

Research on Treatment Status of Inner Rivers in Chinese Cities

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Abstract. The pollution of the Chinese inner rivers was more and more seriously in nearly 20~30 years. The people had already pay widespread attention to this status. The researchers had done a great deal of works on the treatment of these rivers and it had obtained much achievement and gained many effective treating methods. At same time the government had done some policy support to this situation. This paper summarized the treatment status of Chinese inner rivers. It included treatment methods and their advantages and disadvantages. It discussed the government's relevant policies and the implementing of the local governments. It also gave some improved directions in the future.

1. Current Situation

Since the 1980s, the city construct of China was changing day by day. The industry enterprises developed rapidly and many people moved in and began to live in the cities. The population of Chinese cities began increasing annually. The pollution water from the factories and thousands of rooms mostly was been rowing into the city inner rivers directly or indirectly. The living rubbish from the residents and visitors of all over the country was poured out at the river banks. The city inner rivers became drainage ditches year by year. At the same time, the management on the rivers was lack of and treatment had no any. These inner rivers gradually turned into the situations that water body heavily polluted, the ecological function declined, water-carrying capacity seriously insufficient[1], some rivers' beds dried up, most rivers pollution dirt stacking on the beds and the water became black and odorous. These inner rivers were not the beauty signs of the cities any more. They were the scars of the city development.

In recent years, Chinese people and the government already seen the rivers pollution situations and realized the ponderance of this problem. They began to treat the water pollution and had already gained some good effect. The researchers also had done more works on treatment methods in order to change the river status rapidly and enduringly and reasonably.

2. Treatment Methods

The treatment methods[2] of the black and odorous rivers are generally included of physical methods, chemical methods and biological methods. The physical methods are included of artificial aeration, sediment releasing and sweeping pollutant through drawing water, etc. The chemical methods are mainly to use chemical agents to remover the target pollutants in polluted rivers in order to improve the water clarity. But it is obviously that the chemical methods will produce the secondary pollution. The biological methods are new and effective methods in recent years. It is a better and more optimum treatment route when they combined with the aeration technique.

2.1. Artificial Aeration



Artificial aeration is a kind of technical method[3] which injects oxygen to water body through the artificial controlling to recover the aquatic ecology. It has been used to the river treatments since 1960s. The actual experiences showed that the artificial aeration not only could change the black and odorous status of the water body, but also could oxidize and degrade the reducing matters in the upper layer sediments of the water[4]. The aeration method can product a mainly amphimicrobe ecological environment in the surface layer of the water sediments so that there possessed aerobic bacteria growing and exciting probability. It can reduce the organic pollutants during a shorter time, raise the dissolved oxygen content, enhance the water self purification to improve the water quality. The method was generally effective so many researchers had taken lager time to study it. It also should be one of necessarily water treatment methods.

2.2. Drawing Water to Sweep Pollutants

Drawing water to sweep pollutants is a treatment method through drawing lager flow, high velocity clear water or the release flood water to sweep the polluted black and odorous rivers in order to reach the aims of clean up the pollutants and improve the water quality. Generally, after several hours the water quality will be changed. If it could be swept a certain time every day the water should have been gotten a fundamental improvement[5] and cleared away the black and odorous water.

But it has the same effect with the other physical method, sediment releasing, the cost of the method is huge. For example, if it took 19 hours to sweep the river every day, the cost would be 25,000,000 Yuan per year. At the same time, its purifying effect is not durable. After 12 hours stop sweeping the water quality of the inner rivers began to recover. This method can hardly treat those so called cecum rivers and beheaded rivers.

The method is a way that easy to operate, easy to realize, instant[6] to effect and no negative effects. So if the conditions allowed, it would be worth to do more discusses, researches and experiences[7].

2.3. Biological Treatments

Biological methods can recover the biological function of the rivers from the roots. It is a rapidly developing method in the world of recent years. It utilized cultivated plants or culture and inoculated microorganic metabolic activity to transfer, change or degrade the pollutants in the rivers and rebuilt a perfect trophic level aquatic ecosystem. It can self repair river system health and improve the water quality safely and durably. Its project cost and running cost are both lower and it can mix together with the greening environments and sceneries[8].

The ecological floating bed is one of the typical and successful applications. The ecological floating bed is a new, low cost, good effect, high biosecurity technique. It cultivated the terrestrial plants in the beds floating on rivers and utilized the plants' roots to absorb the nutritive salts, mineral substances or other pollutants in water aiming to improve water quality. When the plants were reaped these pollutants were also removed away. Moreover, the root systems of these plants could adhere to those suspended solids in the rivers. The rhizospheric microorganism could degrade the organic matters efficiently. These two facts both could clear up the river water. Furthermore, some plants were able to secrete the algal inhibition materials to inhibit the growing of the red tide planktons to reduce the rates of the red tide. At last, the floating beds formed perfect aquatic ecological landscapes or called water gardens. They supplied the urban residents a clean, beauty and comfortable living circumstance. So, the researches about this technique had been done a great deal of and it had achieved much progress inland or outland in recent years.

But the effect slower was the weakness of the ecological method. The purifying function began to work always after the ecosystem was built completely. Simultaneously, the ecological systems, in most cases, would spare several or ten more years to be established because they depended on a great many biological factors and environmental factors[9].

The progress of the ecological floating bed technique still had many problems to be solved. Firstly, in different areas, of different rivers, there would be different types of pollutants. So it needed to study and find different aquatic plants or microorganism to adapt it. It was not only able to treat the polluting water but also able to prevent the biotic intrusion destroy the ecosystem. This must take a long period

to research and experience. Secondly, the water body circumstance of the same river would be changed by seasons, by various situations of its upstream and downstream, etc. But the plants in the beds were hardly adjusted in time. It made the treatment efficiency not enough. Thirdly, the most plants in the beds could not smoothly go through the winter. It made the application to be restricted in the cold regions. Lastly, yielding process of the floating beds needed to be standardized and factory-like to shorten the product periods. The problems about the joint, fixation, stability of the beds in heavy waves, high flow rate river regions must be solved. At the same time, the less and more scientific daily maintenance were worth to be done more researches in order to make the maintenance-free floating beds be possible in the future.

2.4. Combination Treatment Methods

2.4.1. Artificial aeration-aquatic plants combined treatment technique. This technique was that the aquatic plants played the main parts and the artificial aeration played the auxiliary parts in the purification process. It was a technology combined the artificial treatment with the nature ecological treatment[10]. It originated from aeration biology pools and artificial wetlands using in purification of sewage. It was largely used to treat the urban and village sewage in Europe, America and Japan for the past few years. For example, this system had been used about 20,000 series and occupied 90% of all the sewage treatment equipments in Japanese villages.

2.4.2. Aquatic-microorganism combined treatment technique. This technique was according to the biology and ecology principles, took full use of the synergistic effects and actions between the aquatic plants and various types of micro-organism. The aquatic plants supplied growing surfaces and intermediaries for the microorganism. The aquatic plants' roots and floating beds formed a safe and thick enough living environment for microorganism to degrade the pollutants. The degradation products might help the growing of the aquatic plants. In this complex ecology system, there were germs, fungus, mycetes, algae, protozoa, metazoa[11], benthonic animals, aquatic animals and plants. They got rid of the pollutants, purified the water together by interaction, physical absorption, biological absorption, biological degradation etc.

2.4.3. Aquatic-microorganism- aeration combined treatment technique. This technique took the aquatic and microorganism as the core, the artificial aeration as assisted. Its effect was rapid as well as durable. Its treatment efficiency was far better than any one only or any two. When the rivers were occurred such events as large amount of pollution incoming, abrupt changes of the weather, this technique would not be seriously impacted. So it had prominent advantages.

3. The Government Actions

The pollution of the urban inner rivers was not only the natural environment destructive from the human beings but also the problems of the unsound and inexhaustive government management. It had been over 30 years from the Chinese economic reform since 1980s. The environmental loads became more and more heavy as the economic energetically developing, industry and handicraft industry rapidly stronger, agricultural production greatly growth, urban population intensive expansion etc. The pollution of the inner rivers was only the one of all kinds of cases. The attention of the government for urban river water pollution problem was beginning at nearly ten more years. The local government had taken some measures, but they were mostly superficial, short-term and one-sided. There were no long-term, effective, prompt, applicable method. So there was still a long way to go through for us to treat the pollution and there were many severe problems to solve.

The general problems of the government in river water quality controlling were as follows:

3.1. The One-sidedness of Governance.

The treatment was not comprehensive enough. The black and odor situations on unfocused areas were more serious. Those rivers which related with the local governments "face" were generally abundant quantity, good quality, and becoming beautiful landscapes. But the other rivers which did not concern

the governments "face" were dirty smelly, full of garbage, pollution. The different areas of a same river may be different.

3.2. Management Discontinuity

Once the government changed or the leader changed, it was easy to be a no-end project or the no-management project. Urban water environment management was a systematic project, which included not only the technical engineering of improving the water environment, but also the management measures to maintain the quality of water environment. The technical engineering which was spent a huge sum of money, because of the lack of follow-up supervision and management, might make the water pollution repeatedly. It was not only becoming huge waste, but also harmed the engineers' faith.

3.3. Lack of Management Coordination

Many environmental projects must have regular inspection, supervision, durable operation, cleaning the rivers, transport the rubbish, so that the effect can be kept. It needed the coordination within the different government departments to treat all kinds of problems together. But the reality was hard to be done. For example, Living garbage was poured optionally, for example, was the main cause to lead to the city water body black and odorous. But the environmental protection and health departments could not form linkage mechanism to solve this problem for a long time. So the Garbage clearance and treatment problems become the deep ache of many cities.

3.4. The Method of Governance Was Not Scientific

In some areas, the artificial landscape construction in the process of governance was excessively pursued. Too many artificial lakes were too broad and needed too much water to replenish a large amount of evaporation loss because they were often lack of natural runoff recharge. Those lakes not only can't accumulation rainwater for the city, but become large "water -users" in the city water cycle. They perennially needed abundant water diversion to supplement water quantity, maintain landscape use from the major rivers. They took up a lot of water resources and those small inner river were becoming black and odorous because lack of water supply.

Again, for instance, construction of riparian zone also exist many problems. The landscape requirements were only considered to cement, marble, stone. Using hard revetment was mostly from the perspective of cost clean flood etc, but the water permeability of riparian zone of the water and the ecosystem protection was far less than the ecological slope protection or natural slope protection. These will lead to poor urban rainwater collection, worse inner river ecological condition and aggravating rivers pollution.

There are many problems in the government's work, but the problem of water pollution in the inner rivers of cities was also a common problem in the developing countries. It was unrealistic to expect a quick solution. In the past, some measures are feasible and worthy of promotion and extension. Such as:

1) River Chief System.

It was the rules that the leaders of various levels of the government became the managers of all the inner rivers. They were responsible for river management and protection work within their respective jurisdictions. River Chief System avoided the problem of property right of public rivers. It cleared the main body of management, giving river manager responsibility, permissions and rewards and punishments measures. The chief's main work included strengthening the protection of water resources, the full implementation of the most stringent water management system, strengthen the management and protection of the coastal areas of the river and water areas, and control the ecological environment of water space and water line. It also included improving the prevention and control of water pollution, coordinate pollution control over the water and on the bank, searching for the pollution sources of the rivers, optimizing the distribution of sewage outlets in the rivers, strengthening water environmental management, ensuring the safety of drinking water, increasing the management of black and odorous water, and realizing the clean and beautiful water of the river lake. It would strengthen water ecological restoration, delineate river and lake management scopes

according to laws, strengthen the management of the lake system, and strengthen the supervision of law enforcement and a crackdown on violations involving of lakes.

River Chief System provided a new path to solve the problems of public waters pollution and ecological destruction. In operating one more years, it played a positive role to reduce the river sewage, keep the river clean, reasonable development and protection of river resources. It had gained some significant progress.

2) Public-Private Partnership

It refers to the government made public bidding to purchased water quality maintenance services. The social capital participated in pollution control. It was to realize the water transparency increased significantly, the comprehensive pollution index decline year by year. The inner river water was no smell, no impurity. At the same time gradually restore the ecosystem of the river itself, river self-purification ability of ascension.

4. Conclusion

Urban river management is a comprehensive systematic project for a long time. It needs human beings protect, pay attention to and inherit. The inner water is not only the blood of a city, the life of a city, but also the eyes and face of a city. It is worth to be protected, to be paid more hard work and effort for her. Both the scientists and the government managers are worth doing more researches, more endeavors and more attention for our future generations.

5. References

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