

Discussion on the Causes and Treatment Methods of Urban Black and Odorous Water Bodies

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Abstract

With the development of the economy and society, especially the rapid growth of urban construction and industry, the discharge of sewage, wastewater and pollutants has significantly increased. Some rivers have experienced water pollution, turning black and stinking, and the surrounding ecology has seriously deteriorated. The water body has lost its self-purification capacity, which has drawn widespread social attention. In order to improve the quality of urban rivers, based on the actual situation, the causes were analyzed, and common treatment technologies were proposed. For different types of black and odorous water bodies, targeted technologies were selected for treatment, achieving remarkable results.

Keywords

Discharge of Sewage, Wastewater and Pollutants; Black and Odorous Water Bodies; Treatment Technologies; Improve Water Ecology; Improve the Environment.

1. Introduction

Urban black and odorous water bodies are water environment issues that the public strongly reflects on. They not only damage the urban living environment but also seriously affect the city's image. Since The State Council issued the "Action Plan for Water Pollution Prevention and Control" (referred to as the "Water Ten") in April 2015, local people's governments at all levels have regarded the treatment of urban black and odorous water bodies as an important part of improving the urban living environment and carried out a series of treatment works. After several years of efforts, breakthrough progress has been made in the treatment of black and odorous water bodies across the country. According to preliminary statistics, as of January 2020, the elimination rate of black and odorous water bodies in key cities across the country exceeded 90%, and that in prefecture-level cities reached around 80%. However, there is still a certain gap from the set targets. The year 2020 was the "final year" and "major test year" of the "Water Pollution Prevention and Control Action Plan". Black and odorous water bodies remain a common problem in Chinese cities. Therefore, conducting in-depth analysis and discussion on the existing problems at the current stage has important guiding significance and reference value for the treatment of black and odorous water bodies and water environment protection.

2. The Causes of Black and Odorous Water Bodies

(1) Discharge of domestic sewage and industrial wastewater

In areas without municipal rain and sewage pipe networks, both rainwater and sewage are directly discharged into water bodies through ditches along the banks and outlets, resulting in an increase in the amount of sewage discharged and thus exceeding the self-purification capacity of the water bodies. In some old urban areas, the situation of combined rainwater and sewage still exists, causing the sewage in the combined pipes to be directly discharged into water bodies. After nitrogen and phosphorus, which are oxygen-consuming organic substances

in domestic sewage, enter water bodies, regardless of whether their dissolved oxygen is sufficient or not, they will be degraded by aerobic actinomycetes or anaerobic microorganisms at suitable water temperatures, discharging various types of malodorous substances and intensifying the black and odorous degree of the water body.

Untreated industrial wastewater or wastewater that fails to meet the standards after treatment is directly discharged into urban water bodies. The malodorous substances and organic pollutants in the wastewater are also degraded by anaerobic microorganisms or aerobic actinomycetes, discharging various types of malodorous substances. Over time, this has led to severe organic pollution in rivers and widespread black and odorous water bodies.

(2) Sediment pollution is difficult to cure completely

Sediment can provide a good habitat for the growth and reproduction of microorganisms. Under the metabolic action of actinomycetes and other microorganisms, a series of reactions such as methanation and denitrification will occur in the sediment. The gas rises, thus driving the sediment to float up and causing secondary pollution of the water body [4,5].

In addition, the sediment in urban rain and sewage pipes cannot be ignored. It not only reduces the drainage capacity of the pipes, but in severe cases, it can clog the pipes and even affect the operation of the entire drainage system.

Endogenous pollution, once it enters water bodies, is difficult to eradicate and has a cumulative effect, causing serious impacts on water quality over a long period of time.

(3) The water system is not unobstructed, and the increase in water temperature has an impact. The speed of water flow directly affects the circulation of water bodies. If the speed is too slow, it will lead to the problem of black and odorous water. In many regions of our country, the terrain is relatively flat, and the longitudinal slope of rivers is also relatively small. In addition, in some areas, the water volume is relatively small and the water flow is slow, with insufficient hydrodynamic force, which reduces the self-purification capacity of water bodies. Moreover, some space around the rivers is occupied, and the water circulation cannot proceed in an orderly manner. Pollutants accumulate for a long time. All these factors contribute to the poor self-purification capacity of water bodies. This then leads to the problem of black and odorous substances [6].

(4) The shore has become hard and the ecological environment has been damaged

The existence of urban water bodies plays a significant role in rainwater and flood control and drainage within the city, and also has an important function in draining rainwater during the flood season. Hard revetments have a strong ability to resist erosion. The use of drainage systems may cause damage to the ecosystem. The main construction materials for hard revetments are concrete, mortar stone, etc., which isolate the water body from the external environment and prevent the self-purification treatment of the water body, resulting in relatively poor ecological effects [7].

(5) The management mechanism is not perfect

Among the numerous rivers in our country, many have pollution problems that span provinces, regions and river basins. This requires a sound cross-basin coordination mechanism and a complete institutionalized design, such as a mechanism for each river to set pollutant emissions based on its own environmental capacity. Each region is responsible for strengthening the monitoring of the discharge situation and water body changes in their respective water areas. Strengthen the unified and coordinated management of water bodies by departments such as water conservancy, water environment, and hydrology and water resources. At present, the treatment of black and odorous water bodies is mostly led by a single department. During the implementation of the project and after its completion, there is often a lack of systematic and coordinated management, making it difficult to maintain the treatment effect of the project.

3. Hazards of Urban Black and Odorous Water Bodies

(1) Damage the aquatic ecosystem

The "black and odorous" phenomenon of urban rivers can cause long-term oxygen deficiency in water bodies, thereby causing significant damage or even extinction to aquatic animals and plants, and seriously damaging the ecosystem of rivers and other water bodies.

(2) It affects the daily life of residents and threatens their physical health

The drinking water source is polluted, the water source function is lost, the water body turns black and odorous, there is a lack of fresh air circulation, the living environment is deteriorating day by day, and it causes irreparable damage to the human respiratory and nervous systems.

(3) Damaging the urban landscape

The volatilization of black and odorous substances in water bodies has greatly affected the air quality of cities and caused relatively serious impacts on the surrounding production, life and tertiary industries such as tourism. It has restricted the development of the city itself and damaged its beautiful image.

4. Black and Odorous Water Body Treatment Technology

(1) Physical technical means

The function of sewage interception and pipe connection is to treat sewage from the source through combined sewer interception or rainwater and sewage separation. It can effectively intercept and treat domestic sewage during the dry season and directly incorporate it into sewage treatment, preventing it from entering the urban water body environment.

Non-point source control refers to solid waste and other garbage existing within the city, or water pollution caused by initial rainwater. Among them, the main problem is domestic sewage from urban residents. Its effective quality can be improved through the sponge city approach, and reasonable and effective measures should be applied for ecological governance.

Endogenous control technology is to thoroughly clean up the silt, garbage and other substances existing in the internal water environment of cities, and completely purify water resources. The main treatment measure is to clean up the silt to avoid serious water pollution problems, and the treatment effect is very obvious. After the dredging is completed, a certain amount of purifying agent should also be added to the water body, which can promote the decomposition of organic matter in the sediment and achieve effective water purification.

The circulating water system aims to alleviate black and odorous water problems by enhancing the fluidity of water bodies. At this point, pumping stations and water system connectivity can be added to the water body to enhance its fluidity. The main purpose of clear water replenishment is to better dilute sewage by adding a certain amount of clear water to the water body and enhance the self-purification capacity of the water body. An increase in water flow velocity can enhance the water exchange rate and reduce the black and odorous nature of the water.

(2) Chemical technical means

Chemical reagents are added to flocculate, oxidize and precipitate pollutants in water bodies to enhance the transparency of the water. The chemical reagents used include oxidants such as H_2O_2 and CaO_2 , chemical flocculants such as Al salts and Fe salts, and chemical precipitants such as CaO . Chemical treatment technology can rapidly reduce water pollution in a short period of time, significantly improve sensory perception, and has a relatively obvious rectification effect. However, this method cannot fundamentally solve the problem of black and odorous water bodies and is prone to causing secondary pollution.

(3) Ecological technology means

Microbial enhancement technology. A large number of microorganisms are added to black and odorous water bodies, and the purification is generally achieved by the degradation of microorganisms. In practice, the main approach is to add a certain amount of microbial agents, enzyme preparations, etc. to the water body to promote the degradation of microorganisms and achieve the purification treatment of water pollution.

Biofilm technology. This technology is a relatively common treatment method for attached growth. There are a large number of microorganisms on the biofilm, which can better treat water pollutants and improve water quality during the contact with sewage. The essence of the biofilm method lies in achieving the purification treatment of polluted water bodies through human influence. With the improvement of water pollution treatment technology in our country, biofilm technology has gradually been widely applied, and its effect is also gradually improving.

Aquatic plant purification technology. This technology mainly utilizes the self-purification function of aquatic plants during their growth process. Plants can gradually purify pollutants through their own metabolism. In the process of treating black and odorous water bodies, it is generally only after the effect is confirmed through experiments that it can be applied in practice. Appropriate purification plants should be selected, which should have strong reproductive capacity, be easy to cultivate and manage, and also have a pleasant landscape effect.

5. Conclusion

The treatment of urban black and odorous water bodies is a complex systematic project. It is necessary to take a comprehensive approach and make good prevention and control plans. Adapt to the river conditions and adopt comprehensive technologies; Wise innovation, strengthening technical support; Strengthen supervision and inspection, establish long-term effective mechanisms and other aspects, and carry out multi-faceted governance and collaborative interaction to build measures and management systems for the protection and restoration of urban water ecology, ultimately achieving a city water ecological corridor with unobstructed rivers, clear water, green banks and beautiful scenery.

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