Academic Journal of Science and Technology
ISSN: 2771-3032 | Vol. 5, No. 1, 2023

Research on Environmental Pollution Control Strategies Based on Grey-scale Models

Jianbo Han[1], Meiying Li[2], Zeyu Sheng[3]

[1]School of Tianjin University of Science and Technology, Academy of artificial Intelligence, Tianjin, 300450, China
[2]School of Tianjin University of Science and Technology, Academy of Foreign Languages, Tianjin, 300450, China
[3]School of Tianjin University of Science and Technology, Academy of mechanical engineering, Tianjin, 300450, China

Abstract: With the continuous development of China's economy, the problem of environmental pollution is becoming more and more serious. The formulation and implementation of environmental protection policies have greatly promoted the development of resources and industries. At the same time, resource development and industrial development play an important role in the formulation of environmental protection policies, and the two influence each other and complement each other. Generally speaking, the better the environmental policy, the lower the level of pollution and the better the state of the environment. As major factors affecting the state of the environment, air pollution and water pollution have a guiding role in the formulation of environmental policies. In this paper, we study the relationship between air and water pollution and each influencing factor, and establish a mathematical model to filter out the main influencing factors of each. This paper examines the relationship between air and water pollution and each of the influencing factors. Continuing the previous environmental policies, the development trends of air and water pollution in China in the next ten years are predicted.

Keywords: Grey correlation model, Environmental pollution, Pollution control.

1. Introduction

The analysis of the factors influencing air and water pollution and the adjustment of industrial structure and resource development policies are of great significance to the formulation of environmental protection policies [1]. In recent years, the increasing greenhouse effect has become a serious threat to the survival and development of mankind, and during the two sessions of the National People's Congress in 2020, China set the goal of achieving "carbon peaking" by 2030 and "carbon neutrality" by 2060, with the aim of minimizing CO2 emissions. emissions to a minimum. As China continues to develop, the problem of environmental pollution is becoming more and more serious. The development and implementation of environmental protection policies play an important role in solving environmental pollution problems [2]. This paper will analyze data related to air pollution and water pollution, discuss the relationship between each factor and air and water pollution, adjust some resources and industries, and develop reasonable environmental protection policies. A grey correlation analysis model is used in this paper [3-4]. For solving the main influencing factors of water resources pollution, we carry out grey correlation analysis with 11 influencing factors. And the correlation analysis shows that the main influencing factors of water pollution are the amount of water resources per capita, the area of national nature reserves, and the forest coverage rate; for air pollution, we solve the correlation between its 4 indicators and 11 influencing factors separately, and finally the comprehensive analysis concludes that the main influencing factors of air pollution are the amount of water resources per capita, the area affected, and the area of national nature reserves. The strongest correlation between water and air pollution is the amount of water resources per capita, and the weakest is the gross value of construction output, as shown on the page. In addition, we conclude that the trend of air pollution will decrease to a certain extent in the next ten years, and the trend of water pollution will increase to a certain extent in the next ten years [5].

2. The Basic Fundamental of Grey Models

In this paper, we consider 11 influencing factors affecting air pollution and water resources in the following order: per capita water resources, forest coverage, area of national nature reserves, total primary energy production, total secondary energy consumption, gross domestic product, value of agriculture, forestry, animal husbandry and fishery, total construction output, disaster area, industrial value added and total energy consumption. The grey correlation model is usually used to analyses the degree of correlation between vectors and vectors or between matrices and matrices, the greater the correlation, the greater the impact of the indicator and vice versa, the following is the basic principle of grey correlation analysis. Suppose there is a set of reference series [6-7].

x0 = {x0 (k)|k=1, 2..., n} = (x0 (1), x0 (2), x0 (n))

where k denotes the moment. Suppose there are m comparison series.

xi = {xi (k)|k=1, 2, m} = (xi (1), xi (2), xi (m)), i=1, 2, . . ., m

From the above two matrices, define the correlation matrix as follows.

$$\delta_i(k) = \frac{\min\min|x_0(t) - x_s(t)| + \rho \max\max|x_0(t) - x_s(t)|}{|x_0(k) - x_i(k)| + \rho \max\max|x_0(t) - x_s(t)|} \quad (1)$$

Call the above matrix the correlation coefficient of the comparison series xi to the reference series x0 at moment k, where $\rho \in [0,1]$ is the discrimination coefficient. Call the equations in (1) $\min\min|x_0(t) - x_s(t)|$, and $\max\max|x_0(t) - x_s(t)|$ are the two minimum differences and the two maximum differences, respectively. （The correlation coefficient defined in equation (1) is an

indicator describing the degree of correlation between the comparison series and the reference series at a given moment, and since there is a correlation coefficient at each moment, the information appears too scattered to facilitate comparison, for which we give.

$$r_i = \frac{1}{n}\sum_{k=1}^{n} \delta_i(k) \quad (2)$$

We call r_i as the correlation of the series xi to the reference series.

3. Results

3.1. The establishment of simulation model

As there are four indicators of air pollution, we find the correlation between each factor and each indicator, and then carry out a comprehensive analysis, the results of which are tabulated below.

Table 1. Correlation of each indicator of atmospheric resource pollution with 11 factors

Factors / Indicators	Water resources per capita	Forest cover	Nature reserve area	Total primary energy production	Total secondary energy consumption	Gross Domestic Product	Total output value of agriculture, forestry, animal husbandry and fishery	Total construction output	Area affected	Industrial value added	Total consumption
Sulphur dioxide	0.7292	0.7316	0.7294	0.6738	0.6085	0.5898	0.6203	0.5644	0.8162	0.6141	0.6535
Nitrogen oxides	0.7664	0.7572	0.7587	0.6637	0.6042	0.5721	0.6038	0.5437	0.8704	0.5944	0.6404
Fume (dust)	0.7827	0.7818	0.7863	0.7501	0.6186	0.5261	0.5893	0.4774	0.5231	0.5560	0.6891
Particulate matter	0.7823	0.7803	0.7788	0.6992	0.6207	0.5972	0.6345	0.5700	0.8451	0.6260	0.6743

As can be seen from the table, the maximum value is 0.8704, indicating that the amount of affected area has the greatest impact on NOx emissions. The minimum value is 0.4774, indicating that the total value of construction output has little impact on smoke (dust) emissions. On balance, the amount of water resources per capita has the greatest impact on air pollution, followed by the area affected and the area of national nature reserves.

3.2. Analysis of experimental results

Total water resources pollution and 11 other factors were integrated into the data from 2001-2021, the data were standardized and then the correlation between each factor and water resources pollution was calculated, the results of which are shown in Table 2 below.

Table 2. Ranking of atmospheric pollution in relation to various factors

Factors	Water resources per capita	Area affected	Area of National Nature Reserves	Forest cover	Total primary energy production	Total energy consumption
Sort by Relevance and	1 3.0606	2 3.0548	3 3.0532	4 3.0510	5 2.7869	6 2.6573
Factors	Total secondary energy consumption	Total output value of agriculture, forestry, animal husbandry and fishery	Industrial value added	Gross Domestic Product	Total construction output	
Sort by Relevance and	7 2.4521	8 2.4479	9 2.3905	10 2.2852	11 2.1556	

From the table 2, we can conclude that the factor most strongly associated with air pollution is the amount of water per capita, and the factor least associated is the gross value of construction output.

For water pollution, we ranked the correlations based on the results obtained as shown in Table 3 below.

Table 3. Ranking of water pollution in relation to various factors

Factors	Water resources per capita	Area of National Nature Reserves	Forest cover	Total primary energy production	Total energy consumption	Total secondary energy consumption
Sort by Relevance	1 0.9393	2 0.8714	3 0.8583	4 0.7367	5 0.6820	6 0.6179
Factors	Total output value of agriculture, forestry, animal husbandry and fishery	Industrial value added	Area affected	Gross Domestic Product	Total construction output	
Sort by Relevance	7 0.6050	8 0.5892	9 0.5734	10 0.5522	11 0.5129	

From the table, we can conclude that the strongest correlation with water pollution is the amount of water per capita and the weakest correlation is the gross value of construction.

4. Conclusions

In order to improve the environmental situation, the Environmental Protection Bureau should take measures to reduce the pollution of water resources and air pollution, to achieve sustainable development of resources, and to respond to the national call of "green water and green mountain is the silver mountain".

Based on a comprehensive analysis of the modelling in this paper, we make the following recommendations: The EPA should increase its public awareness campaigns to raise awareness of water conservation among residents. Correct the misconception that water is inexhaustible. At the same time, the EPA should urge water-consuming enterprises to improve their facilities to increase the efficiency of their water use, and hold business-government conferences on water conservation. In this way, a good culture of water conservation can be developed throughout society and the amount of water resources per person can be increased. The environmental protection department should impose logging quotas on forests and encourage afforestation and reforestation to expand the forest cover. At the same time, they should step up publicity and enrich the forms of publicity to raise people's awareness of forest conservation. The environmental protection department should develop agriculture, forestry, animal husbandry and fishery industries as far as possible, so as to improve economic efficiency and reduce water and air pollution at the same time. This will help to realize the vision that "green water and green mountains are the silver mountain of gold".

References

[1] Han JL, Xiong PP, Sun JH. Research on stock price time series prediction based on LSTM and gray model[J]. Journal of Nanjing University of Information Engineering (Natural Science Edition):1-22.

[2] YANG Jingyao,LIU Meihong,SONG Xiaolei. Prediction method of brush seal wear based on grey system theory[J]. Aerospace Materials Technology,2022,52(06):83-86.

[3] CHENG Longhui, REN Qiongqiong, XIAO Pei, ZHANG Bin, ZHU Yanman, WANG Sheng. A study on the prediction of drug resistance trends of common bacteria in China: based on the grey GM(1,1) model[J]. Chinese Journal of Infection Control,2022,21(12):1164-1170.

[4] Han Peng,Song Xiao Xiao. A study on the prediction of population aging trend and its influencing factors in Inner Mongolia based on grey theory[J]. Resources and Environment in Arid Regions,2023,37(01):44-51.

[5] Li Chenglian. Research on urban rail transit switching based on IGM-BP algorithm[J]. China Equipment Engineering, 2022, (24): 200-202.

[6] Sun A,Chen Y. Grey prediction-based design of automated solar photovoltaic grid-connected power generation system[J]. Fluid Measurement and Control,2022,3(06):87-91.

[7] Chen Q. Application of metabolic grey model in predicting the number of confirmed cases of new coronary pneumonia[J]. Modern Trade Industry,2023,44(02):260-262.