Water Quality Monitoring and Standardization in China: A Review

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Abstract. Water quality monitoring is very important for environmental protection. At the same time, it is also an effective detection method for pollution control. In this paper, we review the standardization of water quality monitoring and in China systematically. Then, the differences in water quality standards between China and foreign countries are analyzed. Moreover, the water quality monitoring methods are investigated. Finally, the conclusion and perspective are given.

1. Introduction

Water quality standards are the physical, chemical, and biological properties required by various water or discharge waters prescribed by the state, department, or region. It is a compulsory law with legal effect generated on the basis of the water quality benchmark, it is a scale to determine whether the water quality is applicable, it is the goal of water quality planning and the technical basis of water quality management, and has different requirements for different uses of water quality, so that according to the natural environment, technical conditions, economic level, and profit and loss analysis have drawn up different water quality standards [1-5]. At present, China has formulated and promulgated a series of water quality standards, such as "Sanitary Standards for Drinking Water", "Sanitary Standards for Design of Industrial Enterprises", "Water Quality Standards for Farmland Irrigation", "Water Quality Standards for Fisheries", "Seawater Quality Standards", "Surface Water environmental quality standards", "technical principles and methods for formulating local water pollutant discharge standards", "water pollution discharge standards", etc. have given legal basis for water quality management [6-10].

The scope of water quality monitoring is very extensive, mainly including: unpolluted and polluted natural water, such as rivers, lakes, groundwater and various industrial drainages. Water quality monitoring sometimes requires measurement of flow rate and flow rate. In addition, water quality monitoring can [11-16]:

a) Provide data and information for environmental management and environmental scientific research;

b) Determine the distribution of pollutants in water bodies, trace the sources of pollutants, pollution pathways, migration, transformation and growth and decline, and predict the trend of water pollution;

c) Judge the impact of water pollution on environmental organisms and human health, and evaluate the actual effect of pollution prevention measures;

d) Provide data representing the current status of water quality for use in evaluating the environmental quality of water bodies;

e) Identify the causes of pollution, the mechanism of pollution and various pollutants, and further in-depth theoretical research on polluting the environment and pollution.
2. Water quality monitoring and standardization

The sanitary standards for drinking water are based on the protection of the health of the population and the quality of human life. The various factors (physical, chemical and biological) in drinking water and the health of the population are prescribed by law, and the provisions of the relevant code of conduct for realizing the value, the statutory health standards issued in a certain form after approval by the relevant state departments. At the end of 2006, the Ministry of Health completed the revision of the 1985 edition of "Sanitary Standards for Drinking Water" together with other relevant departments, and formally promulgated a new edition of the "Sanitary Standards for Drinking Water" (GB5749-2006).

2.1. Standardization

• Design hygiene standards for industrial enterprises

  The standard is revised on the basis of GBZ1-2002 "Design Hygiene Standards for Industrial Enterprises". This standard is mandatory except for individual statements that are clearly stated as reference clauses. From August 1, 2010, the "Design Hygienic Standards for Industrial Enterprises" GBZ1-2010 was officially implemented. The standard includes the protection of the atmosphere, water sources and soil quality.

  • Farmland irrigation water quality standards

  In order to implement the "Environmental Protection Law of the People's Republic of China", prevent soil, groundwater and agricultural products pollution, protect human health, maintain the ecological environment, and promote economic development, this standard is specially formulated. This standard stipulates all aspects of farmland irrigation water quality, standard implementation and sampling monitoring methods. This standard applies to farmland irrigation water that uses surface water, groundwater, and treated urban sewage and industrial wastewater with similar water quality as the source of water throughout the country. This standard does not apply to irrigation of wastewater from medical, biological products, chemical reagents, pesticides, petroleum refining, coking and organic chemical treatment. Since October 1, 1992, "Water Quality Standards for Farmland Irrigation" GB5084-92 has been implemented.

  • Fishery water quality standards

  In order to implement the "Environmental Protection Law of the People's Republic of China", "Law on the Prevention and Control of Water Pollution of the People's Republic of China", "Law on Marine Environmental Protection", and "Fishery Law", prevent and control water pollution in fishery waters and ensure fish, shrimp, shellfish and alga. This standard is specially formulated for normal growth, reproduction and the quality of aquatic products. This standard applies to sea and freshwater fishery waters such as fish and shrimp spawning grounds, feeding grounds, overwintering grounds, migratory passages and aquatic aquaculture areas.

  • Seawater quality standards

  Refers to the implementation of the "Environmental Protection Law of the People's Republic of China" and the "Law of the People's Republic of China on Environmental Protection" to prevent and control seawater pollution, protect marine living resources and other marine resources, facilitate the sustainable use of marine resources, and maintain the marine ecological balance to ensure the water quality standards formulated for human health.

  • Surface water environmental quality standards

  In order to implement the "Environmental Protection Law" and "Water Pollution Prevention Law", strengthen surface water environment management, prevent and control water environment pollution, and protect human health, the "Surface Water Environmental Quality Standard" is now formulated as the national environmental quality standard. This standard is mandatory. The standard, published by China Environmental Science Press, has been implemented since June 1, 2002. It promulgated by The State Environmental Protection Administration on April 26, 2002 Standard name and number: surface water environmental quality standard (GB3838-2002).
2.2. Differences in water quality standards between China and foreign countries

At present, China's water quality standards are mainly based on water chemistry and physical indicators, the system needs to be improved, and comprehensive evaluation of the water environment quality still needs effort. The current water quality standards are separately formulated according to different water areas and their functions. Some water quality standards differ from the WHO water quality guidelines and the US water quality standards or benchmark limits not only in the index items, but also in the index limits.

For certain priority pollutants, China’s water quality standards are more stringent than the standards or benchmark limits given by the World Health Organization or the US Environmental Protection Agency, and the current standards in China have been increased by more foreign benchmark tables not recommended. Value-added pollutant items, for example, priority control of pollutant silver, non-priority control of pollutant metal aluminum, organic pesticide pollutants include parathion, malathion and systemic phosphorus, and disinfection by-product chloride. The reasons why the World Health Organization did not give their recommended values are:

1. Not enough human health toxicity information about silver and aluminum has been obtained;
2. With regard to the above-mentioned pesticide pollutants, WHO believes that these pesticides have been banned in developed countries, and the concentration that may exist in drinking water is far lower than the concentration that has a toxic effect on the human body;
3. With regard to chloride, WHO believes that the residual chloride concentration in drinking water after treatment is not sufficient to have an impact on the health?

Therefore, the establishment of these pollutant limits in China's standards needs further discussion and research.

3. Typical water quality monitoring methods

Temperature (platinum resistance): (a) contact: according to the principle of thermal balance, after two objects come into contact with each other, after a long enough time to reach thermal equilibrium, their temperature must be equal. If one of them is a thermometer, you can use it to achieve another object. This method of temperature measurement is called the contact method. Its characteristic is that the thermometer should have good thermal contact with the measured object, so that the two can reach thermal equilibrium. Therefore, the temperature measurement accuracy is high. When the temperature is measured by the contact method, the temperature-sensing element must be in contact with the object to be measured, which often destroys the thermal equilibrium state of the object to be measured and is corroded by the medium to be measured. Therefore, the requirements on the structure and performance of temperature-sensitive components are severe.

(b) Non-contact: the temperature of an object is measured using the principle that the thermal radiation energy of the object changes with temperature. This method of temperature measurement is called the non-contact method. Its characteristics are: it does not contact with the measured object, nor does it change the temperature distribution of the measured object, and the thermal inertia is small. In principle, the upper limit of temperature measurement with this method is very high. It is usually used to measure the surface temperature of high-temperature objects that move, rotate or react quickly above 1000 °C.

Dissolved oxygen content (fluorescence): based on the principle of fluorescence quenching. The blue light is irradiated on the fluorescent material to cause the fluorescent material to excite and emit red light. Since oxygen molecules can take away energy (quenching effect), the time and intensity of the excited red light is inversely proportional to the concentration of oxygen molecules. By measuring the phase difference between the excitation red light and the reference light, and comparing with the internal calibration value, the concentration of oxygen molecules can be calculated.

4. Conclusion and perspective

With the growth of the world's population and the development of industrial and agricultural production, water consumption is also increasing. At the same time, due to human production and life,
it leads to pollution of the surface and groundwater bodies, and the deterioration of water quality, which makes the limited water resources tenser. In the case of such a shortage of water resources, we should cherish water resources more, and at the same time, the testing department should do a good job of testing to provide protection for the health of the people. Water testing is a matter of people's livelihood and cannot be underestimated. This is its important significance.

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