

Study on Urban Wastewater Treatment and Environmental Protection in Hefei

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Abstract. City is the mirror of social civilization, and the rapid development of city not only provides a good material life for people, but also can fundamentally influence the development of people's thoughts. But every coin has two sides: with the rapid economic development, it has also brought a lot of trouble for environmental protection. As we know, environment is the most basic factors we human depend on for living, and the development of the city should fully consider the problem of environmental protection. With the development of society and economy, the environment problem has become the restriction of social development. Especially the urban sewage emissions have seriously hindered the urban construction of environmental protection, which has become the common concern of research and application of water treatment technologies. It requires that sewage treatment should not only meet the water quality improvement, at the same time but also need to consider the problem of resource recycling and energy regeneration of pollutants and sewage. The technology must be used on the premise of low energy consumption and less resource depletion.

Keywords: Urban sewage, sewage treatment, environmental protection, urban development, urban management.

1. Introduction

As the capital of Anhui Province, Hefei currently has jurisdiction over four districts, four counties, one city and four development zones, with a total area of 11,400 square kilometers and a permanent population of 7.457 million. Hefei is located in the central part of Anhui Province, on the south side of the Jianghuai watershed, on the northwest shore of Chaohu Lake, at 116°40'~117°52' east longitude and 31°30'~32°37' north latitude. It is the central city of Anhui and the center of science and education in China. It also belongs to the famous middle and lower reaches of the Yangtze River city cluster. Hefei's manufacturing industry is developing rapidly, and its transportation location advantage is obvious. The development of Hefei itself and its economic progress have had a certain backlash effect, mainly manifested in a significant increase in the amount of pollutants emitted by daily life and factories.

2. Hefei Sewage Treatment

In the face of increasingly stringent environmental protection policies in China and the stubborn problem of water pollution in Hefei, Hefei's sewage treatment system has entered a period of comprehensive upgrading. According to Hefei's plan to build a regional megacity with a population of 10 million, the "141" urban development framework has vigorously transformed the core urban area, bringing opportunities for water environment governance. In the face of increasingly stringent national environmental protection policies and Hefei's stubborn water pollution, Hefei's sewage treatment system has entered a period of comprehensive upgrading. According to Hefei's plan to build a regional megacity with a population of 10 million, the "141" urban development framework has vigorously transformed the core urban area, bringing opportunities for water environment governance. In 2023, the total surface water supply in Hefei will be 1.5 billion cubic meters. The water supply from the three lakes will be 300 million cubic meters. However, the overall development and utilization of surface water in Hefei is only half of the total. Therefore, wastewater

pollution has become a basic limiting factor for the survival and development of the national economy.

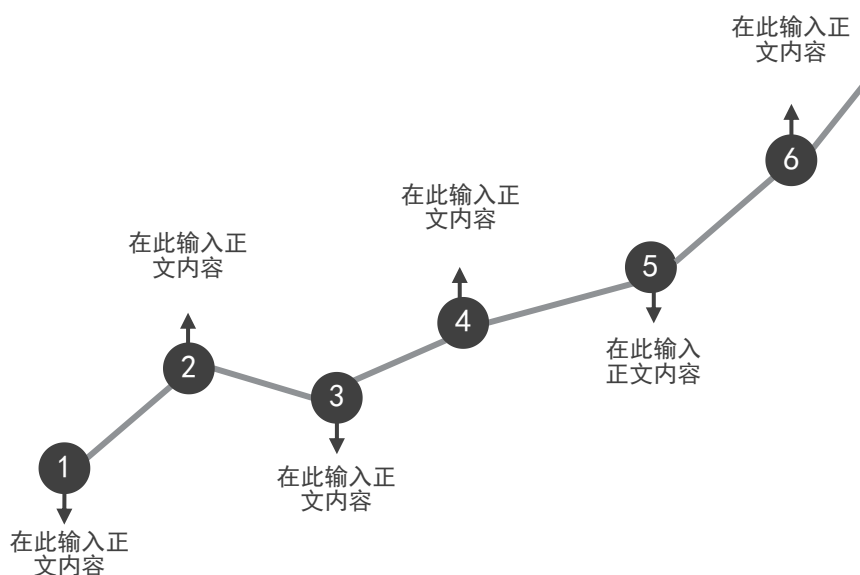


Fig. 1 Two or more references

At present, Hefei's sewage is mainly composed of eight treatment systems, including Wang Xiaoying, Zhu Zhuanjing, Weiyang, etc. Hefei has built 11 sewage treatment plants, including Wang Xiaoying, Wangtang, Zhu Zhuanjing, etc. Among them, Wang Xiaoying sewage treatment plant has a daily capacity of 300,000 tons, Wangtang sewage treatment plant has a daily capacity of 80,000 tons, and Zhu Zhuanjing sewage treatment plant has a daily capacity of 55,000 tons. One sewage treatment plant - Gongxiangtang sewage treatment plant, with a capacity of 100,000 tons/day. Shiwulihe sewage treatment plant, with a capacity of 50,000 tons/day; Wangtang sewage treatment plant phase II, with a capacity of 100,000 tons/day. Hefei City can currently treat 440,000 tons of sewage every day, of which 300 tons are sludge with a water content of four-fifths. According to statistics, by 2024, the urban sewage treatment plants in Hefei will have treated 580 million tons of sewage, an increase of 64.92% from the end of the 11th Five-Year Plan. In 2024, the urban sewage treatment capacity of Hefei will increase by 800,000 tons per day. This study will take Wang Xiaoying Sewage Treatment Plant as an example for analysis.

3. Current Status of Sewage Treatment in Wang Xiaoying Sewage Treatment Plant

3.1 Overview of Wang Xiaoying Sewage Treatment Plant

Hefei Wang Xiaoying Sewage Treatment Plant is located in Wang Xiaoying, Baohe District, Hefei City, covering an area of 225 mu. It adopts oxidation ditch sewage treatment technology for secondary biochemical sewage treatment. The construction scale is 300,000 cubic meters/day, of which the first phase is 150,000 cubic meters/day. The first phase of the project was put into trial operation on May 18, 1998, and was completed and put into operation in September of the same year. At present, the effluent implements the Class A standard in the (GB18918-2002) "Pollutant Discharge Standard for Urban Sewage Treatment Plants". The second phase of the project was put into operation in July 2001. At present, the effluent meets the Class A standard of the Pollutant Discharge Standard for Urban Wastewater Treatment Plants (GB18918-2002). The water collection range of Hefei Wang Xiaoying Wastewater Treatment Plant is: east to Dangtu Road, south to Dongliu Road, west to Hezuohua Road, and north to Dangshan Road. The sewage in the old city of

Hefei mainly enters Wang Xiaoying Wastewater Treatment Plant. Table 1 is an overview of Wang Xiaoying Wastewater Treatment Plant.

Table 1. Overview of Wangxiaoying Wastewater Treatment Plant

Administrative region	Wastewater treatment plants	Receiving water	Implementation standard name	Execution standard condition name	Designed daily processing capacity (tons/day)	Import flow (tons/day)	Export flow (tons/day)
Baohu District	Hefei Wangxiaoying Wastewater Treatment Co., Ltd.	Nanfei River	Pollutant emission standards for urban sewage treatment plants	/ Maximum allowable discharge concentration of basic control items (daily average) / built before December 31, 2005 / water temperature > 12 degrees / Class A standard	300000	285000.00	285000.00

3.2 Analysis of Sewage Treatment Monitoring Data

Table 2. Monitoring data of Wang Xiaoying sewage treatment plant in the second quarter of 2015

Monitoring project	Import concentration(mg/L)	Outlet concentration(mg/L)	Standard limit(mg/L)	Emission units	Does it meet the standard?
PH Value	7.62	7.58	6-9	Dimensionless	Yes
Biochemical oxygen demand	48.5	2.9	10	mg/L	Yes
Total phosphorus	3.68	0.125	1	mg/L	Yes
Chemical oxygen demand	616	31	50	mg/L	Yes
Volatile phenol	0.07	0.02	0.5	mg/L	Yes
Chroma	10	2	30	Times	Yes
Total mercury	0.00003	0.00003	0.001	mg/L	Yes
Alkyl mercury	0.00001	<0.00001	0	mg/L	Yes
Total cadmium	0.001	0.001	0.01	mg/L	Yes
Hexavalent chromium	0.002	0.002	0.05	mg/L	Yes

Total arsenic	0.027	0.027	0.1	mg/L	Yes
Total lead	0.021	0.021	0.1	mg/L	Yes
Suspended matter	32	5	10	mg/L	Yes
LAS	2.18	0.183	0.5	mg/L	Yes
Fecal coliform count	24196	899	1000	mg/L	Yes
Ammonia nitrogen	36.66	3.96	5	mg/L	Yes
Total nitrogen	38.2	4.2	15	mg/L	Yes
Total cyanide compounds	0.002	0.002	0.5	mg/L	Yes
Petroleum	1.04	0.02	1	mg/L	Yes
Animal and vegetable oils	1.04	0.02	1	mg/L	Yes

From Table 2, we can see that the main pollutants of sewage are pH value, chemical oxygen demand, total phosphorus, etc. After being treated by Wang Xiaoying Sewage Treatment Plant, the pollution concentration is greatly reduced, basically meeting the emission standards. This proves that the oxidation ditch treatment process adopted by Wang Xiaoying is low-cost and high-efficiency. The improved oxidation ditch treatment process it adopts has a good effect on the removal of carbon sources, phosphorus and nitrogen, and the technology used is effective in degrading pollutants.

4. Environmental Impact Analysis

4.1 Environmental Impact Analysis of Tailwater on Receiving Rivers

The sewage treatment plant project itself generates very little sewage, but the tailwater discharge is very large.

According to the data of the 2023 Environmental Quality Report of Hefei City, the surface water body near Dafangying Sewage Co., Ltd. is the Nanfei River. The current water quality monitoring results of the Nanfei River are as follows.

Table 3. Current water quality monitoring results of Nanfei River

Water	pH	CODcr	BOD5	NH3-N	Petroleum
Nanfei River Tunxi Bridge Section	7.36	49.5	7.74	10.01	0.480
GB3838-2002 Class V standard	6-9	40	10	2.0	1.0

As can be seen from the table above, the water quality of the Nanfei River near the construction project exceeds the Class V standard in the "Surface Water Environmental Quality Standard" (GB3838-2002), and the pollutants exceeding the standard are mainly CODcr and NH3-. The water

quality of the Nanfei River exceeds the standard mainly because the Nanfei River is one of the main tributaries of Chaohu Lake and accepts Hefei's urban domestic sewage and industrial wastewater.

At the same time, this puts higher requirements on the sewage treatment technology of the sewage treatment plant.

4.2 Impact of Noise From Sewage Treatment Plants

Table 4. shows the monitoring results of noise at the north and south boundaries of Wang Xiaoying Sewage Treatment Plant in August and September 2024.

Monitoring points	Monitoring time	Daytime value (dB)	Daytime standard value (dB)	Night duty (dB)	Night standard value (dB)
North Factory Boundary	2024.8	53.2	60	45.3	50
South Factory Boundary	2024.8	53.6	60	44.6	50
North Factory Boundary	2024.9	53.3	60	44.8	50
South Factory Boundary	2024.9	49.6	60	45.7	50

It can be seen from Table 4 that the daytime noise of the polluting plant is higher than the nighttime noise, but both are close to the standard value, which will bring certain noise impact to the surrounding residents.

5. Hefei Wastewater Treatment Program

In order to make the urban sewage treatment in accordance with the low-cost and high-efficiency scheme, the Hefei Municipal Government has effectively improved the sewage recycling system. The government's sewage treatment is not limited to purifying the water quality, but also pays attention to the low-energy application technology used. In addition, the investment of funds should be institutionalized to form a long-term mechanism of strict assessment and effective incentives, and strive to optimize the urban sewage treatment to the greatest extent. In this regard, I give the following specific suggestions:

5.1 Further Improve the Legal Mechanism for Environmental Protection

Only when the government improves the legal mechanism for environmental protection and strengthens law enforcement can people's awareness of environmental protection be effectively enhanced. For example, the government's formulation of laws and regulations on soil pollution, environmental damage compensation, and chemical pollution will constrain people who are vigilant and relax or ignore environmental protection in this regard; in addition, the government needs to implement a long-term supervision system, and must order units that do not put ecological benefits first to rectify; the government further improves the laws and regulations for victims of pollution, and establishes a corresponding environmental civil litigation system, effectively increasing law enforcement efforts to protect the legitimate rights and interests of citizens.

5.2 Strengthen the Research and Development of Environmental Protection Technology and the Quality Training of Technical Personnel

The government should first strengthen the construction of the environmental protection technology system, put the main sewage special research into the national scientific research list, and strengthen the research on general and important pollution control issues. It mainly focuses on the research and pilot promotion of key projects such as water quality, sewage purification, and recycled water utilization, and promotes the use of new energy, new technology, and biology in sewage treatment. Secondly, the government needs to strengthen the quality training of practitioners,

strengthen the supervision of sewage treatment, and improve the overall quality of sewage treatment personnel.

5.3 Improve the Environmental Awareness of the Whole People

In strengthening the implementation of environmental legislation and various regulations, the administrative units of Hefei City should provide a legal basis for sewage management, and at the same time pay attention to improving the environmental awareness of the public. First, the government uses popular science and publicity tools to popularize the importance and technical knowledge of sewage treatment, so that people can consciously practice sewage treatment; second, the government strengthens the supervision of the public, environmental protection, sewage supervision departments and enterprises, and promotes the standardization of sewage management and sewage discharge. The government needs to strengthen private participation and enhance the environmental protection leadership of private environmental protection organizations.

Summary

The obstacles and environmental problems faced by Hefei's urban sewage treatment are mainly caused by people, so people need to pay more attention to sewage treatment. At the same time, the responsible units in Hefei should also increase investment in sewage treatment technology and the implementation of sewage policies to make urban life cleaner and tidier.

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