

# Study on the treatment measures of urban water pollution in Shaanxi Province

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**ABSTRACT.** With the promotion of urbanization and the development of urbanization, the problems of industrial sewage and domestic sewage have become increasingly prominent. The main body of urban water pollution control can be led by the government, and the community, residents and the third-party departments can participate in it. The urban water pollution in Shaanxi Province is facing the situation of complex composition, rapid growth and low recovery efficiency. In the process of water pollution control, Shaanxi Province is confronted with problems such as single governance subject, insufficient funds, equipment shortage and imperfect policies. Based on the experience of foreign countries and other provinces, Shaanxi Province needs to develop a set of relevant governance system to learn from water pollution problems.

**KEYWORDS:** water pollution, Control measures, governance subject

## 1. Introduction

The per capita water resources of Shaanxi Province is only 1 / 2 of the national average level, and Guanzhong area is even less than 1 / 6 of the national average level. To solve the problem of urban water shortage and do a good job in urban water supply, water conservation and water pollution prevention and control is a long-term major issue of social economy in Shaanxi Province. During the 13th Five Year Plan period, Shaanxi Province invested 21.1 billion yuan in water treatment. By the end of 2018, to achieve an average urban sewage treatment rate of more than 85%, it is urgent to improve the efficiency of sewage treatment. From the perspective of water cycle, it is of theoretical and practical significance to explore an effective way to improve the efficiency of urban sewage treatment, improve the effect of urban sewage treatment in Shaanxi Province, alleviate the contradiction between economic development and water resource depletion, water environment deterioration, and realize the coordinated economic and social development under the sustainable development of urban water resources in Shaanxi Province.

## **2. Research Summary**

### ***2.1 Investment and efficiency of urban water pollution control***

Rauch (1999) established the optimal planning model of urban sewage system with minimum water pollution [1]. Wean et al. (1998) used neural network algorithm to control water pollution[2]. Shi (2014) used the Three-stage DEA model to study the industrial water pollution control efficiency in the East, but in the Midwest [3]. Chen and Fan(2009) Use DEA Malmquist model to put forward the need to strengthen technological progress in Western China[4]. Zhao et al. (2010) found that with the increase of investment and operation costs, the efficiency of urban sewage treatment in Northeast China is increasing [5].

### ***2.2 Operation and investment efficiency of water pollution control facilities***

Feng Ying and Yao Shunbo (2009) Use super DEA model and sensitivity analysis method, the operation efficiency of sewage treatment enterprises in Henan Province is evaluated and sorted [6]. Dogot and xanthoulis (2010) established the cost model of collective sewage treatment in Walloon, Belgium [7]. Many domestic scholars use DEA, super SBM model and new cost DEA model to evaluate the financial cost efficiency, investment and allocation efficiency of sewage treatment plants in different provinces [8-10].

Although there are many researches on environmental protection and pollution control at home and abroad, there are few researches on water pollution control, especially on urban water pollution control measures, and even less researches on a province. From the perspective of governance subject, this paper comprehensively evaluates the current situation of urban water pollution in Shaanxi Province, analyzes the reasons behind it, and then puts forward the corresponding governance measures to provide reliable and effective policy basis for alleviating the crisis of urban water resources in Shaanxi Province.

## **3. Research Progress on the main body of urban water pollution control**

The urban water pollution treatment service belongs to the public service, and the infrastructure for collecting and treating sewage belongs to the public product. Different scholars have different views on the governance and supply of the public product.

William (2001) believes that the supply of public goods cannot reach Pareto optimality in a fully competitive market. Only by relying on the power of the government to regulate the market, can we meet the needs of specific groups of people [11]. The welfare economists, represented by Samuelson, believe that the government's provision of public goods has a scale advantage and saves transaction costs.Arthur Cecil Pigou puts forward Pigou tax in view of the environmental

pollution caused by the production of enterprises, and proposed to achieve Pareto optimality through taxation. The pollution source of environmental problems is not only from the production enterprises, and the government is not necessarily the best controller of public goods.

If we think about the same problem from different perspectives, we will get different views and theories. There are also many economists abroad who oppose government intervention. There are also failures in government intervention, sometimes even worse than market failures. Government intervention may lead to unclear environmental property rights and become an important factor of environmental damage [12].

From this point of view, whether it is the market or the government to provide public goods, there may be failure. Therefore, many scholars think that it is a good choice for the third department to provide public goods. Antonio massarutto and Vania paccagnan (2006) studied and discussed the feasibility of the third sector in providing public goods, and pointed out the shortcomings of the third sector in providing environmental services [13]. Shafiul Azam Ahmed and Mansoor Ali (2005) analyzed and demonstrated the mode of cooperation between public sector and private sector (PPP mode) [14].

#### **4. Analysis of current situation of urban water pollution in Shaanxi Province**

With the change of people's life style and consumption structure, the output and discharge of urban sewage increase greatly, and the proportion of different types of sewage also changes greatly. With the development of urbanization, the original ability of self purification of urban environment has been degraded and weakened. The problem of water pollution has seriously affected people's daily life.

##### ***4.1 The composition of urban sewage is complex***

In recent years, with the acceleration of urbanization and the increase of people's income in Shaanxi Province, the sewage composition has changed accordingly. The composition of urban sewage in Shaanxi Province is more and more close to the national metropolis, showing the characteristics of complexity and high pollution.

##### ***4.2 Rapid growth of urban sewage***

In recent years, the urban sewage in Shaanxi Province has been increasing year by year. According to the Environmental Kuznets curve, with the increase of economic income, the relationship between sewage output and economic income will be inverted U-shaped [15]. Although the lack of statistical data on urban sewage does not objectively and comprehensively understand the specific output of urban sewage in Shaanxi Province, nor can it confirm whether there is an inverted U-shaped curve relationship between residents' income level and sewage output, it is not difficult to

find out from various researches and surveys conducted by scholars that the discharge of urban sewage has been increasing in recent years.

#### ***4.3 Low recovery efficiency of urban sewage***

With the development of economy, the living standard of residents is constantly improving, and the sewage output is also growing rapidly [16]. Although the economy of Shaanxi Province has developed in recent years, the improvement of residents' quality and environmental awareness is not obvious. Residents do not have the habit of classifying sewage, and the city also lacks the equipment and facilities for sewage treatment. As a result, sewage can not be classified effectively, which not only pollutes the environment, but also wastes resources [17].

### **5. Problems in the treatment of urban water pollution in Shaanxi Province**

#### ***5.1 Single main body***

Through investigation and interview, it is found that the main body of urban sewage treatment in Shaanxi Province is almost the government, and there are few joint enterprises, social public organizations and other forms of joint treatment. The single government as the main body of water pollution control has resulted in the rigid supply mode of water pollution control in Shaanxi Province, the insufficient supply of funds, and the poor effect of water pollution control.

On the issue of urban water pollution control, the government bears the main responsibility. However, in real life, the government as the main body of governance is prone to the following three problems: first, the government tends to pay more attention to its own "achievements project", which causes the disconnection between supply and demand in reality; second, the government rarely allocates a large amount of funds to urban sewage treatment; third, when the funds are decentralized by the superior government, they will be intercepted by the government, which leads to the original This is not much governance funds in the final use of sewage treatment is even more stretched.

#### ***5.2 Insufficient funds***

The problem of capital investment is always the key to solve the infrastructure construction of urban water pollution treatment. At present, the capital sources of urban water pollution control in Shaanxi Province are mainly government financial support and collective fund-raising. From the perspective of the collective, because the income is very limited, the way of collective fund-raising is mostly used as an auxiliary. Therefore, the capital source of water pollution treatment mainly depends on the appropriation of the superior government, but it is obviously unrealistic to rely on the government investment to solve the problem of urban water pollution.

### ***5.3 Inadequate supply of facilities and services***

Generally speaking, the direct reason for the poor effect of urban water pollution treatment is that the treatment service is not in place. Urban water pollution management service mainly includes two aspects: necessary environmental health workers and necessary environmental health facilities. From the aspect of environmental health workers, it is found that most of them belong to urban low-income groups, low educational background groups and high-age groups, with low overall quality and low awareness of environmental protection. From the aspect of environmental sanitation facilities, there are few or no facilities for sewage storage, filtration and circulation, and the infrastructure is relatively scarce.

### ***5.4 Imperfect policy***

Our country has always stressed the rule of law, because without a perfect system of policies and regulations, relying on the rule of man can not guarantee the effect and quality of problem governance. In 2018, the No.1 document of the Central Committee stressed that we should steadily promote the comprehensive improvement of the environment, do a good job in garbage and sewage treatment, and improve the living environment. In 2019, at the National Working Conference on environmental protection, the director of the environmental protection bureau clearly proposed that efforts should be made to improve the ecological environment. The central government has some deficiencies in urban environmental management laws and regulations, especially in urban sewage treatment. As a result, there is no uniform regulation and regulation on environmental governance.

### ***5.5 Lack of communication in the process***

Our government is used to making policy “Top-down”, rather than widely listening to the opinions of farmers “Bottom-top”. “Top-down” policy-making leads to the urban water pollution control model is the government's “supply led” model, rather than the farmers' “demand led” model. With regard to urban water pollution control services, most residents can only passively accept the government's supply and control measures, but lack the right to choose and express according to their own actual situation and demand.

## **6. Foreign and provincial experiences**

Foreign advanced sewage treatment systems attach great importance to the reduction, recycling and harmless treatment of water pollution. There is a big gap between China and other countries in terms of good environmental protection awareness, detailed sewage classification, orderly sewage collection, advanced recycling and harmless treatment technology. We need to learn from other countries' experience and improve Shaanxi water pollution treatment system as soon as possible.

### ***6.1 Law and education work together to strengthen environmental awareness***

People are the main body of action in the water pollution treatment system, and the generation and treatment of sewage are all human behaviors. Improving legislation can guarantee the standardization of behavior, clarify the responsibilities and obligations of all parties, prohibit the random discharge of sewage and other negative behaviors, and ensure the classified collection, effective recycling and other positive behaviors. The non-standard behavior is caused by the lack of consciousness. In addition to using laws and regulations to enforce the behavior standardization, education can change the consciousness. We should strengthen the national environmental protection education, popularize the environmental protection knowledge such as water pollution prevention, sewage recycling and utilization as compulsory education to every citizen, and establish the environmental protection consciousness of the whole people.

### ***6.2 Promoting water pollution reduction and resource utilization by means of economic means***

At present, there is a lack of effective restrictions on sewage production in China, which leads to the increase of sewage output. Charge management for sewage disposal not only limits the sewage output, but also charges can be used for effective treatment of water pollution. At the top of the sewage treatment pyramid is sewage reduction. Some economic measures taken in Sweden, such as tax to encourage enterprises to extend the life cycle of products, reduce taxes on maintenance industry, etc., and reduce sewage output. Shaanxi Province can learn from other countries to give economic incentives to product manufacturers, encourage enterprises to reduce sewage production and extend product cycle. Economic stimulus is a powerful driving force. China can issue corresponding economic policies according to specific conditions to encourage enterprises to reduce and recycle sewage, and at the same time, joint enterprises can implement corresponding economic measures to encourage residents to reduce and recycle domestic sewage.

### ***6.3 Establishment and implementation of sewage classification system***

At present, the foundation of sewage classification is weak in China, and systematic sewage classification is the most important environment for sewage treatment, and source classification is the foundation of sewage recycling. China should establish a sewage classification system, popularize the knowledge of sewage classification through education and publicity, regulate the behavior of people in sewage classification by law, and ensure the implementation of sewage classification.

#### ***6.4 Introduce advanced water pollution treatment technology***

Sewage pipeline discharge and purification are the main water pollution treatment methods in China. The recovery and utilization rate of sewage is not high. It is urgent to speed up the development of water circulation and reclaimed water and establish industry standards. The main sewage treatment technologies in Europe and the United States include recycling, sewage purification, reclaimed water treatment, etc. new treatment technologies continue to emerge, such as anaerobic digestion, mechanical biological treatment, pyrolysis, etc. Shaanxi Province can introduce foreign advanced waste management technology, waste collection and transportation technology, waste recycling technology, etc.

### **7. Suggestions on urban water pollution control in Shaanxi Province**

#### ***7.1 Improve the urban water pollution control system***

Compared with the complete regulations and rules of environmental treatment in large cities, the standardization of environmental treatment in most urban areas of Shaanxi Province is poor, and even there is a gap in the regulations of water pollution treatment in some small towns. Shaanxi Province has a wide area and can be divided into three parts: Northern Shaanxi, central Shaanxi and southern Shaanxi. The distribution of cities and towns is relatively scattered. It is obviously unreasonable for the government to formulate unified regulations on specific governance. However, the government should guide the water pollution in macro policies. At the same time, each city and town should formulate corresponding governance regulations and establish standardized regulations according to its own actual situation. The control measures make the whole urban water pollution control have rules to follow.

#### ***7.2 Building a diversified governance model***

The single governance model with the government as the main body not only aggravates the burden of government work, but also causes problems such as the shortage of governance funds and the rigidity of governance model, which leads to the poor governance effect and the failure to effectively solve the problem of urban water pollution. Under the market economy system, the government should change its role, decentralize its power and perform less functions, make more use of the means of market economy, and combine local enterprises, social organizations, including residents, to control water pollution[18].

Third party social organizations such as social welfare organizations, such as friends of nature and China Environmental Protection Federation, are more professional, responsible and enthusiastic in environmental protection and governance. On the one hand, relevant government departments can formulate corresponding governance mechanisms to jointly manage urban living environment with the help of local social public welfare. On the other hand, we can also change our

role of supply into a role of supervision, pay a certain fee to the third-party organization, formulate corresponding assessment rules and indicators, and entrust the third-party organization to deal with urban water pollution.

As the main body of urban life, residents' living environment is directly related to their health and quality of life. To enhance the residents' sense of ownership and let them participate in the process of water pollution control can enhance the residents' enthusiasm to protect the living environment, and then promote the solution of urban water pollution.

### ***7.3 Establish a flat communication channel***

The consistent “Top-down” governance mode of our government can not hear the wishes and demands of residents, which affects the enthusiasm and initiative of farmers to participate in and cooperate with governance. The results of field investigation also show that not only residents rarely ask for residents' opinions and suggestions before or during the implementation of the governance plan, but also the residents' committee and street office at the higher level lack of communication. In this way, it may result in mismatching between governance demand and governance supply, poor governance effect and low satisfaction of residents with governance results. Therefore, to establish a flat communication channel and fully understand the needs of grass-roots management organizations and residents can better solve the problem of urban water pollution.

The premise of effective communication is the openness and transparency of information. Therefore, to establish a flat communication channel, it is necessary to strengthen the openness of information, publicize the basic system and regulations of water pollution control to the grass-roots government and residents through broadcasting, blackboard newspaper, publicity meeting and other forms, and ensure the timeliness and accuracy of information.

### ***7.4 Clear division of governance areas***

Urban area has a negative effect on the effect of water pollution control. That is to say, the larger the area is, the worse the effect of water pollution control may be; on the contrary, the smaller the area is, the better the effect of water pollution control will be. In the course of the actual investigation, some leaders and residents of the neighborhood committee did reflect that the large area of the community is not conducive to the overall governance, but the smaller community is more effective in the governance of various problems. Although it is unrealistic to divide a large area of community administratively, in the specific process of governance, it can divide regions and govern in different areas, so as to achieve the goal of overall governance.

A complete water pollution control and management organization should be established. Urban water pollution control is a project that needs long-term follow-up and management. It involves a wide range of areas, but it is relatively scattered. It is not realistic to have a unified governance by one organization or organization, and it is

unlikely to achieve good governance results. However, the effect of sewage treatment can not be guaranteed if the work of water pollution treatment is fully entrusted to the neighborhood committee and other basic departments. Therefore, a special treatment group can be set up in the municipal government, and the county, street and community below will set up separate organization personnel to manage the water pollution treatment, and report the work to the upper government in a unified way.

### ***7.5 Increase the publicity of residents' environmental awareness***

Residents' cognition of living environment affects their willingness to pay and their behavior of paying, while whether residents' committee members attach importance to water pollution control directly affects water pollution control. Therefore, the governance work should not only improve the way, technology and investment, but also improve the residents' awareness of living environment sanitation and protection from the aspect of ideology.

(1) Improve the environmental protection awareness of the residents committee members, especially the leaders of the residents committee, as well as the management level and management concept of dealing with domestic waste. As the manager of the community, the neighborhood committee has the final decision-making effect on various decisions of the community, so it is very important to publicize the environmental awareness of the members of the neighborhood committee and improve their level of water pollution control.

(2) Pay attention to the main body of community residence -- residents' environmental awareness. Residents are the beneficiaries of sewage treatment, at the same time, residents are also producers of domestic sewage. Improve the residents' awareness of environmental protection, let them understand the importance of living environment to themselves, and reduce the output of domestic sewage at the source, which will do half the work for the treatment of community water pollution.

(3) Improve the environmental awareness of local primary and secondary school students, strengthen the publicity of environmental protection, and organize primary and secondary school students to participate in voluntary activities of environmental protection. Compared with residents, primary and secondary school students can realize the importance of environmental protection more quickly and easily, and at the same time, they have stronger executive power. The neighborhood committee can organize primary and secondary school students as volunteers of environmental protection, take turns as cleaners and inspectors of community environmental health, let students bring the concept of environmental protection to their parents, and use the power of people around them to influence the concept and behavior of the majority of adult residents.

### **Acknowledgements**

This work is supported by the Social Science Foundation of Shaanxi Province "Research on the efficiency evaluation and promotion path of urban water

pollution control in Shaanxi Province”(2015D064), and the Special scientific research project of Shaanxi Provincial Department of Education in 2019“Study on the evaluation of government environmental performance audit :Taking the prevention and control of water pollution in Shaanxi Province as an example”(016166523) .

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