

## The Progress of Chinese Aquatic Ecological Restoration

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### Abstract

In this article, we reviewed the application and development of aquatic ecological restoration technology in China; elaborated artificial ecological floating bed techniques, aquatic plants ecological restoration techniques and biological-ecological joint repair technology. Artificial floating island is an effective method that is currently used for water purification of eutrophic water. Ecological restoration techniques have given priority to restore aquatic plants. Biological-ecological joint repair technology is using plants and microbes for transfer, transformation, and degradation of water pollutants, purifying water, and has received better treatment effect. Finally, we propose that future research should be focused on.

**Keywords:** Aquatic ecological restoration; China

### Introduction

With the rapid development of China's urbanization and large-scale intensive industrialization of modern agriculture, improvements of rural environment have become increasingly prominent. The situation has very grim serious impact on towns and villages safe drinking water. The quality of drinking water sources are generally suffering contamination in Chinese small towns and the drinking water security has become an important social problem. The village drinking water pollution mainly highlights some aspect, such as organic nitrogen and phosphorus pollution, toxic organic compounds of heavy metals pollution. The water quality compliance is low, so difficult to protect the safety of drinking water [1-3]. Agricultural source nitrogen and phosphorus pollution in village's drinking water source is a direct result of widespread contamination by nitrogen and phosphorus. Water sources with nitrogen and phosphorus pollution, also lead to eutrophication, algal blooms, and has become a serious hazard for drinking water safety. In this article, we focused on the application and development of aquatic ecological restoration technology in China; elaborated artificial ecological floating bed techniques, aquatic plants ecological restoration techniques, and biological-ecological joint repair technology.

### Major Ecological Restoration Techniques

#### Artificial ecological floating bed

A new kind of ecological waste water treatment technology has developed rapidly in recent years. Artificial floating island is an effective method that is currently used for water purification of eutrophic water. Artificial floating island is floating on the water surface, and it is a carrier which prohibits the dispersion of the materials. Its man-made surface is suitable for planting various types of plant varieties, which are suitable for the growth of the aquatic environment. The head former carrier materials commonly use foam boards, which are low-cost, but of low mechanical strength. If it's used for a long time, it will break into blocks and drift on the water surface, and eventually form into white pollution. Growing plants on canna and umbrella grass are beautiful, but they will decay in winter and become dying materials. Secondary contamination of the tall fescue, also known as the reed-like fox Mao and high oxtail grass is also there. The *Gramineae fescue* is a perennial herb, and can withstand safely under the cold and heat conditions, such as the high temperature of 38°C in the summer and -15°C in winter. Its green time could last for a long periods, even in the south of the Yangtze River.

Many Chinese scholars have carried out efforts to repair the city

ecological floating island city, river, lakes, and aquaculture water. Some scholars carried out the experimental and ecological phytoremediation of floating island in urban polluted rivers [4]. Using the related technology to deal with the black-odour water in small and medium-sized rivers in Shanghai city, they have got about 70% decontamination rate [5,6]. In 1998, scientists use ecological floating island to carry out repairing work in Wuli Lake, Wuxi City. They found that N, P removal efficiency is high and in 2002, by using the technology of phytoremediation brake Lake, the Yongding River and other polluted water bodies in Beijing have reached better phytoremediation results [5-7].

In China, about 85% of our lakes are with varying degrees of eutrophication. This is a disaster in environmental point of view, but from the resource point of view, this is a kind of rare agricultural resources. Tong and Xu-hong [8] took use of eco-Floating Island for phytoremediation in Shahu Lake in China. Using about 30 species of terrestrial and wetland plants to make "Water Garden", water lawn, water paddy agriculture-shaped transferred to the surface cultivation, the results showed that 27 kinds of plant growth and good plant production are higher than the land, and heavy metal and nitrite contents are also far below the national food safety standards, so they can be used as green food. Ecological floating islands and other bioremediation technologies are effective. Hung et al. [9] activated this ecology Floating Island technology; the magnetization of the aeration of natural ecological technology into Taicang City, Jiangsu Province, for there is a better purification effect. Ammonia nitrogen, total phosphorus, Chemical Oxygen Demand (COD), chlorophyll, removal efficiency was 61.8%, 50.4%, 31.3%, 75.2%. The system has played a synergy between the significantly technical improvement and consolidated repair effect, which greatly improves the transparency of the water body. Ecological floating island is carried out into the Lake River for lotus pollution ecological restoration. The integration of technology could repair the Dianchi Lake. The removal rate of total nitrogen and total phosphorus is about 30%. More than 20 species

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of aquatic plants were recovered and biodiversity was significantly improved [10-13].

But, using of ecological floating island has some problems, such as the application prospect. Researchers should pay attention to the floating body material due to the rot after soaking for a long time and the secondary pollution; some plants such as water peanuts, water hyacinth and other alien species could get higher purification efficiency about water quality, but most likely do harm to the local agriculture, fisheries and biodiversity.

### The aquatic plants ecological restoration techniques

Ecological restoration techniques have given priority to restore aquatic plants. It is useful to set up the health of biological diversity of the aquatic ecological system. It could also improve the lake water's ecological system stability, and resistance to pollution impact. The water ecosystem restoration in Sweden Trummen Lake, Japan Pipa Lake, Jianghu River and South Korea LiangCai River are the typical successful cases of the lake water's ecological system restoration.

Our country began to improve the environment by restoring the experiment work of aquatic plants, develop Tai lake, Dianchi Lake, and the East Lake's eutrophication control and ecological restoration demonstration research in the early 1990s. The study found that the disappearance of the Donghu Lake's cyanobacteria populations was related to the stocking filter-feeding fish. The further research and test were using silver carps such as predatory fish, as filters to control eutrophication for lake water's phytoplankton (algae) quantity and improve water quality. Chinese Academy of Sciences, Nanjing lakes Geography, set up a pilot area of the demonstration project in Wuli Lake Shore, for establishing the associations among emergent aquatic plants, floating-leaved plants and submerged plants. During the project, the aquatic plants' diversity index reached 40%, and the dominant plant in lake water was changed from algae to large aquatic plants. The demonstration area got water quality improvement, and became clear water.

Restoring aquatic plants are important for establishing healthy water ecological system in ecological restoration of water source. At present, our country and abroad are widely using the emergent aquatic plants (such as bulrushes, ShuiCong, *Rhizoma acori tatarinowii*, Lu Zhu, reed, rushes, and so on) and submerged plants (such as horworts, bitter grass, Zu grass, fox tail algae), to develop the pollution water's restoration. They also use cold-resistant and thermophilic submerged plants to build evergreen aquatic plants. Complex Bio-ecosystem building by submerged plants and new fillers is beneficial to improving the self-purification capacity of eutrophic water body [14,15]. Due to the obvious difference in phosphorus absorption ability of aquatic plants and different Niche, exploring absorption ability of high phosphorus aquatic plants and removing phosphorus effectively are the keys in ecological restoration. The domestic and foreign research found that in addition to the aquatic plants removing the nitrogen and phosphorus, a large area of lipid-rich epidermal can absorb lipophilic organic pollutants. *Eichhornia crassipes*, parrot hair, Duckweed, Elodea algae can effectively remove the methyl parathion, ethion and dicofol, as well as pesticide DDT. In addition, PAHs pollution in the sediment of water body can rely on the root of the plant itself. The microbial degradation and absorption can repair the surface water's PAHs. In recent years, some researchers focus on the allelopathy of some plant's infusion on algae, but many are still in the laboratory research phase [16-19].

Due to the composite pollution of nitrogen and phosphorus, pesticides, algal toxins in China's drinking water supply in villages, it

is necessary to explore plants that can effectively enrich and degrade organic toxic matter, heavy metals and algae. Researches and new technology based on the synergy between roots of plants and microbes are developing to repair the combined pollution.

### Biological-ecological joint repair technology

In recent years, the polluted water biological-ecological joint repair technology has become the focus of foreign research and development of technology. The technology is using plants and microbes for transfer, transformation and degradation of water pollutants, and purifying water. We have received better treatment effect. This project is low-cost and needs no energy consumption or low consumption. This project is lower cost, no secondary pollution, etc. At present, the technology has reached the level of practical engineering. The biofilms contact oxidation method is a kind of main technology of biological-ecological joint repair technology. It can effectively remove ammonia nitrogen in water and organic pollutants, reducing total pollution amount and purifying water. China, Japan and South Korea have used biological contact oxidation repair technology in river body remedy engineering.

In drinking water sources repair, the project team according to China's western hilly area's special natural conditions on the biological-ecological joint repair joint process began research. Research and development is suitable for the mountain rivers habitat. It can highly and efficiently increase oxygen decontamination by biological contact oxidation repair technology, repair water source, guarantee water quality by multi-stage filling water filtration system, river corridor along the longitudinal increasing oxygen, and ecological gradient repairs new technology and new technology, and a construction pilot demonstration. Because of differences (such as regional conditions, hydrological conditions, pollution characteristics) in different villages of China, it is necessary to construct technology integrated demonstration project and to further process performance optimization [16-21].

### Future Research is mainly carried out in the Following Aspects

(1) Screening and cultivating plants with large biomass and strong enriched capability of collecting pollutants.

Strong hyper-accumulating plants are the primary task to expand the ecological floating island engineering applications. Hyper-accumulator generally grew more slowly, and the ecological competitiveness is not strong. Many of them are the wild-type rare plants and need strict climatic requirements. The introduction is restricted.

(2) Deeply and systematically studying plant community ecology and plant body physiology.

Carrying out nutrient uptake dynamics studies about germplasm resources, that is common to the local aquatic (wet) source, after collection. Classify and match plants by their needs. Explore the function of root exudates in microbial communities; Doing research on the mechanism of interaction and effects between plant roots and rhizosphere microorganisms.

(3) The existing position and manner of toxic and hazardous substances of plants need to be researched. This could prevent its potential risk to humanity. If necessary, carrying out the secondary pollution's disposal research study.

### Conclusion

Towns and villages drinking water have security risks also from pesticides, antibiotics and endocrine disruptors, heavy metals, and other toxic pollutants. Water source protection and improve drinking water security barrier has arised. In China, water pollution is still very

grim; towns and villages drinking water source pollution has become an increasingly serious situation. Protection and enhancement of the water quality of the source of drinking water to the rural masses is an important part of the safety of drinking water.

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