Water Pollution Control and Ecological Restoration of Urban Lake Landscape

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Abstract. Under the background of ecological civilization, the landscape construction of inner lake meets the needs of people's good life to some extent. However, in recent years, the landscape water body of our city is affected by itself and its surrounding environment, and eutrophication, blackening and frequent peculiar smell of water seriously affect the quality of urban ecological environment and residents' living environment. This paper introduces and analyzes the application of water pollution control and ecological restoration technology in Pantang Park, Wuzhou City, in order to provide reference for water pollution control of small rivers and lakes.

1. Introduction
In order to enhance the quality of life, urban managers should constantly beautify and purify the urban ecological environment, and transform small rivers and lakes as the city landscape water body. As most of these water bodies are constructed or reformed manually, they are basically in a closed or semi-closed state with poor flow and low volume, coupled with the single structure of the ecosystem and limited environmental capacity, which leads to poor self-purification ability of the water body and is vulnerable to the influence of the surrounding environment. Unlike domestic sewage and industrial waste-water, the disposal of landscape water pollution could not utilize the biochemical handling process. Once the its water quality is polluted or deteriorated, it is difficult to recover by itself. It is necessary to govern urban landscape water. The research of ecological restoration technology has achieved obvious results, and gradually become important means to landscape water body management and restoration[1]. This paper introduces and analyzes the application of water pollution control and ecological restoration technology in Pantang Park, Wuzhou City to provide reference to water pollution control of small rivers and lakes.

2. Pollution Control and Ecological Restoration Technology of Landscape Water
Guided by the principle of ecosystem, the ecological restoration technology of landscape water body adds aquatic animals and plants and microorganism, which are artificial, anti-pollution and strong purification function to establish balanced ecosystem in landscape water body, restore its ecological function, and enhance purification ability[2]. The source of landscape water pollution is generally divided into exogenous pollution and endogenous pollution. Exogenous pollution mainly comes from atmospheric deposition, rainwater runoff and other sewage seepage. Endogenous pollution is from sediment, excreta, residual branches and leaves, etc. As to restore, it focuses on reducing nitrogen and phosphorus nutrients in water, organic pollutants, and inhibiting algae breeding, purifying the water body[3]. The pollution control and ecological restoration of water body in Pantang Park is as follows(Table 1).
Table 1. The pollution control and ecological restoration in Pantang Park.

| Technology               | Mechanism of action                                                                 | Applied method                  |
|-------------------------|-------------------------------------------------------------------------------------|---------------------------------|
| Water treatment         | Pollutants contained in sewage are separated or converted into harmless substances by various methods to purify the sewage. | physical or mechanical separation |
| Aquatic animals         | Use aquatic animals to absorb organic matter, inorganic matter, algae, etc.         | zooplankton, zoobenthos etc.    |
| IEFI                    | Plant roots can absorb nutrients such as nitrogen and phosphorus, release oxygen into water, and secrete special chemicals to promote microbial nitrification and denitrification in root areas | dry floating island wet floating island |
| Water increasing oxygen | Add dissolved oxygen, promote water body flowing, and make river course visit.      | flotation fountain aerator       |
| Stabilization pond      | The process of purifying water body is similar to that of natural water body, and could be improved and accelerated by artificial technology | pond, impervious layer, microorganism, aquatic plants, etc. |

3. Overview of Water in Pantang Park, Wuzhou
Pantang Park water area is about 81,280 M2. Its average depth is 2M and total volume 155,000 M3. It is a closed water body with natural mud bottom, growing submerged plant, and the water system is connected as a whole. The main pollution sources are rain water, stormwater runoff of green belt fertilization, residents laundry and car washing waste-water.

The water body capacity is small with poor self-purification ability and management. So water quality indexes have exceeded the class V standard in the Environmental quality Standard of Surface Water (GB 3838-2002) (Table 2). The main pollutants are TN, TP and organic matter, low-transparency and anoxic-anaerobic. The principle problem is to dispose pollution of total phosphorus, total nitrogen and organic matter pollution[4]. After the project treatment, the water body should reach the class IV standard.

Table 2. raw water quality. (mg /L )

| Water quality indicators | Mass concentration |
|-------------------------|--------------------|
| CODMn                  | 55.5               |
| CODCr                  | 42.3               |
| BOD5                   | 20.1               |
| NH3N -                 | 3.4                |
| TN                     | 2.9                |
| TP                     | 1.6                |

4. Pollution Control and Ecological Restoration Measures

4.1 Water treatment process: bed mud dredging engineering
The bottom of the water body has been silted up throughout the year, forming internal pollution sources, and constantly releasing pollutants[5]. The volume of dredging is 16500M3. By dredging, the nutrients in the bed mud are transferred away, and removed algae spores and algae cells such as microcystsins to achieve the treating aim.

4.2 Aquatic animals Technology
Choose suitable aquatic animals, following principles. They will not reproduce largely or even out of control; they will not stir severely in the water body; the aquatic plants and animals can form a reasonable ecological chain cycle. Putting in mussels is effective to remove suspended algae and tiny organic matter, making the lake more transparent. Snails could ingest fixed algae, secrete substances promoting flocculation, and make water clear. Fish such as silver carp and bighead can effectively remove green algae[6]. Crucian carp, low oxygen and cold resistant, could prey on mosquito larvae. koi and red grass carp control algae growth. These aquatic animals, forming a stable food chain, could control aquatic plants and algae growth and create a benign ecosystem. In Pantang Park, the released density of young mussels in water bodies is 0.05kg/M2, totaling 4000kg; snails is 0.05 kg/M2, totaling 4000 kg; Putting in long crap with 8-40,000, long crap 20,000, and red grass carp with 8-24cm 35000.

4.3 Water increasing oxygen technology
Through the lifting circulation of flotation fountain aerator, the pollutants such as hydrogen sulfide, ammonia nitrogen overflow in the form of gas to purify water. The aeration equipment floats the water surface, without pedestal, free from the water level, has the functions of purifying and the fountain landscape, meanwhile the oxygen increasing technology oxidizes the organic matter, eliminates the water stench. Pan Tang Park selected 48 aerators, and reasonable layout to form 6 water purification landscape functional areas, reoxygenation and forming bright fountain landscape.

4.4 Ecological floating island technology
Floating field type ecological floating island is an ecological artificial floating island, using all-in-one unit structure, non-pot planting mode (avoid plant root propagation restrictions, declining water purification capacity)[7]. The floating island medium should not use foam plastic, avoiding the secondary pollution to the water body after crushing, and the plant root system of the formed floating field ecological floating island stagger and pull each other. In the ecological island, TN, TP removal rate of aquatic plants is up to 65%. In Pantang Park, various aquatic plants are planted, such as water hyacinth, floating lotus and water lily, as well as water celery, Zizania latifolia, reed, bushel, cattail, which absorb nutrients such as nitrogen and phosphorus to purify water quality.

4.5 Stabilization pond technology
The water restoration project in Pantang Park treats slope protection along the entire lake coast, about 8000M2. Adopt the stone bank method, the management area of barge is about 5000M2. Using natural stones pile barge, and its lines would be the curve, combined with the original shoreline, creating more beautiful landscape effect. Holes among stones can be used efficiently to grow aquatic plants, or as animal habitat, forming a composite ecosystem. Conduct domestic sewage interception which might be discharged into the water, and construct the interception pipeline into the nearby municipal pipe network, including 900M drain-pipe and DN500 steel-concrete pipes.

5. Analysis on the Effect of Management and Repair
Through the implementation of the project, the water quality was sampled and monitored(Table 3). The organic matter in water, after interception transformation, domestic sewage could not put into the water. The oxygen-increasing technology increases dissolved oxygen concentration, stable at 4mg/L, and organic matter are oxidized. Nitrifier changes ammonia nitrogen into nitrate nitrogen and nitrite nitrogen, absorbed by plants to denitrify. Dredging the bed mud slows down the rate of phosphorus
release, and without external pollutants entering the water body, decreasing the overall level of phosphorus element. Phytoplankton and tappers absorb phosphorus, keeping concentration below 0.1mg /L. So the results of shows that, after the project management, the lake water has reached the class IV standard.

| Water quality indicators | Mass concentration |
|--------------------------|--------------------|
| pH                       | 7.33               |
| COD$_{Mn}$               | 3.76               |
| COD$_{Cr}$               | 13.1               |
| BOD$_5$                  | 2.56               |
| NH$_3$N -                | 0.254              |
| TN                       | 0.039              |
| TP                       | 1.33               |

6. Conclusion
The construction of ecological civilization and the demand of environmental optimization make it is necessary to manage the pollution of rivers, lakes and other landscape water bodies, which would be a new type of water management field followed industrial wastewater and domestic sewage government. As to the present situation of urban landscape water body in our country, it should select reasonable remediation technology and process, optimize and integrate different restoration technology and then apply to management. Meanwhile, strict sewage interception and emission reduction and environmental protection management measures will be taken to improve the landscape water environment.

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