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Discussion on the Technology of Ecological Restoration of Freshwater Lakes

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Abstract

Lake fresh water resources, which account for a small part of the total global water resources, play an indispensable role in the development of human beings. However, the development of society makes the lake ecosystem suffer different degrees of damage. Firstly, the lake ecosystem restoration research progress at home and abroad is briefly described. Then through analyzing the principle and harm of the lake eutrophication and acidification, and by the means of physical, chemistry, biological control and some other lake restoration techniques, it is concluded that analysis should be made according to the specific situation. Only by combining a wide variety of methods can freshwater lakes ecosystem be sustained and restored.

Keywords

Lake ecosystem, eutrophication, acidification, biological manipulation.

1. Introduction

Among all the water resources on the earth, freshwater and saltwater lakes only account for less than 0.02% of the total water resources. However, freshwater lakes are still the most important water resources in many regions of the world. For example, lakes can be used as drinking, irrigation, and landscape water. The water source can also provide recreational activities such as boating, swimming, and fishing; in addition, the lake has a high biodiversity and is a food source for many terrestrial animals and water birds. However, with the development of society, especially population growth, industry and urban development, many freshwater aquatic ecosystems such as lakes and rivers have been severely damaged, making the scarce and important freshwater resources even more scarce. Due to the rapid economic development in these areas and the inappropriate development and utilization of lake resources, most of the freshwater lakes in our country are facing the problems of deterioration of the water environment and eutrophication. The destruction of the lake water environment will inevitably lead to the depletion of aquatic resources and affect human health and living environment.

The relative stability of the ecosystem is a necessary condition for human survival and development. The restoration of the lake ecosystem is to improve the lake water quality (transparency, oxygen conditions, the number of algae) to improve the preset conditions of the lake water for humans Entertainment, fishing and water supply, etc. Therefore, it is necessary to discuss the disturbances and restoration techniques suffered by the lake ecosystem.

2. Lake Ecosystem Disturbance

2.1. Eutrophication

Lake eutrophication refers to the process in which nutrients such as nitrogen (N) and phosphorus (P) enter the water body in large quantities, and phytoplankton dominates, leading

to the structural destruction and functional alienation of the aquatic ecosystem. The basic process of eutrophication is: in the initial state, there are less nutrients in the lake body, rich dissolved oxygen, low biological productivity, and the lake presents oligotrophic characteristics; as time goes by, nutrients enter the lake from the outside Gradually accumulate, the nutrients in the lake water increase, the biological production capacity of the lake increases, the biomass increases, the dissolved oxygen content in the water decreases, the water color is dark, and the transparency decreases. The composition of aquatic organisms is gradually replaced by those suitable for eutrophication, and the lake responds accordingly. From oligotrophic to mesotrophic, and then to eutrophic.

3. Lake restoration technology

Ecological restoration must first identify the main factors that cause damage to the ecosystem, and then must eradicate and reduce the impact of these factors on the system. For the eutrophic lake ecosystem, the input of a large amount of nutrients is undoubtedly the main hazard factor. The nutrients can come from the outside or from the inside of the lake. The reduction of the nutrient load becomes the prerequisite for the lake ecosystem. For acidified lakes, preventing the acidic substances discharged into the atmosphere from entering the lake water body is a key link. In addition, alkaline substances can be added to neutralize the acidity of the water body to restore the lake ecosystem.

3.1. External source pollution control

Exogenous pollution can be divided into two categories: point source and non-point source: point source refers to the discharge of urban domestic sewage and industrial pollution sources from the watershed; non-point source refers to the farmland runoff, livestock and poultry breeding, aquaculture and other areas in the watershed. source. With the continuous compliance of point source pollution emissions, non-point source pollution has increasingly become the main source of eutrophication of water bodies.

Non-point source pollution is the third largest source of pollution after urban domestic sewage and industrial wastewater, and it is much more difficult to control than point source pollution. Many non-point sources are heavily polluted. Rainfall runoff pollution has become the most important source of nutrients. Large amounts of nutrients migrate from the surface to the lake area under the scouring of heavy rains, resulting in pollutant concentrations in runoff far exceeding those in non-torrential rains. In the process of treatment of eutrophic lakes, it is first necessary to fully and fully grasp the pollution and treatment status of the basin, secondly determine the main control factors of eutrophication, and then calculate the environmental capacity of the water body and the total control target of the key pollution control area , And then get the maximum allowable emissions and the maximum allowable into the lake, and finally according to the stage of comprehensive management goals, formulate the corresponding comprehensive treatment project plan.

3.2. Internal source pollution control

Endogenous pollution refers to the polluted bottom sediments formed by the main accumulation of various nutrients and pollutants entering the lake. Under the influence of wind, waves, weather and other environmental factors, the bottom sludge is agitated and suspended, and nutrients will be dissolved and released into the water body; when the anaerobic and aerobic conditions of the bottom sludge are changed, the nutrients will also be released, causing the interior of the lake. The nutrient content is too high, which provides an effective endogenous supply for the growth and reproduction of algae, which is the main source of eutrophication in the lake. When a lake reaches an eutrophic state, a large amount of nutrients will be accumulated in its sediments, especially in heavily polluted lakes. Long-term accumulation

often causes high N and P loads in the sediments. When external sources exist, it may be possible This internal load only exerts a significant effect on the water bodies of eutrophic lakes in a certain season or period; however, when the external pollution of the lake is controlled, will the lake still be rich due to the existence and release of the internal load in the sediment? Nourishment, even "blooms" appear.

3.2.1 Artificial aeration and reoxygenation

Dissolved oxygen in lakes mainly comes from atmospheric reoxygenation and photosynthesis of aquatic plants, among which atmospheric reoxygenation is the main source of dissolved oxygen in water bodies. However, relying solely on atmospheric reoxygenation, the lake's self-purification process is very slow. The principle of lake deep water aeration technology is based on the characteristics of hypoxia after lake pollution, artificially inject air or oxygen into the water body to accelerate the reoxygenation process of the water body to increase the dissolved oxygen level of the water body, restore and enhance the aerobic water body The vitality of microorganisms purifies the pollutants in the water body, thereby improving the water quality of the lake. At present, the main aeration methods include mechanical stirring, pure oxygen injection and air injection.

3.2.2 Chemical inhibition

Chemical inhibition refers to the inhibition or delay of the release of endogenous P through chemical reactions. Specifically, it can be divided into two methods: sediment oxidation and chemical precipitation.

Generally speaking, when the water pH is less than 9, the redox condition is the main control factor for the release of endogenous P (reduction release of Fe-P), and the sediment oxidation method can effectively inhibit the release of P; when the pH of the water is high At this time (pH>9), neither sediment oxidation nor chemical precipitation can inhibit the release of endogenous P. At this time, other methods need to be considered.

3.2.3 Sediment Dredging

Polluted sediment is a potential source of pollution in lake water bodies. When the water environment changes, the nutrients in the sediment will be released into the water body again. The main purpose of sediment dredging is to remove the pollutants (N, P, heavy metals, etc.) contained in the sediment, remove the internal sources of polluted water bodies, reduce the release of sediment pollutants to the water body, and increase the capacity of the lake. Therefore, to solve the problem of eutrophication of lake water bodies, excavating sediment is an effective means to improve the high nutrient content of sediment. The prerequisite for sediment dredging is to first clarify the degree of the impact of sediment on the eutrophication of the lake. This method can be considered when the external pollution has been effectively controlled and the nutrients released by the sediment have a significant impact on the lake. Eliminate the effects of.

3.2.4 Drainage and flushing

Water is the most important environmental factor in the lake ecosystem, and it is also an important factor in maintaining the health of the lake system. Drainage and flushing of pollution refers to the introduction of unpolluted or less polluted river water into lakes where conditions permit to dilute the concentration of nutrients. Due to the dilution effect, the concentration of nutrients in the lake water decreases, reducing the supply of nutrients for algae growth. The growth of phytoplankton such as cyanobacteria and green algae is restricted, which has a certain effect on controlling blooms and improving water transparency.

Although drainage and flushing have a certain effect on lake governance, it is easy to cause suspension and diffusion of the bottom sediments in heavily polluted lakes, which promotes the release of N and P nutrients in the sediments and the adsorbed metal ions. , So that the water environment faces the risk of "secondary pollution". In addition, the lack of "clean water"

and the complexity of the drainage process also limit the widespread use of drainage and flushing.

4. Concluding remarks

Although lakes and reservoirs only occupy a small part of the land area in most countries, their importance to human health, recreation and national economy cannot be ignored. Although research on the restoration of lake ecosystems has been conducted for decades, the water quality of lakes still needs to be improved. Unnecessary nutrients, organic matter, sediment and pollutants in lakes and reservoirs are still relatively large, and further reductions and transfers are needed. And processing.

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