Discussion on Urban Black Odor Water Body Treatment and Long-term Management and Maintenance

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Abstract. In view of the increasingly serious pollution of urban rivers, seasonal or end-age black odor, not only affects the urban landscape, but also affects the daily life of the surrounding residents, in order to eliminate urban black and smelly rivers and improve the quality of urban water environment. This paper proposes the treatment technology of urban black and odorous water from the aspects of controlling source pollution, water pollution control and ecological restoration technology. Strengthen management from the long-term improvement system of water quality and policy guarantees to achieve the long-term clear effect of urban water bodies.

1. Introduction
With the rapid development of China's economy, especially urbanization and rapid population development, the discharge of sewage and pollutants has increased significantly, while urban rivers have been regarded by the people as the main sewage channels and sites for urban wastewater and domestic sewage. Increasingly serious, seasonal or end-age black odor, complete loss of function, affecting landscape and human life and health [1]. In April 2015, the "Water Pollution Prevention Action Plan" promulgated by the State Council ("Water Ten") proposed that "by 2020, the black and odorous water bodies in the built-up areas of prefecture-level and above cities will be controlled within 10%, and by 2030, the urban built-up areas will be completed. The control goal of the black odorous water body is generally eliminated [2]. The existence of black and odorous water body destroys the image of the city and restricts the sustainable development of the city. Therefore, it is imperative to take effective measures to improve the phenomenon of urban black and odorous water.

2. Urban Black Odor Water Treatment Technology
The rectification of urban black and odorous water bodies should be carried out in accordance with the basic technical route of “control source pollution; water pollution control; strengthen water flow, use clear water to supplement water source; water purification and ecological restoration”, in which control source pollution and water body pollution control are Choose the basis and premise of other technology types [3].

2.1. Control Source Pollution Technology
Point source pollution control technology. The point source pollution affecting urban black and
Odorous water bodies mainly include urban residents’ domestic sewage, industrial sewage, and large-scale livestock and poultry breeding. Sewage collection is the most direct and effective engineering measure for the treatment of black and odorous water and it is also a prerequisite for adopting other technical measures. By laying a sewage intercepting pipeline along the riverside lake and rationally setting up a lifting (transporting) pumping station, the sewage will be intercepted and incorporated into the urban sewage collection and treatment system. In areas close to the urban sewage pipe network, sewage should be concentrated in the pipeline.

Non-point source pollution control technology. In addition to the surface runoff of the city, the non-point source pollution affecting the urban black and odorous water body may also include non-point source pollution of the surrounding areas of the city, rainwater in the villages and towns, and pollution of domestic sewage. In combination with the construction of the sponge city, various low-impact development (LID) technologies [4], initial rainwater control and purification technologies, surface solid waste collection technologies, and ecological revetment and isolation (blocking) technologies are adopted.

Local treatment. For sewage that cannot be connected to sewage pipes in a short period of time, and black and odorous water bodies that do not replace or supplement water sources, physical, chemical or biochemical treatment methods are adopted, and devices with small footprint, simple and easy operation, and low operating cost are selected. Quickly remove contaminants from water.

2.2. Water Body Pollution Control Technology
Sediment cleaning. The pollutants present in the sediment are removed from the water body to reduce the release of pollutants in the sediment, which can effectively and significantly reduce the endogenous pollution load, and avoid the implementation of other treatment measures. Contaminants are released into the water. It is suitable for the initial treatment of serious water bodies with sediment pollution.

Garbage cleaning. There is a temporary dumping point for garbage along the coast of the city. Domestic garbage and other solid waste management should be strengthened to prevent it from entering the water body and causing pollution to the water body.

Biological debris and floating debris cleaning. For aquatic plants, seasonal defoliation and water bloom algae, it is necessary to salvage and clean up before dry and decay, to avoid decay of plant residues, further release pollutants into the water and consume water oxygen. Plastic bags, other household garbage, etc., require long-term cleaning and maintenance.

2.3. Ecological Restoration Technology
Shoreline repair. The planting grass ditch, ecological revetment, and permeable bricks are used to transform the original hardened river bank (lake bank), and the pollution control effect of the water body is strengthened by restoring the natural purification function of the shoreline and water body. Cai et al. [5] showed that ecological slope protection has a delay effect on surface runoff and has good ecological benefits in controlling surface runoff pollution.

Ecological purification. Mainly adopting artificial wetland, ecological floating island, aquatic planting and other technical methods, using soil-microbial-plant ecosystem to effectively remove organic matter, nitrogen, phosphorus and other pollutants in water. Considering water purification, landscape enhancement and plant climate adaptability, try to use local species with good purification effect and pay attention to the spatial layout and matching of plants in water.

The study of sewage purification in constructed wetlands began in the late 1970s [6]. Germany uses horizontal and vertical flow wetland reed bed systems to treat nutrients (N, P, etc.) in eutrophic water, and compares them. The results show that more than 90% of organic pollution and N, P pollution are removed [7]. The average removal rate of TN in the Canadian subsurface reed wetland system during plant growth season was 60%, TKN was 53%, TP was 73%, and average phosphate removal rate was 94% [8]. The British reed bed vertical flow pilot system is used to treat high ammonia nitrogen sewage with an average removal rate of 93.4% [9].

The ecological floating bed or ecological floating island is based on aquatic plants and uses the principle of no soil cultivation technology to artificially build aquatic plant systems, degrade pollutants
in water bodies and achieve water purification. Yang Jian [10] showed that the biological floating island was selected as the degraded plant. After the operation was stable, the removal rate of CODcr, NH3-N, total phosphorus and turbidity could reach 60%, 64%, 43% and 83%.

Generally, aquatic plants are divided into emergent plants, submerged plants, floating plants and floating-leaf plants. Aquatic plants such as water hyacinth, cattail, water celery, giant salamander, water onion and valerian have obvious purification effects on river black odor [11].

Artificial aeration. It mainly uses falling water, fountains, jets, and other types of aeration to effectively raise the dissolved oxygen level of the water. As a kind of river pollution control measure, aeration and reoxygenation technology has been widely used abroad due to its low investment and operating costs and good governance effects [12]. Chen Wei et al. performed laboratory artificial aeration and reoxygenation on the black water of Suzhou Creek. The results showed that after 20 hours under aerobic conditions, the odor was basically eliminated, the color of the water was obviously changed, and the COD was greatly reduced [13].

2. Other Governance Measures

2.4. Other Governance Measures

Increase the flow of water. By setting up the pump station, the water system is reasonably connected, using wind or solar energy, the water body flow can be realized, the water body flow rate can be increased, the water body re-oxygenation capacity and self-purification capacity can be improved, and the water quality of the water body can be improved.

Use water to replenish water. The use of urban reclaimed water, urban rainwater, clean surface water, etc. as supplementary water sources for urban water bodies; promote the transfer and diffusion of pollutants to achieve water quality improvement, increase water mobility and environmental capacity.

Use treatment facility governance. For the purification of water from a large black odorous water body that cannot completely intercept sewage, or a closed water body that does not have external water source hydration, appropriate treatment facilities should be installed in the surrounding area of the water body to extract river water from the most polluted section, and after purification by the treatment facility, Discharge to the other end to achieve purification and circulation of water.

3. Long-term Maintenance of Black Odorous Water Treatment in Cities

After the treatment of black and odorous water, it may face problems such as the increase of pollution load, which makes the water quality deterioration and black odor repeated [14]. Therefore, it is necessary to ensure the effective management of water quality and ensure the long-term effect of water quality improvement.

3.1. Organizational Implementation

The government is the main body responsible for the rectification of urban black and odorous water bodies. In the process of rectification, maintenance, maintenance and long-term management of urban black and odorous water bodies, the “river and lake system” is implemented to clarify the responsible persons of water quality management in each water body and implement relevant management measures.

3.2. Long-term System and Policy Guarantee

The government shall strengthen the supervision of water function areas and sewage discharge outlets, strictly discharge into the total discharge of rivers; establish or entrust professional urban water conservation units, be responsible for the daily maintenance of urban black and odorous water bodies, and achieve no floating objects on the water surface.

The black and odorous water body restoration project should implement the post-project evaluation system, regularly assess and implement the main body of responsibility, and implement the long-term management in place [15]. The government should formulate a reasonable monitoring and evaluation plan for indicators related to black and odor in urban water bodies, and regularly publish the results of urban water quality monitoring and evaluation to the public and accept public supervision.
4. Cases of Black Odor Water Treatment and Long-term Water Quality Improvement

Before the treatment of the small canal in Yangzhou, there was serious river channel siltation, the river's regulation and storage capacity was seriously insufficient, and the river water quality was generally poor. Especially in the high temperature period in summer, the turbidity of the river water increased significantly, and it was easy to form cyanobacterial blooms, causing water body oxygen deficiency. The damage to the water ecosystem is large, and the odor of the sludge is diffused. Through river dredging to expand the water storage capacity of the river, improve the self-purification capacity of the river water body, and through the construction of ecological protection, sewage access pipelines, greening arrangements and other engineering measures, cut off the source of pollution, improve the river hydrodynamics, water quality, water environment, making it "The river is clear, the river is green, the river is smooth, and the scenery is beautiful. After the remediation, the water environment and surrounding environment of the river have been greatly improved, which has improved the quality of the regional water environment and improved the living environment of the people.

After the completion of the river improvement, the government commissioned a professional agency to conduct a public survey and evaluation. The survey issued a total of 101 public commentaries on the urban black odor water remediation effect, including people of different ages, working conditions and different distances. The survey results basically reflect the opinions and suggestions of the public at all levels in the project area, and they are representative. In the survey, 97% of the respondents expressed great satisfaction and satisfaction with the remediation effect, and 3% were dissatisfied with the remediation effect.

The quality of the water environment has been significantly improved after the renovation of the small canal. According to the black odor water body determination standard, the four physical and chemical indicators of the small canal 12 times in six consecutive months are not in the range of the black odor water body determination index, and are not black odorous water bodies, and the black odor has been eliminated.

5. Conclusion

In summary, the treatment of urban black and odorous water is relatively complicated system engineering. In order to ensure the scientific, operability and long-term effects of urban black and odor water treatment measures, appropriate measures are taken to comprehensively and scientifically control urban water bodies. In the process of controlling urban black and odorous water bodies, the formation of black and odorous water bodies and the long-term improvement of water quality after treatment should not be neglected. In addition, long-term systems should be established to ensure long-term effective management of urban water quality.

6. References

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