Eutrophication Control and Treatment Measures

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Abstract: Eutrophication usually refers to the excess of nutrients in water bodies, which often leads to the deterioration of water quality or the collapse of ecosystems.Eutrophication is a global problem with direct and indirect impacts on human health, agricultural output and ecosystems.This paper will review eutrophication standards, and through the analysis of references, it aims to explore the research progress and development trend of existing eutrophication standards, and explore how to improve water quality and restore ecosystems by reducing eutrophication, in order to provide scientific basis for the control and prevention of eutrophication.

Keywords: Eutrophication; Standards; Measures; Govern

Eutrophication refers to a phenomenon in which the environment such as water, soil and atmosphere is excessively rich in nutrients (especially nitrogen and phosphorus), leading to the imbalance of the ecosystem and the shortening of the life cycle [1].The main sources of eutrophication include many factors such as human activities, natural processes and climate change.However, human activities are the most important factor in eutrophication.Common eutrophication bodies of water include lakes, rivers, and oceans.Eutrophication not only has a negative impact on human health, but also has a negative impact on environmental protection and the balance of ecosystems.Therefore, it is of great significance to study and control eutrophication.

1. Definition and Classification of Eutrophication Criteria

Many countries and international organizations have developed standards and guidelines for eutrophication.Among them, the most commonly used are Total Nitrogen (TN), Total Phosphorus (TP) and water eutrophication (TSI).TN content is often used to invert the changes of lake primary productivity, and then infer the changes of lake nutrient state [2].As a limiting nutrient for algae growth in most freshwater lakes, phosphorus plays an important role in phytoplankton [3].TSI is usually used to represent the degree of eutrophication of water bodies, and the higher the value, the higher the degree of eutrophication of water bodies [4].

According to the different degree of eutrophication, eutrophication can be divided into mild, moderate, severe and extremely severe.Among them, mild eutrophication usually only has a certain impact on phytoplankton, and moderate eutrophication will increase the number of phytoplankton and benthos, but will not have a significant impact on water quality and ecosystems.Severe and extremely severe eutrophication has caused obvious damage to water quality and ecosystem, and effective measures need to be taken to control it.

2. Formulation and Application of Eutrophication Standards

The development of eutrophication standards should take into account the influence of geography, climate, ecosystem and other factors.More and more attention has been paid to the study of eutrophic standards abroad.In the 1990s, the United States Environmental Protection Agency began to develop a series of standards applicable to the eutrophical

assessment of different water types, including the concentration standards of total nitrogen and total phosphorus, as well as the evaluation criteria for the amount and variety of plants, animals and benthos [5].In addition, the European Union is also gradually developing a series of eutrophication standards applicable to different water types in Europe, with a view to controlling and predicting the trend of eutrophication.China's eutrophication standards are mainly based on physicochemical indicators, such as total nitrogen and total phosphorus concentrations, which are used to monitor and evaluate the degree of eutrophication of water bodies [6].On top of this, there are eutrophic criteria for specific water types, ecosystem types and water quality objectives aimed at protecting specific water ecosystems and ecological environments.

In terms of the application of eutrophication standards, some studies have shown that TN, TP and TSI can be used to predict the water quality of rivers and lakes [4].Researchers can use these indicators to determine the source of nutrients in the water body and take corresponding measures to reduce the impact of eutrophication.In addition, there are some new indicators that are being studied, such as Nutrient Ratio (NR) and some biological indicators.When determining the nutrient threshold, the adjustment of the input ratio of N to P should be considered.Therefore, the adjustment of nutrient salt ratio is of great significance [7].The main biological indicators are chlorophyll a, algae biomass and biological activity.Chlorophyll a is an objective biological index of water nutrition in lakes.Its content reflects the eutrophication degree of water body to a certain extent, and is an important parameter for evaluating the nutritional status and eutrophication degree of water body [8].Functional group biomass of planktic algae refers to the sum of the cell biomass of representative algae species (genus) in each biological functional group, and can be obtained by adding the biomass of representative algae species (genus) [9].Some people see bacteria as an important indicator of environmental change because, from a biological point of view, these microorganisms can reflect the degree of contamination of aquatic ecosystems [10].

3. Monitoring Methods of Water Eutrophication

3.1 Field Direct Measurement Method

The field direct measurement method is mainly used in the measurement of physical properties such as depth and water depth.For example, a sampler can be used to obtain water samples at different depths or bottom sediments for analysis using a sampling hook or float.And can directly read temperature, pH, transparency, chlorophyll and other parameters through field experiments.The advantage of this method is that the samples can be analyzed immediately after sampling, and the data processing is more simple and convenient, and does not require a lot of instruments and equipment and experience technology.Its disadvantage is that the accuracy and precision of the measurement data are poor, and it is not suitable for data analysis that requires high precision and accuracy.

3.2 Instrument Monitoring Method

Instrument monitoring method is mainly used in ecosystem data and environmental response analysis, its operation process is more complex, and requires a certain level of technology.The main monitoring indicators include water temperature, pH, transparency, turbidity, dissolved oxygen (DO), ammonia nitrogen, total nitrogen, total phosphorus, silicate and other parameters.Among them, silicate is one of the important indicators of eutrophication.Regarding the measurement of silicates, Aspila[11] et al. (1999) established a set of standards to characterize the concentration of silicates in seawater and fresh water.Meanwhile, Jiang et al. [12] (2008) established eutrophication standards and evaluation methods based on IAP (inorganic phosphorus in water) and silicates, which provided strong support for the control and prediction of eutrophication.

3.3 Biological Monitoring Method

Biomonitoring refers to the presence and evolution of eutrophication by analyzing biological properties such as microorganisms, plankton, benthos or plants in waters.For example, depending on the proportion of suspended microorganisms, the content of chlorophyll a in the body can be inferred, algae show different light sensitivity, some algae will die quickly in high temperature and low light environment, and the nutritional situation of the water can also be inferred from the benthic insects, dragonfly larvae, shrimp, lobster, etc.

4. Hazards and Control Methods of Eutrophication

4.1 Hazards of Eutrophication

(1) Ecological environment destruction: water eutrophication will lead to the proliferation of aquatic plants, blocking water bodies, rivers and other waterways, affecting the flow of water and the balance of the ecological environment.At the same time, eutrophication will also lead to the imbalance of aquatic ecosystems, resulting in serious pollution of water sources.

(2) River sedimentation: the accumulation of a large number of organic matter and sediment in the river, resulting in shallow river beds, slow down the flow rate, while the chemical substances in the water will accumulate, causing serious interference to biological growth.

(3) Air pollution: eutrophication can lead to the proliferation of large numbers of algae and plankton, which will take the process of absorbing carbon dioxide and release oxygen and other chemicals, thereby polluting the air environment.

(4) Harm to human health: water eutrophication leads to the decline of water quality, and there are a lot of harmful substances in the water, such as bacteria, causing people's drinking water sanitation problems. At the same time, water eutrophication also affects fishing, and safe seafood is far from easy to grasp.

4.2 Control Methods of Eutrophication

In terms of controlling eutrophication, there are three main methods, namely source control, transmission control and comprehensive control.Source control refers to the reduction of nutrient emissions at source, such as the reduction of nutrient flow from land to water through manure and fertilizer management, vegetation cover and water conservation.Transport control refers to the reduction of the transport and transfer of nutrients in the water body through the establishment of anti-penetration and interception devices, the construction of wetlands and aquatic plants, bacterial trays and underwater plates.Comprehensive control refers to the comprehensive use of source control and transmission control measures to achieve eutrophication control and treatment through different treatment measures. For example, the West Lake in Hangzhou adopted comprehensive treatment focusing on water diversion and exogenous reduction from 1986 to 2011 [13].Cases of water pollution control and eutrophication treatment of Lake Apopka in the United States and eutrophication treatment of Taihu Lake, etc., show that ecological pollution control projects can improve and restore the ecological environment of waters [14].

5. Eutrophication and Global Governance

5.1 How to Prevent Lake Eutrophication

Eutrophication has become a global environmental problem.Through the formulation and application of eutrophication standards and guidelines, the degree of eutrophication can be effectively predicted and controlled.We will strengthen environmental supervision and control, and actively carry out various governance measures.Government departments strengthen the supervision of the environment, implement various environmental protection laws and regulations, take effective measures to reduce the discharge of various pollutants that are easy to cause eutrophication, and effectively cooperate with the control work.Promote environmental protection technology and promote scientific and technological innovation.Environmental protection departments need to actively promote environmental protection technology, carry out innovative work, so that environmental protection technology gradually mature, reduce the emission of pollutants, so as to prevent the occurrence of eutrophication.In the control of eutrophication, it is necessary to use source control, transmission control and comprehensive control measures.Governments and academics need to strengthen cooperation to promote the reduction of nutrient emissions and the governance of eutrophication to jointly build a sustainable future.

5.2 Global Governance of Eutrophication

Eutrophication is a global issue that requires global governance and cooperation.In 2008, the United Nations Environment Programme (UNEP) issued the Global Eutrophication Action Plan [15], which aims to reduce the emission and loss of nutrients, control and control the problem of eutrophication through global cooperation.Eutrophication in oceans and ocean basins is also of international concern because these seas are closely linked to the global climate and ecosystems.Lake eutrophication is

an important problem in the field of water pollution control at present, and it is also a key issue in the sustainable utilization of regional water resources [16].Compared with lakes and reservoirs, the eutrophication situation of rivers is relatively optimistic, because moderate eutrophication can promote the growth of underwater plants, and thus improve the self-purification capacity of river systems [17].

The management of eutrophication needs the joint efforts of scholars and the government.The government needs to strengthen the regulation of industrial and agricultural production and promote clean energy and sustainable production methods.For example, according to the actual situation of rural environmental protection in China, the state has formulated specific Regulations on Rural Ecological Civilization, which details the issues related to rural environmental protection and species control [18].Scholars need to strengthen scientific research on eutrophication, propose effective treatment plans, and promote the exchange and application of related technologies.

6. Conclusion

Eutrophication standard is an important means to control and prevent water eutrophication, it can guide the formulation and implementation of management measures, and provide basic data for environmental protection and ecological protection.With the continuous development of related fields, we can expect more new biological and ecological factors to be added to the eutrophication criteria, so as to more comprehensively and scientifically assess the degree of eutrophication of water bodies.

Acknowledgement

This work was supported by China-Finland International Cooperation Project (2017YFE0114800), Optimization and Integration Demonstration of Comprehensive Ecological Environment Management Technology of Typical Lakes in the Yellow River Basin in Inner Mongolia (2021GG0089) and National Natural Science Foundation of China (52260028).

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