Analysis and Prevention of Urban River Pollution

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Abstract. According to the principle of "nearby discharge" of waste-water treatment, with the progress of industry, the amount of pollutants discharged into urban rivers keeps increasing. Under the requirements of limited river pollution and environmental carrying capacity, the pollution situation of urban rivers needs to be explored and the ways of pollution control need to be explored. At present, most of China's rivers are polluted, and none of the seven major river systems has been spared. The pollution sources of urban rivers include industrial pollution sources, domestic pollution sources, agricultural pollution sources, oil tankers and other pollution sources. The pollutants in urban rivers include organic pollutants, inorganic pollutants, plant nutrients and heavy metals in water. Pollution prevention and control measures of urban rivers: pollution source control, adhere to the income reduction; physical method, chemical method, biology-ecological method. In a water basin of Guangdong province as an example, some indexes because of pollution in urban river "surface water environment quality standard GB 3838-2002" V class level, basic use as mentioned in the measures for prevention and control of pollution of rivers.

1. Introduction

In recent years, with the rapid development of our country's economy and the rapid growth of GDP, the amount of waste water produced in industrial and agricultural production keeps increasing. According to the "nearby discharge" principle of waste-water treatment, after treatment, waste-water is discharged into the surrounding surface water, including rivers, rivers and lakes, most of which are discharged into rivers nearby, which leads to the pollution of urban rivers [1]. In fact, China's surface water environment is facing many problems such as serious water pollution, shortage of water resources and flood and waterlogging disasters. At present, the increasingly serious water pollution in cities has posed a threat to the residents' living safety and become a major obstacle to people's health and social development. Polluted water through drinking water or food chain, pollutants into the human body, harm to the health of residents. Water pollution increases the cost of water treatment for industrial production, causes waste of resources and energy, and reduces production efficiency. Water eutrophication affects the survival of aquatic organisms and reduces biodiversity, leading to a vicious cycle. Therefore, analyzing and studying the current situation of river pollution and proposing effective treatment measures, these problems have reached the point where urgent solutions are needed [2].

Regional economic development and regional environmental capacity is not suitable for the water pollution is also an important reason. In the past, when determining the development direction of
regional industry and the layout of regional productivity, the regional environmental capacity was often neglected. The serious regional water pollution in major rivers in China is directly related to the unreasonable industrial structure and distribution of river basins to a large extent. Since the early 1980s, the four provinces in the huaihe river basin have made full use of local resources to develop water-intensive small-scale industries such as chemical industry, paper making, leather making, thermal power and food. Due to the lack of scientific certification and scientific management, some water-scarce areas blindly develop water-consuming industries, resulting in the decline of groundwater level; some resource-rich regions develop a single resource-based industry instead of a matching processing industry, and the industrial structure is similar, resulting in serious structural pollution [3].

2. Pollution of urban rivers

2.1. Pollution profile
Because of the flow characteristics of river water, river ecology is more vulnerable to external pollution. Moreover, once pollution occurs, it can easily spread to the whole river basin. In recent years, due to the rapid development of the urban economy, the rapid increase of the population, the deepening of the degree of industrialization, the increase of the urban water consumption and the discharge of river pollutants, the river self-purification and ecological compensation of the regulation ability of decline, the water quality significantly deteriorated. For example, when the Pearl River flows through Guangdong, it flows through Guangzhou and its surrounding areas, and has many functions such as irrigation, water supply, shipping, drainage, flood discharge, and entertainment, which has played a great positive role in the economic and cultural development of Guangzhou. In recent years, due to the population explosion, the development of industry and the aging of urban infrastructure, the sediment deposition is serious, and the river water is seriously polluted. The local government has invested a huge amount to clean up the Pearl River, but there are many pollution sources along the Pearl River, which makes it more difficult to clean up the Pearl River [4].

Pollution of China's major rivers: China has more than 50,000 river basins with an area of more than 100 square kilometers, and most of them have been affected by water pollution to different degrees, including the Yangtze River and the seven major river systems.

2.2. Sources of urban river pollution
(1) Industrial pollution source: This is the most major source of water pollution. It refers to the waste water used in the production process discharged by industrial enterprises. According to the nature of pollutants, industrial waste-water can be divided into: (a) waste-water containing organic matter, such as paper, sugar, food processing, dyeing and weaving industry wastewater; (b) waste-water containing inorganic substances, such as hydraulic ash flushing waste-water from coal-fired power plants, tailings water from mining industries and coal washing water from coal mining and coking industries; (c) Waste water containing toxic chemical substances, such as industrial waste water of chemical industry, electroplating and smelting; (d) Industrial waste-water containing pathogens, such as biological products.; (e) Waste water containing radioactive substances, such as waste water from nuclear power plants, radioactive mines and nuclear fuel processing plants; (f) Production cooling water, such as waste water from thermal power plants and steel mills.

(2) Domestic pollution sources: Domestic pollution sources mainly come from cities. Refers to residents in daily life in the discharge of all kinds of sewage, such as washing clothes, bathing, cooking water, washing urinals, etc., the amount, concentration and domestic water consumption. After the decaying organic matter in domestic sewage is discharged into the water body, the sewage is gray, with low transparency, and has a special odor, containing organic matter, detergent residues, chloride, phosphorus, potassium, sulfate, etc.

(3) Agricultural pollution sources: Agricultural pollution sources mainly refer to the pollution caused by the improper use of pesticides and fertilizers. Such as long-term abuse of organochlorine pesticides and organic mercury pesticides, pollution of surface water, aquatic organisms, fish and
shellfish will have high pesticide residues, plus biological enrichment, such as food will endanger human health and life.

(4) Other pollution sources: Oil pollution to the ocean caused by oil tanker oil leakage or accidents, because the oil film covering the water surface causes a large number of aquatic organisms to die, the decomposition of dead residual body can cause water pollution.

2.3. Analysis of pollutants in urban rivers

The pollution of urban rivers comes from domestic sewage, industrial waste water, early rainwater and urban sewage. There are many kinds of pollutants in rivers, including organic pollutants, inorganic pollutants, plant nutrients and heavy metals in water. According to the pollution situation of urban rivers, the above pollutants are analyzed as follows [5].

(1) Organic pollutants

Common river organic pollutants include phenols, aldehydes, sugars, polysaccharides, proteins and oils. In the process of biological oxidation and decomposition of these pollutants in the water, a large amount of dissolved oxygen needs to be consumed. Once the oxygen supply in the water is insufficient, the oxidation will stop, causing the anaerobic fermentation of organic matter, emitting a stench, polluting the environment and poisoning aquatic organisms. Over time, aquatic organisms in the water die, exacerbating the deterioration of the water and creating a vicious cycle. These organic pollutants come from the discharge of municipal sewage and industrial wastewater. Among them, domestic sewage mainly refers to sewage generated by domestic life, mainly including human excreta and detergents, etc., excreta contains high bod addition to pathogenic microorganisms, and detergents contain phosphates. Pollution sources of industrial pollution are mainly concentrated in dyeing and finishing, leather making, food, paper making, electroplating and other industries with high pollution.

(2) Inorganic pollutants

All kinds of harmful substances (or energy) that cause the deterioration of water quality, biological community and sediment quality can be called water pollutants. Water pollutants from the chemical point of view of inorganic non-toxic substances: acid, alkali, general inorganic salts.

(3) Plant nutrients

Plant nutrients mainly refer to nitrogen and phosphorus compounds. Eutrophication led to the decrease of the water quality, water surface growth of cyanobacteria, green algae as the dominant species of algae, the sun was blocked out, underwater algae can of sunlight and breathe oxygen in water, make water gradually reduce oxygen and water in biological death due to lack of oxygen, the accumulation of organic matter under the condition of anaerobic decomposition of harmful gases and some of the plankton produce biological toxin harm fish. Because the eutrophication water contains nitrate and nitrite, the long-term consumption of these substances in excess of a certain level of water, also toxic disease. In addition, the bodies of aquatic organisms cause water to stink, affecting the ecological environment and the quality of life of urban residents.

(4) Heavy metals in water

Heavy metals generally refer to a density greater than 5 g/cm³ In the periodic table, metal elements whose atomic number is greater than 20 mainly refer to the heavy elements with significant biological toxicity such as mercury, cadmium, lead, inscription and metal-like tablets, and also refer to the general heavy metals with certain toxicity, such as zinc, copper, drilling, iron, tin, etc. As long as there are trace heavy metals in natural water, toxic effects can be produced, and the microorganisms can not degrade heavy metals, heavy metals can be converted into more toxic compounds.

The heavy metals in rivers mainly come from two aspects: first, heavy metals are widely distributed substances in the earth's crust, which are distributed in the water in the migration cycle of the natural environment; Secondly, as non-ferrous metals, heavy metals are widely used in the production and life of human beings. There are various heavy metal pollution, such as the burning of fossil fuels, mining and smelting, and the discharge of waste water, waste gas and waste residue from heavy metal industrial enterprises.
3. Treatment of river pollutants

River pollution treatment needs to solve two problems: One is to control the discharge of pollutants at the source and prevent new pollution; The second is to reduce the pollution degree of the already polluted water [6].

3.1. Pollution source control, and adhere to the principle of increasing income and reducing expenditure

First of all, the national awareness of the environment is still low, many environmental problems are not aware of. In this regard, the environmental protection publicity should be intensified to make urban residents understand the severe situation of river pollution in China and raise their awareness of water environmental protection. Second, environmental laws are not followed, law enforcement is lax, and local governments in order to economic development and achievements of the project to open their eyes to environmental problems, environmental protection departments are often powerless. We will strengthen law enforcement, and ensure that all laws are followed, violations are prosecuted, and law enforcement is strictly enforced. Finally, for the indiscriminate discharge of river pollutants industrial enterprises, increased penalties or even forced closure.

We will vigorously carry out water-saving activities and adopt effective measures to reduce water consumption. To carry out water-saving and efficient agricultural irrigation technology in an organized way; Improve scientific management measures of agricultural water use and change the situation of water consumption in agricultural production as soon as possible. To formulate water quota and water reuse rate assessment indicators for unit products, and to establish an assessment system for industrial water use; It clearly stipulates that industrial waste-water such as cooling water and process water must be recycled and reused. Develop the closed - circuit recycling of water to minimize waste water discharge.

While saving water and solving the shortage of water resources in China, we will comprehensively strengthen the prevention and control of water pollution, especially in key river basins. The key point of river basin treatment lies in the city, the treatment of urban industrial waste-water and domestic sewage, which should be combined with centralized and decentralized treatment and the way of waste water recycling.

3.2. Treatment of polluted water bodies

The treatment techniques of polluted river water are divided into three categories: physical, chemical and biological-ecological.

(1) Physical methods

Physical treatment includes aeration and reoxygenation, water diversion, mechanical algae removal, sediment dredging, etc. For rivers with serious organic pollution, due to the use of microorganisms to decompose organic matter and consume oxygen, the reduction of dissolved oxygen in Hanoi leads to the deterioration of water quality. Water diversion measures are to introduce clean water into water conservancy facilities to improve the quality of polluted river. In essence, they increase clean water to reduce water pollution, but they do not reduce the flux of pollutants in the river. Mechanical algae removal refers to the removal of a large number of blooms and cyanobacteria in the river by mechanical methods, which plays a great role in effectively reducing the pollution load such as nitrogen and phosphorus. Sediment dredging is to remove the pollutants contained by dredging sediment, which is suitable for the treatment of Eutrophication Rivers.

(2) Chemical methods

Chemical treatment method is mainly to use a variety of chemical agents, such as adding chemical agents to kill algae, adding iron salts to promote the precipitation of phosphorus. Chemical algae removal is a fast and effective method to control the growth of algae, but attention should be paid to avoid secondary pollution when using, which is forbidden in drinking water sources. Chemical flocculation treatment is a treatment technology that can remove water pollutants and improve water quality by adding chemical agents.
(3) Bio-ecological approach

Biological-ecological method has the advantages of good treatment effect, low cost, low energy consumption and low operating cost. Microorganism technology is directly to the vaccination of exogenous pollution degradation bacteria in polluted water, using its wake up or activate the originally existed in water, but are suppressed and cannot play its function of microbes, and through them the rapid proliferation of strongly to clamp down on the growth of harmful microbes and activities to eliminate organic pollution and eutrophication of water bodies. Biological technology is by placing antidote, degradation of pollutants in the polluted river material, reduce the toxicity of the environment, the nature of the pollutants degradation of indigenous microorganisms play a role in the growth, for can create a complete natural degradation of the function of environment, the self-purification ability of strengthening environmental pollution, accelerate the decomposition of organic pollutants.

4. Case analysis

Guangdong has 543 rivers with an area of more than 100 square kilometers, of which 52 rivers flow into the sea. Rivers in Guangdong generally have the following characteristics: (1) Large amount of water, long flood season. The water module of all parts of Guangdong is more than 1 million cubic meters per square kilometer, 2.4 times higher than the national average. The average discharge of all rivers in the province is large. The Han River’s basin is just over 4% the size of the Yellow River, but its average annual flow is 53% of the Yellow River's. The flood season of rivers in Guangdong is mostly half a year long. (2) The variation of river discharge is smaller than that of the northern rivers, and there are still obvious seasonal and interannual variations. For example, in shijiao section of Beijiang River, the amount of abundant water reaches 6,500 cubic meters/second, while the amount of dry water is only several hundred cubic meters/second. (3) The sediment content of the river is small, but the total amount of sediment transport is still considerable.

Take the pollution of a river basin in Guangdong province as an example. Arrangement of monitoring points: a total of 3 monitoring research points are arranged as sampling points. Water quality monitoring method: according to the provisions of "GB 3838-2002 surface water environmental quality standard" [7-8], the following monitoring items are determined: temperature, pH value, turbidity, total non-filtration residue, ammonia nitrogen, chemical oxygen demand, biochemical oxygen demand, calcium, zinc, tin, manganese, copper, cadmium, magnesium, iron, etc. Water quality monitoring results are shown in Table 1 below:

| project name               | Sample 1 | Sample 2 | Sample 3 | Average | Standard category |
|----------------------------|----------|----------|----------|---------|-------------------|
| Temperature(℃)             | 29.2     | 29.3     | 29.2     | 29.2    | I                 |
| pH                         | 6.45     | 6.40     | 6.18     | 6.34    | I                 |
| turbidity(degree)          | 125.10   | 257.20   | 150.02   | 177.5   | —                 |
| No filter residue(mg/L)    | 28.13    | 30.74    | 9.24     | 22.70   | —                 |
| Ammonia nitrogen(mg/L)     | 0.0150   | 0.0159   | 0.0155   | 0.0155  | I                 |
| BODs(mg/L)                 | 17.8     | 10.2     | 10.1     | 12.7    | V                 |
| CODC(mg/L)                 | 70       | 69       | 71       | 70      | V                 |
| Calcium(mg/L)              | 0.014    | 0.014    | 0.015    | 0.014   | I                 |
| Zinc(mg/L)                 | 0.045    | 0.044    | 0.040    | 0.043   | I                 |
| Tin(mg/L)                  | 0        | 0        | 0        | 0       | I                 |
| Lead(mg/L)                 | 0        | 0        | 0        | 0       | I                 |
| Manganese(mg/L)            | 0        | 0        | 0        | 0       | I                 |
| Copper(mg/L)               | 0        | 0        | 0        | 0       | I                 |
| Cadmium(mg/L)              | 0        | 0        | 0        | 0       | I                 |
| Magnesium(mg/L)            | 3.384    | 3.601    | 3.287    | 3.427   | —                 |
| Iron(mg/L)                 | 0.035    | 0.039    | 0.016    | 0.03    | —                 |
For the water pollution in the above river basin, the treatment measures adopted are as follows: give priority to prevention, reduce expenditure and open source, breed and fish water hyacinth moderately, and purify the water in the river basin.

5. Conclusion
With the progress of industry, the amount of pollutants discharged into urban rivers keeps increasing. Under the requirements of limited river pollution and environmental carrying capacity, urban rivers cannot meet the required "GB 3838-2002 surface water environmental quality standard". It is of practical value to explore the pollution situation of urban rivers and explore the ways of pollution control. At present, most of China's rivers are polluted, and none of the seven major river systems has been spared. Industrial pollution sources, domestic pollution sources, agricultural pollution sources, oil tankers and other pollution sources constitute the sources of pollution of urban rivers. The pollutants in urban rivers include organic pollutants, inorganic pollutants, plant nutrients and heavy metals in water. Pollution source control, adhere to the income reduction; Physical, chemical, biological and ecological methods constitute the pollution control measures of urban rivers. In a water basin of Guangdong province as an example, some indexes because of pollution in urban river "surface water environment quality standard GB 3838-2002" V class level, using the above measures to prevention and control of pollution in rivers, the effect is remarkable.

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