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Research Progress of Hydrophytes on Ecological Restoration of Polluted Water

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Abstract

Plants play a key role in aquatic ecosystems. The research on purification of water bodies by aquatic plants has always been a hot spot in the field of water quality improvement. In this paper, the role of plants in the ecosystem, the research status of phytoremediation water technology, and the existing problems in the research of phytoremediation water technology are comprehensively discussed and summarized, and the development trend is prospected.

Keywords

Aquatic Plants; Water Quality Improvement; Polluted Water Bodies.

1. Introduction

The total amount of freshwater resources in China is 2.8 × 1012m3, accounting for 6% of the world's total water, ranking fourth in the world. However, China has a large population, and the per capita freshwater resources are only 2150 m3, which is 1/4 of the world's average level [1].With the acceleration of China's economic development and industrial process, the pollution emissions in water bodies are increasing. The discharge of industrial and urban domestic wastewater, the loss of chemical fertilizer and pesticide residues, the leakage of municipal solid waste and industrial solid waste, etc., lead to nitrogen, phosphorus, organic matter, heavy metals in lakes, estuaries and bays and other relatively closed, slow flow of water, causing water pollution, damage and change of aquatic ecosystems, resulting in deterioration of the ecological environment. At present, the problem of water quality caused by human activities has become a difficult problem in water pollution control in the world.

If the water body is polluted, that is, the environment in which aquatic organisms are located is deteriorated, the species composition of animals and plants in the aquatic ecosystem will change, the number of some submerged plants will decrease sharply or even disappear, and the harm to aquatic animals will be serious, and even some amphibians will be disabled and deformed, then the food chain will be shortened, the food network will be simplified, and the species diversity of the main biological communities will be reduced [2] . In recent decades, due to the continuous decline in water quality, many large aquatic plants have disappeared from the water bodies of shallow lakes in China. Lakes, estuaries and bays are relatively closed and poorly mobile water bodies, and their self-purification ability is relatively weak. However, there may be construction waste, domestic waste and other storage around them, industrial and urban domestic waste water discharge, fertilizer and pesticide residues loss, which will pollute the water body in the basin. Although the effect of engineering treatment is ideal, the

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investment is large, and it can only be aimed at the existing pollution situation. In the later stage of treatment, various pollutants may still appear in the water body, and plants are used for water restoration. The process is relatively simple, low cost, avoids secondary pollution, and has the dual effects of repairing water bodies and improving the landscape environment. It has important practical significance for solving the problem of water pollution and improving the ecological environment.

Aquatic plants constitute an important part of aquatic ecosystems and are important regulators of the water environment, which is conducive to improving the biodiversity and stability of lake ecosystems [3]. The related technology of purifying water by aquatic plants has broad research and application prospects, and its related research has always been a hot spot in the field of water quality improvement.

2. The Role of Plants in Aquatic Ecosystems

Aquatic plants need to absorb nutrients such as nitrogen, phosphorus, CO2 and organic matter, as well as heavy metals and other pollutants [4-6] to maintain the level of nutrients in the water. The roots of submerged plants can absorb suspended particles in water and increase the transparency of water, which is beneficial to submerged plants and other organisms that need to use light to obtain more energy. The growth of aquatic plants also provides a place for aquatic animals to lay eggs and inhabit; there will be a large number of microorganisms attached to the stems and stems under the water surface and the dead branches and leaves in the water in the plant belt. There will also be a large number of microorganisms in the soil, which can degrade the nutrients in the river water and provide carriers for the growth of microorganisms [7]. At the same time, many aquatic plants also have certain ornamental value.

3. Research Status of Phytoremediation Water Technology

Phytoremediation water technology is an in-situ treatment technology that uses green plants and their rhizosphere microorganisms to remove pollutants in water. In recent years, domestic and foreign scholars have done a lot of research work on the use of plant technology to clarify the pollutants in water. Fang [2] and Xia et al. [8] studied the mechanism of aquatic plants on water restoration, and found that plants mainly played the role of absorption and microbial degradation in water restoration. Zuo [9], Xing et al. [6], Huang et al. [10], Mei et al. [11], Li et al. [12] studied the combined effect of one or more plants on water purification. The results showed that plants had a good purification effect on eutrophic substances and some pollutants in water, and the purification effect was related to water level, concentration and planting density. This shows that the phytoremediation water technology is feasible. Different types of aquatic plants play different roles in absorbing nitrogen nutrition and restoring damaged water bodies, and the required growth conditions are different in the ecosystem [13]. Native plants have strong adaptability to the local environment and the cost of restoration is relatively low [14].Therefore, appropriate plants are generally selected according to local conditions. In-depth understanding of different plants on pollutants in polluted water bodies

4. The Existing Problems and Development Trend in the Research of Phytoremediation Water Technology

Using plants to repair and improve water body is a kind of water restoration technology integrating economic, ecological and social benefits. At present, after years of research and exploration, some progress has been made, which has important reference value for improving water quality. However, at present, the research on phytoremediation of water body technology is still in the laboratory simulation stage. However, in practical applications, it is restricted by

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geography, environment and climate. For example, the growth state of plants will change with the change of seasonal environment. There is still a lot of work to be done to truly extend it to practical engineering applications. At present, most of the research on phytoremediation of water body technology focuses on a specific pollutant, and the surrounding environment of the actual water body is complex. Therefore, other remediation directions and the combined remediation effect of multiple pollutants should be strengthened. The composition of pollutants in polluted water is different, so when selecting plants, their adaptability to the environment must be taken into account to maximize their role.

In the future, in the use of phytoremediation of water quality, we should strengthen the research on plant remediation of various pollutions and their combined remediation, and should take into account environmental factors, and combine phytoremediation with other remediation technologies.

5. Conclusion

The use of plants to repair water bodies has many advantages. The research on phytoremediation of water bodies is of great significance to the improvement of water quality, and there are also some shortcomings. Based on the summary of the current research status, this paper draws the following two points:

(1) Plants play a very important role in aquatic ecosystems. Using plants to improve water quality can absorb nutrients and heavy metals in water. On the other hand, aquatic plants can provide convenience for the growth of aquatic animals and microorganisms, and aquatic plants also have certain ornamental value.

(2) At present, the research on aquatic plant restoration technology is still in the laboratory simulation stage, and there is still a lot of work to be done to truly extend it to practical engineering applications.

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References

[1] Wang Lei, Yang Song. Effect of soil suction test method on soil water characteristic curve [J].Water-saving irrigation, 2018 (8): 5-8.

[2] Sun Zhaodong, Li Zaixing, Song Hongqing, et al. Influence of soil water characteristic curve on runoff yield in sponge city construction [J].Water supply and drainage in China,2020,36(09):117-122.

[3] Zhang Yuanhang, Gao Qianfeng, Yu Guangtao, , et al. Study on soil water characteristics and strength characteristics of fissured red clay [J]. Science technology and engineering, 2023, 23(12):5278-5284.

[4] Liang Zhichao, Hu Zaiqiang, Guo Jing, Wang Kai, et al. Study on soil water characteristics and compression collapsible characteristics of unsaturated lime loess [J]. Journal of Hydroelectric Power Generation,2020,39(03):66-75.

[5] Yang Yonghui, Zhao Shiwei, Liu Nana, et al. Soil moisture characteristics of different vegetation measures in loess hilly region of southern Ningxia [J].Science of soil and water conservation in China,2006(02):24-28.

[6] Xing Xiumin, Qu Chao, Zhi Qing, et al. [J]. Journal of Hebei University of Engineering (Natural Science Edition), 2018,35 (1): 84-87+93.

[7] Wang Chao, Wang Peifang, Tang Jinsong, et al. Study on the reduction characteristics of ammonia nitrogen in the reed belt along the river [J].Water Science Progress, 2003, 14 (3): 311-317.

ISSN: 2710-0723

[8] Xia Huilong, Wu Lianghuan, Tao Qinnan.Study on the effect and mechanism of phytoremediation of methyl parathion in aqueous solution by Eichhornia crassipes [J].Journal of Environmental Sciences, 2002, 22 (3) : 329-332.

[9] Zuo Xiaofeng. Study on the absorption and purification effect of four aquatic plants on eutrophic substances in water [D]. Southwest University, 2010.

[10] Huang Renjun, Pan Mingan, Shen Yuanming.Effects of planting aquatic plants on the quality of sewage water in the suburban tributaries of the reservoir area [J].Modern Agricultural Science and Technology, 2017 (2): 165-165.

[11] Mei, Yao, Chen, et al. [J].Effects of three aquatic plants on main pollutants in artificial aquaculture wastewater.

[12] Li Shangzhi, Tang Yongqiong.Ecological restoration of polluted water by aquatic plants [J].Journal of Shenzhen University (Science and Technology Edition), 2005, 22 (3) : 272-276.

[13] Ma Kai, Cai Qinghua, Xie Zhicai, Li Daofeng, Liu Ruiqiu, 2003. The influence of the distribution pattern of submerged plants on the N and P factors of lake water environment. Journal of Aquatic Biology. 27 (3), 232 - 236.

[14] Wang Shengrui, Nian Yuegang, Hou Wenhua, et al. Selection of wetland plants [J]. Lake Science, 2004, 16 (1) : 90-95.