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Study on Ecological Restoration Technology of Acidified Lake

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Abstract

The acidic substances in the atmosphere and discharged into the water cause the acidification of the water body, which in turn leads to the simplification of the aquatic community structure and the reduction of the decomposition rate of organic substances, which inhibits the material circulation of the water body. From the perspective of the restoration of acidified lakes and the restoration of biological manipulation, this article proposes comparative technical measures for the ecological restoration of acidic lakes, hoping to provide the necessary reference for the ecological restoration of acidic lakes.

Keywords

Acid lake; Ecological restoration; Technology application.

1. INTRODUCTION

Lake acidification is the second major problem in the degradation of lake ecosystems, and there are many sources of material sources for lake water acidification, such as acid rain, the loss of a large amount of amino salts caused by agriculture or animal husbandry, etc. Among the many acidification sources, the impact of acid rain is the most significant. The burning of fossil fuels emits a large amount of S and N oxides into the atmosphere. These acidic substances fall into the lake through dry and wet precipitation or directly, or fall into the river and then flow into the lake through surface runoff, or fall on vegetation and wash away by rainwater. Inject into the lake, or infiltrate into the soil and then flow into the lake through underground runoff, which will eventually lead to acidification of the lake.

2. RECOVERY OF ACIDIFIED LAKES

The pollution sources of acidified lakes mainly come from waste gas discharged by industries, etc. The acidic compounds contained in the waste gas settle into the lake through the atmosphere. Therefore, the restoration of the pH of the lake can be considered from two aspects: one is to control the discharge of pollution sources from the source; the other is to neutralize the acidity of the lake water with alkaline substances such as limestone.

2.1. Control of Pollution Emissions

The control of pollution emissions mainly refers to the control of the discharge of acidic substances produced after the combustion of fossil fuels. In addition to industrial waste gas, automobile exhaust has become an important source of pollution in modern society. Around the mid-1970s, exhaust emissions in Europe, the United States, and Canada had reached their peaks. At this time, actions to control exhaust emissions began; by the mid-1980s, the control actions had achieved significant results, with significant annual SO2 and NOX emissions. To reduce. Due to the implementation of the International Clean Air Act, almost all countries have pledged to reduce sulfur emissions by 30% by 1983, and many European countries have also agreed that emissions by 2010 will be reduced by 70-80% compared to 1980. However, acidification will

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still be a serious environmental problem in many areas in the coming decades. In the acidified areas of southern Norway, although sulfur emissions have been reduced by 40%, the reduction in nitrogen compounds has not been significant. Therefore, the emission of nitrogen compounds is a major problem in the treatment of acidification.

2.2. Lime Clarification Method

Lime clarification is currently the most common method for restoring acidified lakes. The most used compound is limestone, in addition to calcite and dolomite that contain a large amount of magnesium carbonate. The principle of lime clarification is shown in the following formula. It mainly uses calcium carbonate to react with hydrogen ions in the water to reduce the acidity of the water in the lake.

$$CaCO_3 + H^+ \rightarrow Ca^{2+} + HCO_3^- \quad (pH<6) \tag{1}$$

$$CaCO_3 + H_2O \rightarrow Ca^{2+} + HCO_3^- + OH^- \quad (pH>6) \tag{2}$$

This method of lime control of lake water body acidification is technically effective, economically reasonable and feasible. However, the lime clarification method is a temporary remedy after all. If we want to eradicate the acidification of lakes, we must start with pollution source control.

3. BIOMANIPULATION RECOVERY

In 1975, Shapiro et al. first proposed the classic biomanipulation theory, which mainly reduces the number of plankton-eating fish (planktivore) or adding carnivorous fish (piscivores). Regulate the community structure of zooplankton, promote the development of high-efficiency herbivorous zooplankton, especially cladocerans, so as to improve the feeding efficiency of zooplankton to phytoplankton, and ultimately reduce the phytoplankton biomass. This method is also It is called food-web manipulation.

3.1. Controlling Fish

In the application of biological manipulation theory, chemical methods such as poisoning, selective netting, electric fishing, and fishing are used to reduce 50-100% of plankton-eating fish or high-density stocking of carnivorous fish to reduce plankton-eating fish. Promote the development of large zooplankton and bottom feeding fish (which can feed on benthic epiphytes and phytoplankton).

In addition, the role of fish can also be reflected in the stocking of filter-feeding fish. Non-classical biological manipulation theory believes that direct addition of filter-feeding fish can also achieve good results. Because filter-feeding fish not only filter-feed zooplankton, some can also filter-feed phytoplankton. The enclosure experiment on Wuhan East Lake showed that the filter-feeding fish silver carp and bighead carp have a strong control effect on the water bloom of Microcystis, and they also filter and eat a lot of large plankton such as copepods and cladocerans. Crustacean. At present, the results of this research have been applied in the treatment of water pollution in Dianchi Lake and Chaohu Lake.

3.2. Introducing Large Submerged Plants

Studies have shown that through reasonable biological manipulation, the reconstruction of large submerged plants, the use of the interaction between plants and their microorganisms and the environment, through physical adsorption, absorption, and decomposition, can establish effective zooplankton populations, thereby controlling phytoplankton The excessive

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growth of water purifies the water body. Experience has shown that many shallow lakes are in the clear water stage because submerged plants are the main primary producers.

3.3. Adding Zooplankton

Through zooplankton feeding (downward action), the goal of direct control of phytoplankton can be achieved. According to different lake ecological characteristics, the researchers screened the zooplankton that can control the dominant species of algae and directly added them. When the density of plankton-feeding fish is lower than 15 kg/ha, it will cause a decrease in chlorophyll. Therefore, the biomass and productivity of algae in lakes dominated by large transparent flea animals such as daphnia are low. The filter feeding effect of zooplankton can be used to restore eutrophic water bodies, but some researchers have pointed out that the ingestion of edible algae by zooplankton may lead to the growth of inedible algae and play a positive role in promoting the total biomass of phytoplankton.

3.4. The Special Status of Bacteria

In addition to decomposing organic matter and providing nutrients for phytoplankton, bacteria can also serve as food for zooplankton. Studies have found that bacteria can provide food supplements when large fleas are short of food, and play an important role in maintaining a high biomass of large fleas. Therefore, the ingestion of bacteria by large fleas is considered to be able to stabilize the biological manipulation process and occupies an important position in the food web for biological manipulation of lakes. If most phytoplankton cannot be eaten or digested by large fleas, other food particles must be increased to prevent food restriction. Due to the higher primary productivity, the higher the production of bacteria, and the large fleas can directly ingest and use the bacteria, so bacteria become such an alternative food source.

4. CONCLUSION

According to the current restoration work, the restoration of the acid lake ecosystem has failed to achieve sustainable effects. An important reason is that the release of large amounts of nutrients stored in lake sediments is very slow, making the phenomenon of eutrophication always exist; On the other hand, the insufficient reduction of nutrients in runoff and the continuous input of pollutants in the agro-ecological zone make the restoration of the lake a bottleneck. Therefore, the restoration of the lake ecosystem should combine the local natural conditions and the pollution status of the lake, use a variety of treatment methods, formulate a comprehensive treatment plan, implement it in stages, and gradually restore the structure and function of the lake ecosystem to improve it. And stability, so as to solve the environmental problems of the lake.

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