of
SO₂ appears, which is directly related to the heating and vehicle flow, resulting in the increase of SO₂ emission.

![Graph showing changes in SO₂ over three years](image)

**Figure 2.** Monthly variation of SO₂ in the plateau of Gansu Province in the past three years

### 4.3. Annual change in SO₂

The data structure in Figure 3 shows that the SO₂ concentration was relatively high in 2017, with an average annual concentration of 13.8 ug/m³, and the SO₂ concentration was relatively low in 2018, with an annual average concentration of 12.3 ug/m³. The SO₂ concentration in 2019 was relatively low, and the annual average concentration was 10.1 ug/m³. According to the national "Ambient Air Quality Standard (GB3095-2012)" standards, the annual average of three years is within the scope of national standards, which is related to the strict national and local air governance in recent years.

![Bar chart showing annual changes of SO₂ in the past three years](image)

**Figure 3.** Annual changes of SO₂ gaseous pollutants in the Gansu Plateau in the past three years

### 5. Strategies for Scientific Physical Exercise to Improve Health from the Perspective of Environmental Science

#### 5.1. According to the characteristics of SO₂, choose a safe environment for physical exercise

The characteristics of SO₂ in the Gansu Plateau are obvious and there will be different degrees of pollution. Therefore, it is recommended that people in Gansu Plateau should scientifically understand the dangers of SO₂ during physical exercise, master the relevant knowledge of SO₂, and avoid physical exercise during the peak of the shuttle bus flow. When working on the roadside at work, taking into account the characteristics of high SO₂ concentration in winter and spring, you should choose to exercise indoors if possible, choose a safe environment for physical exercise, and improve your body's health index.
5.2. Actively promote environmental governance and improve the living environment

Environmental pollution also leads to a crisis of human survival. The harm of SO$_2$ to the human body is to enter the organs from the respiratory tract, destroy the normal functions of the organs, and then endanger human life. Therefore, pay close attention to the SO$_2$ emission path, control and control from the source, actively promote the improvement and governance of the large environment, improve people's living environment, and provide safe and clean air for human survival.

5.3. Reduce SO$_2$ emissions, purify the air, and reduce the health hazards of air pollution

Air pollution in the Gansu Plateau is relatively low, and the SO$_2$ emission channel presents a single feature. SO$_2$ is mainly derived from automobile exhaust and heating in winter and spring. It is recommended that localities adopt single and double number traffic restrictions and traffic diversions to minimize vehicle travel and control SO$_2$ emissions. In addition, we will speed up the transformation of shanty towns, change the heating method of residents who are heating outside in winter, and replace coal combustion by providing low-cost electricity and new energy to reduce air pollution at the source.

References

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