POLYTECH TOURS

université de TOURS

Rapport de stage individuel

4ème année

Utilisation et application des instruments de test de la qualité de l'eau

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IMA
2020-2021

1. Sommaire

2. Remerciements

I take this opportunity to express my heartfelt thanks to all those who directly or indirectly contributed to the development of this work through this report.

First of all, I would like to thank Mrs. Qingyi CHENG, the technical director of Yongcheng Company, for welcoming me into this company, so that I can gain very useful professional experience.

I would like to especially thank my university tutor, Mr. Pierre PEETERS, who guided me with great patience and teaching methods throughout the internship. I thank him for everything, thank you for listening and allowing me to participate in the internship. I also want to thank her for her confidence in my project and his indispensable help in writing this report.

Then, I would like to thank my colleague Mr. Yucheng ZHU very much, I am very happy to work with him. I am especially grateful for his listening and guidance, for his knowledge sharing and reasonable suggestions, and for taking the time to answer my questions. I would also like to thank him for his suggestions and very important help in drafting this report. Thank you also for sharing and relaxing together.

Thank you very much to my family, especially my parents, for their valuable help in writing this report. Finally, I thank my friends for their support, their suggestions and the relaxing moments shared together.

3.Abstract

Environmental monitoring is a scientific activity that uses modern scientific and technological methods to quantitatively determine environmental factors and other environmental changes that are harmful to human health, and analyze the process and extent of their environmental impact. In the sense of law enforcement supervision, it is the whole process of using scientific methods to monitor and detect various data representing environmental quality and changing trends. Environmental testing is a test of a certain environment. Environmental testing and governance is a very technically emerging industry. The medium objects of environmental testing can be roughly divided into water quality testing, air testing, soil testing, solid waste testing, biological testing, noise and vibration testing, electromagnetic radiation testing, radioactive testing, heat testing, light testing, sanitation, testing, etc. Ensure the safety of the environment. Environmental testing is an important part of environmental monitoring, and this is the meaning of environmental testing.

This report will study various environmental testing standards and general water quality testing instruments in China, and learn the commonly used testing methods and corresponding testing items in water quality testing: general physical and chemical methods, ultraviolet spectrophotometry and Atomic Absorption Spectroscopy, Atomic fluorescence spectroscopy . Finally, by learning the application of heavy metal detection methods in the Shanghai Dishui Lake Project, understand the role of environmental detection in actual engineering and its contribution to environmental monitoring

Key words: Water environment, water quality testing, heavy metals

4. Sigles et définitions

VOCS：volatile organic compounds

COD : Chemical Oxygen Demand

CMA: China Metrology Accreditation

PM : Particulate matter

SPM: Suspended particulate matter

TSP: Total suspended particulate

PM_{10}: Inhalable coarse particles, designated PM_{10}, which are coarse particles with a diameter of 10 micrometers (μm) or less

$PM_{2.5}$: Fine particles, designated $PM_{2.5}$, with a diameter of 2.5 μm or less

BHC: hexachlorocyolohexane, $C_6H_6Cl_6$

DDT: Dichlorodiphenyltrichloroethane, $C_{14}H_9Cl_5$

BOD: Biochemical oxygen demand

UV: Ultraviolet

GFAAS: Graphite furnace atomic absorption spectrometry

AFS: Atomic Fluorescence Spectroscopy

AES: Atomic Emission Spectroscopy

AAS: Atomic Absorption Spectroscopy

DOI: Digital Object Identifier

5.Presentation of the structure

Yongcheng Environmental Testing Technology Service Co., Ltd. is a professional environmental testing organization with independent legal personality. Mainly engaged in environmental protection testing, quality inspection technical services, environmental protection equipment installation and maintenance, and environmental protection technical consultation. The company was established in December 2017 and settled in the Urumqi High-tech Zone Inspection, Testing and Certification Industrial Park, equipped with various testing instruments worth more than 10 million yuan, and the laboratory area is more than 2500 square meters. It is the first batch of comprehensive environmental monitoring socialized institutions (third-party monitoring units) certified by the Environmental Protection Department of the Autonomous Region in Xinjiang Province. It is the only environmental testing director unit of the Urumqi Construction Engineering Quality Inspection Association.

The company obtained the qualification certificate issued by Xinjiang Provincial Technical Supervision Bureau in April 2018. At present, the company is not only able to carry out the detection of more than 400 factors in 11 categories such as water and wastewater, ambient air and exhaust gas, noise and vibration, indoor ambient air, soil and water system sediments and solid waste, but also has ultra-low emission detection and VOCs The ability to detect. The company's business covers Urumqi City, Aksu, Karamay, Tacheng, Changji Prefecture, Yili Prefecture, Bazhou, Hami, Turpan, Altay and other places. It serves more than 1,000 enterprises annually, including enterprises, parks, governments and individuals.

The company has an experienced, technical, professional and efficient technical team. The research team is committed to building an environmental testing laboratory with the best quality and best service in Xinjiang.

I received welcome and guidance from Mrs. Qingyi CHENG, a technical guide. She is responsible for the use of equipment and technical guidance in the laboratory. I accept her guidance to learn how to use these instruments and understand the treatment standards of various pollutants.

In the development of the company, the company has always carried out various tasks in accordance with national standards and relevant industry norms, and issued legally effective test reports to meet the high-quality requirements of customers. With strong professional technology, advanced testing equipment, professional spirit, and sincere and trustworthy business philosophy, Yongcheng provides customers in different regions and different industries with scientific, fair, accurate and efficient quality services, and has won the society and the majority. Customers’ praise and trust, and will always strive to provide a healthy and harmonious environment for all mankind.

6. Introduction

Environmental testing is to conduct detailed site monitoring and analysis of selected evaluation areas.Environmental testing and governance is a very technically emerging industry. The medium objects of environmental testing can be roughly divided into water quality testing, air testing, soil testing, solid waste testing, biological testing, noise and vibration testing, electromagnetic radiation testing, radioactive testing, thermal testing, light testing, sanitation, testing, etc. The purpose of environmental monitoring is to ensure the safety of the environment.

With the increasing awareness of environmental protection and the continuous expansion of the environmental monitoring market, traditional environmental monitoring stations can no longer fully meet the needs of the society for environmental monitoring, and China is gradually opening up In terms of channels in the field of environmental monitoring, for social environmental testing organizations that specialize in environmental monitoring and have CMA environmental testing qualifications, as a third-party testing force, they have become the first choice for social commissioned testing.

The task of this internship is to learn the use of environmental testing equipment and understand the processing standards related to environmental testing

1. Understand the relevant knowledge of wastewater quality testing, and understand the testing standards for COD, suspended solids, ammonia nitrogen, nitrate nitrogen, heavy metals and other substances

2. Learn how to use environmental detection methods, such as: chemical method, ultraviolet method using ultraviolet spectrophotometer; different equipment, such as: meteorological chromatograph, atomic absorption meter, atomic fluorescence, etc.

The report will introduce the corresponding treatment methods and equipment for different pollutants, and discuss the application of these methods in examples

7. Contexte

7.1 Environmental monitoring and standards

Environmental monitoring is a monitoring activity that people conduct on the environmental quality that affects the survival and development of human beings and other organisms. It usually includes physical index determination, chemical index determination and ecosystem determination.

Environmental monitoring method standards are an integral part of environmental standards. Environmental standards are one of the basic systems of the Environmental Protection Law. It is designed to prevent and control environmental pollution, maintain ecological balance, and protect human health. It sets various technical specifications and technical requirements that need to be unified in environmental protection work in accordance with legal procedures. The general term for standards.

Title	Standard Number	Category of standards	Part
Guideline for eco-environmental biosafety assessment of Insect-resistant transgenic plants	HJ 625—2011	Environmental pollutants	Plant
Measurement technology guidelines for check and accept of air pollution control project for bulk gasoline terminal and gasoline filling station	HJ/T 431—2008	Environmental pollutants	Atmospheric
Ambient air quality standards	GB 3095—2012,replacing GB 3095—1996 GB 9137—88	Environmental pollutants	Atmospheric
Technical specifications on manual methods for ambient air quality monitoring	HJ 194-2017, replacing HJ/T 194-2005	Standard of environmental pollutants	Atmospheric
Technical regulation for selection of ambient air quality monitoring stations（on trial）	HJ 664—2013	Standard of monitor	Atmospheric
Technical specifications on manual methods for ambient air quality monitoring	HJ 194-2017, replacing HJ/T 194-2005	Standard of monitor	Atmospheric
Technical specifications for emission monitoring of stationary source	HJ/T 397-2007	Standard of monitor	Atmospheric
Technical Specifications of quality assurance and quality control for monitoring of stationary pollution source (on trial)	HJ/T 373-2007	Standard of monitor	Atmospheric Water
Technical requirement and test procedures for	HJ/T 378-2007,replacing	Equipment	Atmospheric

operation recorder of pollution treatment facility	HCRJ039-1998		Water Solid
Specifications and Test Procedures for PM10 and PM2.5 Sampler	J 93-2013,replacing HJ/T 93-2003	Equipment	Atmospheric
The technical requirement and test procedures for Water Quality Automatic Sampler	HJ/T 372-2007	Equipment	Water

Tableau 1. China's current environmental monitoring standards (partial)

Environmental monitoring method standards are normative, compulsory, strict formulation procedures and notably technical and time-bound. They are an important basis for formulating environmental protection rules and plans, are the basic guarantee for the implementation of environmental protection laws and regulations, and strengthen environmental supervision and management. The main point is also the driving force for improving environmental quality and promoting the progress of environmental science and technology.

7.2 Environmental testing content and items

(1.) Water quality monitoring is the process of monitoring and measuring the types of pollutants in a water body, the concentration and changing trends of various pollutants, and evaluating the state of water quality. Including unpolluted and polluted natural water (river, river, lake, sea and groundwater) and various industrial drainages.

The main monitoring items can be divided into two categories: the first category is a comprehensive indicator reflecting the water quality, such as temperature, color, turbidity, pH, conductivity, suspended solids, dissolved oxygen, chemical oxygen demand and biochemical oxygen demand And so on; the other is some toxic substances, such as phenol, cyanide, arsenic, lead, chromium, cadmium, mercury and organic pesticides. In order to objectively evaluate the water quality of rivers and oceans, in addition to the above monitoring items, it is sometimes necessary to measure the flow velocity and flow.

There are many pollution indicators related to water quality. The main water quality indicators and testing are divided into the following aspects:

- Domestic sewage, industrial waste water detection
- Drinking water testing, tap water testing(106 items)
- Water quality heavy metal pollution detection, industrial wastewater heavy metal detection
- Surface water(109 items) and groundwater detection(92 items)
- Water quality testing of drinking water sources

Item: microbiological indicators, sensory indicators, toxicological indicators, metals Indicators, comprehensive organic testing, organic indicators, pesticide indicators, odor testing, pH, salinity, total hardness, suspended solids, sulfides, conductivity, odor, color, turbidity, acidity, alkalinity, transparency , Total residue, arsenic, selenium, total mercury, copper, lead, cadmium, zinc, silver, aluminum, barium, hexavalent chromium, total chromium, nickel, iron, manganese, potassium, sodium, calcium, magnesium, dissolved oxygen, ammonia nitrogen (Ammonium salt)[1].

(2.) Urban ambient air quality monitoring points can be divided into five categories: urban points, regional points, background points, pollution monitoring points, and roadside traffic points. Among them, the

[1] Annexe1, Annexe 2, Annexe 3, Annexe 4

environmental air quality evaluation urban sites receive the most attention, focusing on reflecting the overall status and changing trends of air quality in urban built-up areas, and participating in urban air quality evaluation. The routine monitoring items of China's environmental air quality assessment urban sites are SO_2, NOx, CO, PM10, PM2.5, and other monitoring items are TSP, Pb, benzo(a)pyrene, fluoride and other toxic and harmful pollutants.

Industrial waste gas detection includes organic waste gas and inorganic waste gas. Organic waste gas mainly includes various hydrocarbons, alcohols, aldehydes, acids, ketones and amines, etc.; inorganic waste gas mainly includes sulfur oxides, nitrogen oxides, carbon oxides, halogens and their compounds. Industrial waste gas has different treatment methods according to its exhaust air volume, temperature, concentration and its own chemical and physical properties.

The main ambient air quality indicators and testing are divided into the following aspects:

- Ambient air and industrial waste gas detection, VOCs detection
- Indoor ambient air quality testing
- Fume detection in catering industry[2]

Ambient air detection: sulfur dioxide, total suspended particulate matter, particulate matter (particle size less than or equal to lOUm), nitrogen oxides, nitrogen dioxide, ozone, carbon monoxide, fluoride, benzo(a)pyrene, lead, acetone, volatile organic compounds (VOCs)), phenolic compounds, polycyclic aromatic hydrocarbons, aldehydes and ketones.

(3.)Soil solid waste detection: Soil pollution can be roughly divided into two categories: inorganic pollutants and organic pollutants. Inorganic pollutants mainly include acids, alkalis, heavy metals, salts, strontium compounds, compounds containing arsenic, selenium, and fluorine; organic pollutants mainly include organic pesticides, phenols, petroleum, synthetic detergents, urban sewage, and sludge And harmful microorganisms brought by manure.

The main ambient air quality indicators and testing are divided into the following aspects: [3]

- Soil heavy metal pollution detection
- Soil environment investigation and risk assessment and testing
- Self-monitoring of the soil environment by key soil pollution supervision units
- Testing the soil environmental quality of construction land and agricultural land
- Solid waste leaching toxicity test, municipal sludge test

Soil solid waste detection: pH (corrosive), moisture content (moisture), cation exchange capacity, dry matter, organic content, inorganic fluoride (excluding calcium fluoride), BHC, DDT, copper, chromium , Hexavalent chromium, zinc, nickel, iron, manganese, cadmium, mercury, bismuth, arsenic, lead, antimony, total cyanide, organic matter, leaching toxicity, fecal coliforms, volatile organic compounds, semi-volatile organic compounds, volatile Halogenated hydrocarbons, volatile aromatic hydrocarbons, total petroleum hydrocarbons, total phosphorus, total nitrogen, organic carbon, phenolic compounds, beryllium, cyanide, hydrolyzable nitrogen, nitrate nitrogen, ammonium nitrogen, total phosphorus, available phosphorus, total Potassium, quick-acting potassium, slow-acting potassium, selenium.

(4.) With the improvement of modern science and technology and industry, noise and its hazards are becoming more and more recognized by the people. Noise has an impact on human physiology and psychology, the most obvious of which is damage to hearing, non-auditory effects, including the central nervous system,

[2] Annexe 5, Annexe 6, Annexe 7, Annexe 8

[3] Annexe 9, Annexe 10, Annexe 11, Annexe 12, Annexe 13

cardiovascular system, vision, endocrine and metabolic systems, etc., as well as human psychology and society Life brings a series of influences.

The main ambient air quality indicators and testing are divided into the following aspects:[4]

- Aircraft noise around the airport, wind farm noise, railway boundary noise, railway vibration monitoring
- Noise barrier insertion loss, highway traffic noise monitoring
- Noise at the boundary of industrial enterprises, noise at the boundary of construction sites, noise from social life, and sound environmental quality monitoring
- Muffler noise measurement, structure propagation fixed equipment indoor noise monitoring

Noise and vibration monitoring: environmental noise, social life noise, factory boundary noise, construction site boundary noise, road traffic noise, railway boundary noise, machine noise, urban rail transit station platform noise, environmental vibration, civil construction noise, railway environment vibration.

8. Materials and methods

The experiment is mainly based on project learning. The intern company provides information about previous projects (project cases, equipment operation instructions, etc.), learns how to use the equipment frequently used in the project, and conducts weekly video conferences with the technical director, Mrs. Chen Qingyi, and reports on the learning status, discuss the impact of existing technology and equipment on environmental testing(Research method, demonstration of equipment use, latest environmental standards).

There are many indicators for water quality testing. There are different testing methods for each indicator, which can be roughly divided into three categories:

- **Chemical methods** for detecting general physical and chemical indicators.
- **UV spectrophotometry** for detecting petroleum, ammonia nitrogen, nitrate nitrogen etc.
- **Atomic absorption spectrometry** and **atomic fluorescence spectrometry** for the detection of heavy metals.

8.1 Chemical methods

(1.) Chemical Oxygen Demand(COD)

COD is a chemical method to measure the amount of reducing substances that need to be oxidized in a water sample. The oxygen equivalent of substances (generally organics) that can be oxidized by strong oxidants in wastewater, wastewater treatment plant effluent and polluted water. In the study of river pollution and the nature of industrial wastewater and the operation and management of wastewater treatment plants, it is an important and fast-determinable organic pollution parameter.

Under certain conditions, the water sample uses the amount of oxidant consumed to oxidize the reducing substances in 1 liter of water sample as an indicator, converted into milligrams of oxygen required for each liter of water sample to be fully oxidized, expressed in mg/L. It reflects the degree of water pollution by reducing substances. This indicator is also used as one of the comprehensive indicators of the relative content of organic matter.

Ecological impact: High chemical oxygen demand means that the water contains a lot of reducing substances, mainly organic pollutants. The higher the chemical oxygen demand, the more serious the organic pollution of the river water. The source of these organic pollution may be pesticides, chemical plants, organic fertilizers, etc. If not treated, many organic pollutants can be adsorbed and deposited on the bottom of the river, which will cause lasting toxic effects on aquatic organisms in the next few years. After a large number of aquatic life died, the ecosystem in the river was destroyed.

[4] Annexe 14

If people feed on organisms in the water, they will absorb a large amount of toxins in these organisms and accumulate in the body. These toxins often have carcinogenic, teratogenic, and mutagenic effects, which are extremely dangerous to humans. In addition, if the polluted river water is used for irrigation, plants and crops will also be affected, and they will easily grow poorly, and people cannot eat these crops. However, a high chemical oxygen demand does not necessarily mean the aforementioned hazards. Specific judgments need to be analyzed in detail, such as analyzing the types of organic matter, and what impact will it have on water quality and ecology, is it harmful to the human body etc.

If detailed analysis is not possible, the chemical oxygen demand can also be measured on the water samples at intervals of a few days. If the value drops a lot compared with the previous value, it means that the reducing substances contained in the water are mainly easily degradable organic substances, which are relatively harmful to the human body and biology light.

Generally, the oxidant used to measure the chemical oxygen demand is potassium permanganate or potassium dichromate. The values obtained by using different oxidants are also different, so the detection method needs to be indicated. In order to be uniform and comparable, all countries have certain monitoring standards. According to the different oxidants to be strengthened, they are called potassium dichromate oxygen consumption (chemical oxygen demand, chemical oxygen demand, abbreviated as cod) and potassium permanganate oxygen consumption (oxygen consumption, abbreviated as oc, also Called the permanganate index).

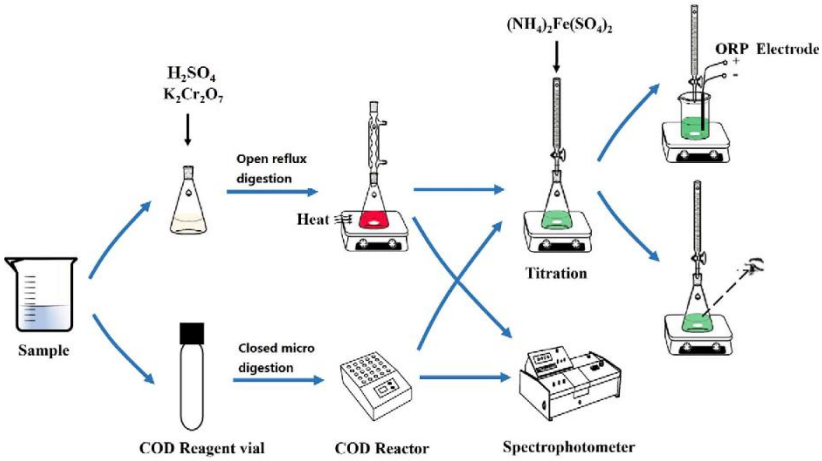

Figure 1. Determination of chemical oxygen demand in aqueous samples with non-electrochemical methods

Chemical oxygen demand can also be compared with biochemical oxygen demand (BOD). The ratio of BOD/COD reflects the biodegradability of sewage. It takes a long time to analyze the biochemical oxygen demand. Generally, it takes more than 20 days for the aquatic organisms to be completely consumed. For convenience, about 95% of the oxygen consumed in five days is generally taken as environmental monitoring data, which is marked as BOD5.

COD is an indicator of the amount of reducing substances in the water. The reducing substances in water include various organic substances, nitrites, sulfides, ferrous salts, etc., but the main ones are organic substances. Therefore, COD is often used as an indicator to measure the amount of organic matter in the water. The greater the chemical oxygen demand, the more serious the pollution of the water body by organic matter. COD determination, with the determination of reducing substances in the water sample and the different measurement methods, the measured value is also different. The most common applications are the acid potassium permanganate oxidation method and the potassium dichromate oxidation method. The potassium permanganate ($KMnO_4$) method has a low oxidation rate, but it is relatively simple. When the organic content in the water sample is relatively large, the potassium dichromate ($K_2Cr_2O_7$) method can be used, which has a high oxidation rate and good reproducibility. It is suitable for determining the total amount of organic matter in water samples. Organic matter is very harmful to industrial water systems. Strictly speaking, the chemical oxygen demand also includes the inorganic reducing substances present in the water. Generally, because the amount of organic matter in wastewater is much greater than the amount of inorganic matter, chemical oxygen demand is generally used to represent the total amount of organic matter in wastewater. Under the measurement conditions, organic substances that do not contain nitrogen in water are easily oxidized by potassium permanganate, while organic substances that contain nitrogen are more difficult to decompose.

Therefore, the oxygen consumption is suitable for the determination of natural water or general wastewater containing easily oxidized organic matter, while the chemical oxygen demand is often measured for organic industrial wastewater with more complex components.

Water containing a large amount of organic matter will contaminate the ion exchange resin when it passes through the desalination system, and it is particularly easy to contaminate the anion exchange resin and reduce the exchange capacity of the resin. Organic matter can be reduced by about 50% during pretreatment (coagulation, clarification and filtration), but it cannot be removed in the desalination system, so it is often brought into the boiler through make-up water to reduce the pH of the boiler water. Sometimes organic matter may also be brought into the steam system and condensed water, lowering the pH and causing system corrosion. The high content of organic matter in the circulating water system will promote the reproduction of microorganisms. Therefore, regardless of the desalination, boiler water or circulating water system, the lower the COD, the better, but there is no uniform limit index. When COD ($KMnO_4$ method)>5mg/L in the circulating cooling water system, the water quality has begun to deteriorate.

In the standard of drinking water, the chemical oxygen demand (COD) of category I and II water is ⩽15mg/L, the chemical oxygen demand (COD) of category III water is ⩽20mg/L, and the chemical oxygen demand (COD) of category IV water is ⩽ 30mg/L, Class V water chemical oxygen demand (COD)⩽40mg/L. The larger the value of COD, the more serious the pollution of the water body.

Basic principles: The Chemical Oxygen Demand (COD) test measures the oxygen required to oxidize organic matter in water and wastewater samples by the action of strong oxidizing agents under acid condlitions.

$$C_nH_aO_bN_c + O_2 \xrightarrow{Cr_2O_7^{-2}} CO_2 + H_2O + NH_3$$

Detection method: The standard method for the determination of chemical oxygen demand is represented by the Chinese standard GB11914 " *Water quality-Determination of the chemical oxygen demand-Dichromate method*" and the international standard ISO6060 " *Water quality — Determination of the chemical oxygen demand*". This method has high oxidation rate, good reproducibility, accuracy and reliability, and has become a classic standard method generally recognized by the international community..

In a sulfuric acid medium, potassium dichromate is used as oxidant, silver sulfate is used as catalyst, and mercury sulfate is used as a masking agent for chloride ions. The acidity of the digestion reaction liquid is 9mol/L. Heating makes the digestion reaction liquid boil, 148℃±2℃ The boiling point temperature of is the digestion temperature. Use water to cool and reflux to heat the reaction for 2 hours. After the digestion solution is naturally cooled, add water to dilute to about 140ml. Use ferrous ammonium sulfate as an indicator to titrate the remaining potassium dichromate with ferrous ammonium sulfate solution. Calculate the COD value of the water sample. The oxidant used is potassium dichromate, and the oxidizing property is hexavalent chromium, so it is called the dichromate method.

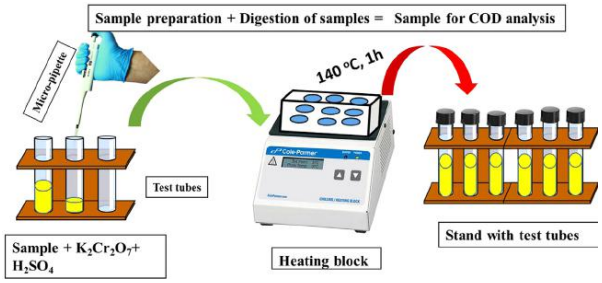

Figure 2. Operation to determine chemical oxygen demand

Total COD is run on undiluted samples. For a soluble COD, the samples are filtered through a 0.45 mm filter before analysis to remove biological interference. 2 mL of the sample is pipetted into a COD digestion reagent vial. The vial is then inverted several times to mix (vial will get hot). The vial is placed in the COD reactor at 150 ° C for two hours. The samples then cool and the samples are tested using a spectrophotometer. The chemical oxygen demand value will be read in mg/L for both total COD (tCOD) and soluble COD (sCOD).

For samples with a concentration of 0 to 150 mg/L, use the low range COD vials. For higher concentrations the high range COD vials (0-1500 mg/L) should be used. If the COD exceeds 1500 mg/L, the sample should be diluted to bring the results in range.

Chloride is the primary interference. Vials with mercuric sulfate can be used to eliminate chloride interference up to 2000 mg/L Cl--. Samples with higher chloride concentrations should be diluted enough to reduce the chloride concentration below this limit. If the sample is diluted the values are adjusted based on the dilution factor. If the COD testing is for permit reporting, the method including vials with mercury is the EPA approved method.

(2.) Suspended Solids

Suspended Solids refers to solid substances suspended in water, including inorganic substances, organic substances, mud, sand, clay, microorganisms, etc. that are insoluble in water. The content of suspended solids in water is one of the indicators to measure the degree of water pollution. Suspended matter is the main cause of water turbidity. The organic suspended matter in the water body is easy to anaerobic fermentation after being deposited, which makes the water quality worse. China's comprehensive sewage discharge standards are divided into three levels, which stipulate the maximum allowable discharge concentration of suspended solids in sewage and wastewater. China's groundwater quality standards and drinking water sanitary standards stipulate turbidity as an indicator for suspended solids in water.

Suspended substances in water are particles with a particle diameter of about 0.1μm-100μm. Visible to the naked eye. These particles are mainly composed of sand, clay, protozoa, algae, bacteria, viruses, and macromolecular organic matter, and they are often suspended in water streams. The turbidity of water is also caused by such substances.

Solid particles that can be suspended in sea water for a long time. Sometimes called suspended solids or suspended colloids. It is divided into two parts: organic and inorganic. The organic part is mostly detrital particles, which are composed of carbohydrates (see carbohydrates), protein (see protein), lipids (see lipids), etc. The inorganic part includes terrestrial mineral fragments (such as quartz, feldspar, carbonate, and clay), aquatic minerals (such as precipitated glauconite and staurolite and other silicates, carbon).

The particle size of the suspended solids is generally between a few to a few hundred microns. In order to study its chemical composition, it is usually separated from seawater with a filter membrane with a pore size of 0.45 microns. Suspended matter contains two types of organic components and inorganic components:

(1) Organic components. Mainly biological debris, excrement and decomposition products, composed of cellulose, starch and other carbohydrates, proteins, lipids and chitin.

(2) Inorganic components. Including quartz, feldspar, carbonate, clay and other mineral detritus from the continent, and silicate formed in the chemical process of seawater.

Figure 3. Organic and inorganic particles of various sizes will affect the concentration of suspended solids

Features: 1. Suspended solids refer to solids that cannot pass through the filter. Put the filter paper weighed to a constant weight into a Buchner funnel, filter the water sample with a medium-speed quantitative filter paper, and dry it to a constant weight at 103-105°C. The total non-filterable residue (suspended matter) content (see the detection method below for details).

2. Suspended matter refers to water-insoluble sand, clay particles, and remains of animal and plant organisms. Containing impurities in the water is very harmful to boiler maintenance and steam evaporation, and easy to form scale, which causes metal corrosion and over burning to cause foam and steam water wells.

3. Suspended matter refers to the clay minerals, silt, humus and iron and aluminum hydrated oxides contained in the soil extract. Organic matter and inorganic matter undergo a series of migration and transformation

processes at the interface of suspended matter and water phase, such as adsorption, desorption, precipitation and dissolution.

4. Suspended matter refers to the solid matter remaining in the filter and dried to constant weight at 103～105℃. The suspended solids in the surface water make the water turbid, reduce the transparency, affect the respiration and metabolism of aquatic organisms, and even cause blockage of the river. Therefore, in water and sewage treatment, the determination of suspended solids is of special significance.

5. The 0.45μm pore size filter membrane can retain suspended solids and most of the bacteria in the water, so the ones that pass through the 0.45μm pore size filter are usually defined as "dissolved" and "soluble", while the blocked part is Known as suspended matter.

6. Impurities in natural water can be divided into three categories according to their particle size: the largest particles are called suspended matter; the second is colloids; the smallest are ions and molecules, that is, dissolved substances. The suspended particles are large, unstable in water and easy to remove. The turbidity of water is mainly caused by such substances.

Detection method: Refer to the "*Environmental quality standards for surface water"(GB/T 5750)* and "*Living standards inspection methods" (GB/T 14848)*. These standards stipulate the determination of suspended matter in water, applicable to surface water, groundwater, and also applicable to the determination of suspended matter in domestic sewage and industrial wastewater.

Principle: Suspended matter in water quality refers to the substance that the water sample passes through a filter membrane with a pore size of 0.45 μ m, is trapped on the filter membrane and is dried at 103～105℃ to a constant weight. Use distilled water or water of equivalent purity.

Instruments: 1. Commonly used laboratory instruments and the following instruments. 2. All-glass microporous membrane filter. 3. GN-CA filter membrane, pore size 0.45μm, diameter 60mm. 4. Suction filter bottle, vacuum pump 5. Flat-nosed tweezers without teeth.

Figure 4. All-glass microporous membrane filter

Experimental steps:

1. Sampling: The polyethylene bottles or rigid glass bottles used should be washed with detergent. Then rinse with tap water and distilled water in turn. Before sampling, wash three more times with the water sample to be collected. Then, collect a representative water sample of 500 to 1000 mL, and close the cork tightly.

Note: Uneven solid matter floating or submerged is not a suspended matter and should be removed from the water sample.

2. Sample storage: The collected water samples should be analyzed and determined as soon as possible. If it needs to be placed, it should be stored in a 4℃ refrigerator, but the longest shall not exceed seven days. (Note: Do not add any protective agent to prevent damage to the distribution balance between solid and liquid.)

3. Membrane preparation: use flat-nosed toothless tweezers to pick up the microporous filter membrane and place it in a weighing bottle with a constant weight in advance, move it into an oven and dry it at 103～105℃ for half an hour, then take it out and place it in a desiccator to cool to room temperature , Weigh its weight.

Repeat drying, cooling, and weighing until the weight difference between the two weighings is less than or equal to 0.2mg. Place the constant-weight microporous membrane on the membrane tray of the membrane filter, cover it with the matching funnel, and fix it with a clamp. Moisten the filter membrane with distilled water, and filter continuously.

4. Measurement: Measure 100 mL of a well-mixed sample and filter by suction. All the water passes through the filter membrane. Wash it with 10 mL of distilled water each time for three consecutive times, and continue to filter with suction to remove trace amounts of water. After the suction filtration is stopped, carefully take out the filter membrane with suspended matter and place it in the original constant weight weighing bottle, move it into the oven and dry it at 103～105℃ for one hour, then move it into the desiccator, let it cool to room temperature, and weigh it. weight. Repeat drying, cooling, and weighing until the weight difference between the two weighings is less than or equal to 0.4 mg.

(Note: Excessive suspended matter trapped on the filter membrane may entrain too much water. In addition to prolonging the drying time, it may also cause filtration difficulties. In this case, you can take less samples as appropriate. Too little suspended matter on the filter membrane , It will increase the weighing error and affect the accuracy of the measurement. If necessary, the sample volume can be increased. Generally, 5-100mg suspended solids are used as the practical range for measuring the sample volume.)

Calculation: Suspended matter content C (mg/L) is calculated as follows

$$c = \frac{(A - B) \times 10^6}{V}$$

C——The concentration of suspended solids in water, mg/L;

A——Suspended solids + filter membrane + weighing bottle weight, g;

B——Filter membrane + weighing bottle weight, g;

V——Sample volume, mL.

8.2 Ultraviolet and visible spectrophotometry

Ultraviolet-visible spectrophotometry is a method for measuring the absorbance of substances in the wavelength range of 190-800nm for identification, impurity inspection and quantitative determination.

When light passes through the solution of the substance to be tested, the degree of absorption of light by the substance varies with the wavelength of the light. Therefore, by measuring the absorbance of the substance at different wavelengths, and drawing the relationship between the absorbance and the wavelength, the absorption spectrum of the substance to be measured can be obtained. From the absorption spectrum, the maximum absorption wavelength λmax and the minimum absorption wavelength λmin can be determined. The absorption spectrum of a substance has characteristics related to its structure. Therefore, the substance can be identified by comparing the spectrum of the sample with the control spectrum or the spectrum of the reference substance in a specific wavelength range, or by determining the maximum absorption wavelength, or by measuring the absorption ratio at two specific wavelengths.

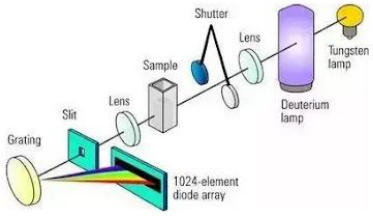

Figure 5. Principles of UV Spectrophotometry

When used for quantification, measure the absorbance of a certain concentration of sample solution at the maximum absorption wavelength and compare it with the absorbance of a certain concentration of control solution or use the absorption coefficient method to calculate the concentration of the sample solution.

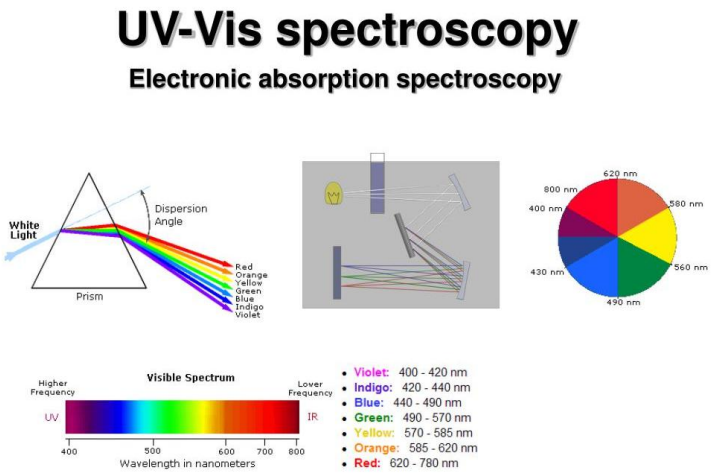

Figure 6. Electronic absorption spectroscopy

(1.)Nitrate nitrogen

Nitrate nitrogen (NO3-N) is the final product of oxidation and decomposition of nitrogen-containing organic matter. Nitrogen in water is in the form of nitrate, which is low or non-toxic. The high content of nitrate nitrogen in the water is harmful to the human body.

For example, only the content of nitrate in the water body is increased, and the content of ammonia nitrogen (NH3-N) and nitrite nitrogen (NO2-N) are low or even not, indicating that the pollution has been in a long time, and it has tended to be self-cleaning. Nitrate in the water can also come directly from the formation

Principle: Use the absorption of nitrate ion at 220nm wavelength in the ultraviolet region to quantitatively determine nitrate nitrogen. Dissolved organic matter absorbs at 220nm and 275nm, while nitrate ion does not absorb at 275nm. Therefore, another measurement was made at 275nm to correct the nitrate nitrogen value. This method is suitable for the determination of nitrate nitrogen in clean surface water and unobviously polluted groundwater. The concentration range of nitrate nitrogen detected is 0.08mg/L~4mg/L.

Reference standard "*Water quality—Determination of nitrate-nitrogen—Ultraviolet spectrophotometry" (HJ/T 346—2007).* This standard specifies the ultraviolet spectrophotometric method for the determination of nitrate nitrogen in surface water and groundwater. This standard applies to the determination of nitrate nitrogen in surface water and groundwater. The lowest detection concentration of this method is 0.08 mg/L, the lower limit of determination is 0.32 mg/L, and the upper limit of determination is 4 mg/L.

Instrument: 1000ml volumetric flask, 250ml volumetric flask, several test tubes, a pipette gun with a maximum range of 5ml, 1ml, 0.2ml, and a spectrophotometer;

Drugs: potassium nitrate, 1mol/L hydrochloric acid;

UV-Visible spectrophotometer is composed of 5 parts:

1.Radiation source. It must have a stable, sufficient output power and a continuous spectrum that can provide the instrument's use band, such as tungsten lamps, tungsten halogen lamps (wavelength range 350-2500 nanometers), deuterium lamps or hydrogen lamps (180-460 nanometers), or Tuning dye laser light source, etc.

2.Monochromator. It is composed of entrance and exit slits, lens systems and dispersive elements (prisms or gratings). It is a device used to generate high-purity monochromatic light beams. Its functions include decomposing the composite light generated by the light source into monochromatic light and branching. The required monochromatic beam.

3.Sample container, also called absorption cell. It is used to measure the absorbance of the test solution. It is divided into quartz cell and glass cell. The former is suitable for ultraviolet to visible region, and the latter is only suitable for visible region. The optical path of the container is generally 0.5-10 cm.

4.Detector, also known as photoelectric converter. Commonly used are phototubes or photomultipliers. The latter is more sensitive than the former and is especially suitable for detecting weaker radiation. In recent years,

light-guide camera tubes or photodiode matrixes have also been used as detectors, which have the characteristics of fast scanning.

5.Display device. This part of the device is developing rapidly. Higher-level photometers are always equipped with microprocessors, fluorescent screen displays and recorders, etc., which can display the spectrum, data and operating conditions.

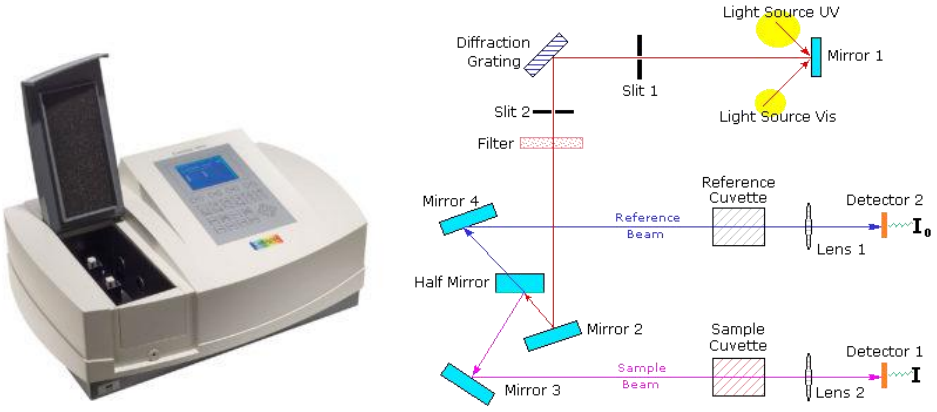

Figure7. The principle of UV spectrophotometer

The scope of application includes: 1.Quantitative analysis, which is widely used in the determination of trace, ultra-trace and macro inorganic and organic substances in various materials. 2. Qualitative and structural analysis, UV absorption spectroscopy can also be used to infer steric hindrance effects, hydrogen bond strength, tautomerism, geometric isomerism, etc. 3.Reaction kinetics research, that is, to study the functional relationship of reactant concentration with time, determine the reaction speed and reaction order, and explore the reaction mechanism. 4.Study solution balance, such as determining the composition of complexes, stability constants, acid-base dissociation constants, etc.

Experimental steps(Take the actual experiment as an example)

1. Reagent preparation

(1) Nitrate nitrogen standard solution (100mg/L): Weigh 0.7218g of potassium nitrate dried at 105～110℃ for 2h, dissolve it in water, transfer it into a 1000ml volumetric flask, dilute with water to the mark, and mix well (add 2ml chloroform as Preservative, stable for at least 6 months);

(2) Nitrate nitrogen working solution: Pipette 25ml standard solution to a 250ml volumetric flask with constant volume. The nitrate nitrogen concentration of this working solution is 0.01mg/ml;

2. Draw a standard curve

Take 7 10ml colorimetric tubes, add reagents according to the table, use a 25px quartz cuvette on the UV spectrophotometer, use distilled water as a reference to zero, measure A220 and A275, and draw a standard curve. Dilute with distilled water to make the volume 10ml, add 1mol/L hydrochloric acid 0.25ml.

Number	0	1	2	3	4	5	6
Nitrate nitrogen standard working fluid volume/ml (nitrogen content 0.01mg/ml)	0	0.5	1.0	1.5	2.0	2.5	3.0
Concentration/(mg/L)	0	0.5	1.0	1.5	2.0	2.5	3.0
A220	0.007	0.136	0.246	0.381	0.463	0.586	0.656
A275	0.001	0.004	0.002	0.008	0.004	0.009	0.012
Ar=A220-2×A275	0.050	0.128	0.242	0.365	0.455	0.568	0.632
A=Ar-Ar(0)	——	0.123	0.237	0.360	0.450	0.563	0.627

Tableau 2. Spectrophotometer index sampl

Take the data numbered 1~6 (data in red font) as the standard curve, the abscissa is the concentration of nitrate nitrogen in the prepared solution (mg/L), and the ordinate is A.

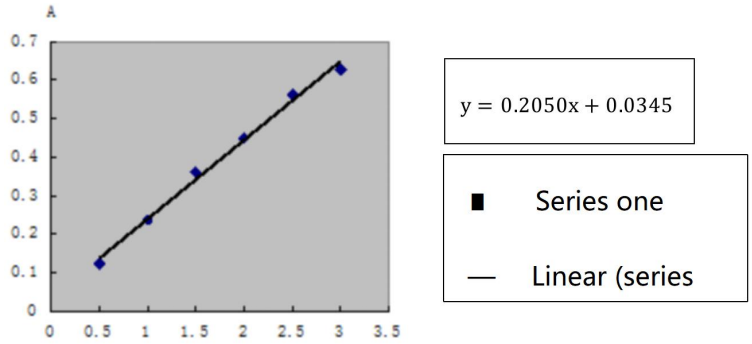

Figure 8. Standard curve for determination of nitrate nitrogen

3.Water sample determination

Take 1ml water sample separately (you can replace it with diluted water sample if necessary, note down the dilution multiple D) into a 10ml colorimetric tube, add water to dilute to about 10ml, record the dilution multiple, add 1mol/L hydrochloric acid 0.25ml, shake After homogenization, perform color development and measure the absorbance values A220 and A275. Zero adjustment with distilled water as a reference (this whole process should be operated at the same time as the standard curve). Dilute with distilled water and set the volume to 10ml.

Number	0	A	B	C	D	E	F
Water sample/ml	0	0.5	1.0	1.5	2.0	2.5	3.0
Concentration/(mg/L)	0	1	1	1	1	1	1
1mol/L hydrochloric acid/ml	0.007	0.136	0.246	0.381	0.463	0.586	0.656

Tableau 3. Water sample determination index

The concentration of nitrate nitrogen in the water sample is calculated as follows:

$$\rho N(NO3^-)= [(10\times A) /(b\times V)] \times D$$

ρN($NO3^-$)——The concentration of nitrate nitrogen in the original water sample, mg/L, in N;

A——The corrected absorbance value of the sample (A= A220-2×A275);

b——The slope of the standard curve;

V——The volume of the sample taken, ml;

D——Dilution multiple (the value is 1 when the water sample is not diluted);

Precautions: The function of sulfamic acid is to cover up the interference of nitrite nitrogen that may be contained in distilled water on the absorbance value, and it has little interference on the absorbance value. When the nitrite nitrogen concentration is lower than 0.1mg/L, 0.8% (m/V) sulfamic acid solution can be omitted (that is, the standard curve can choose not to add this reagent, and the water sample needs to be measured in the water sample. After nitrate nitrogen concentration, decide whether to add or not, and its calculation needs to be changed accordingly).

(2.)Ammonia nitrogen

The combined nitrogen in the form of free ammonia (NH_3) and ammonium ions (NH_4^+) is called ammonia nitrogen. Ammonia nitrogen is a nutrient in water bodies, which can lead to water eutrophication. It is the main oxygen-consuming pollutant in water bodies and is toxic to fish and certain aquatic organisms.

Ammonia nitrogen detection methods usually include Nessler's colorimetry, phenol-hypochlorite (or salicylic acid-hypochlorite) colorimetry and electrode method. The Nessler's reagent colorimetric method has the characteristics of simple operation and sensitivity. The interference determination of metal ions such as

calcium, magnesium and iron, sulfides, aldehydes and ketones, color, and turbidity in water requires corresponding pretreatment. Phenol-time The chlorate colorimetric method has the advantages of sensitivity and stability. The interference situation and the elimination method are the same as the Nessler's reagent colorimetric method. Electrode method usually does not require pretreatment of water samples and has the advantages of wide measurement range. When the ammonia nitrogen content is high, distillation-acid titration can still be used.

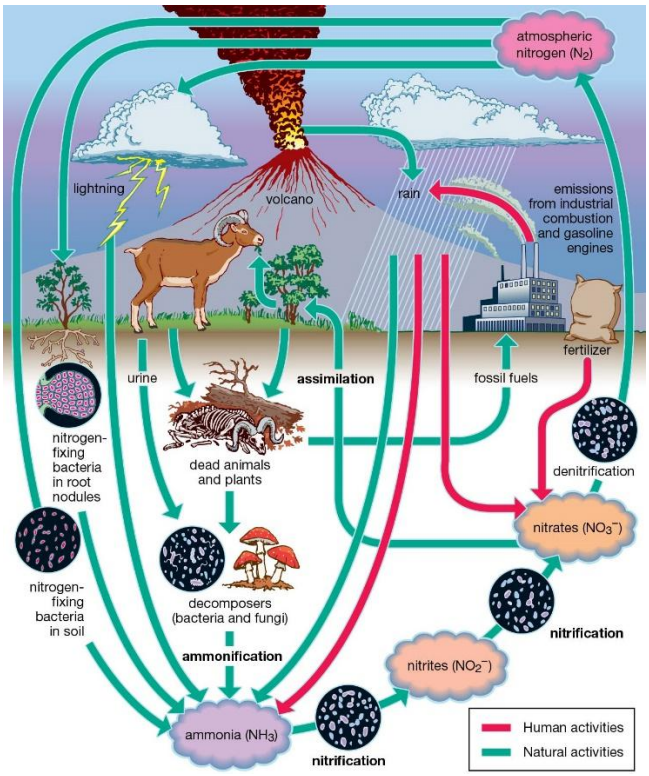

Figure 9. The cycle of ammonia nitrogen in nature

Here will introduce the Nessler colorimetric method and the phenol-hypochlorite colorimetric method. This refer to *the standard Water quality-Determination of ammonia nitrogen-Salicylic acid spectrophotometry (HJ 536-2009, replacing GB 7481-87)* and *Water quality-Determination of ammonia nitrogen-Nessler's reagent spectrophotometry (HJ 535-2009, replacing GB 7479-87)*. This standard applies to the determination of ammonia nitrogen in groundwater, surface water, domestic sewage and industrial wastewater.

Water sample pretreatment: The water sample is colored or turbid and contains some other interfering substances, which affects the determination of ammonia nitrogen. For this reason, proper pre-processing should be done during analysis. For cleaner water, flocculation and sedimentation can be used, and for heavily polluted water or industrial wastewater, distillation can be used to eliminate interference.

Nessler's reagent photometry

1.Method principle: The alkaline solution of mercury iodide and potassium iodide reacts with ammonia to form a reddish-brown colloidal compound. This color has a strong absorption in a wide wavelength range. Usually the measurement wavelength is in the range of 410-425nm.

2. Interference and elimination: aliphatic amines, aromatic amines, aldehydes, acetone, alcohols and organic chloramines and other organic compounds, as well as inorganic ions such as iron, manganese, magnesium, and sulfur, may cause interference due to discoloration or turbidity. The color and turbidity of the water also affect the color comparison. For this reason, it must be pretreated by flocculation precipitation filtration or distillation, and the volatile reducing interfering substances can also be removed by heating under acidic conditions. The interference of metal ions can be eliminated by adding an appropriate amount of masking agent.

3. Scope of application: The lowest detectable concentration of this method is 0.025mol/L (photometric method), and the upper limit of determination is 2mg/L. Using visual colorimetry, the lowest detectable

concentration is 0.02mg/L. After proper pretreatment of water samples, this method can be applied to surface water, groundwater, industrial wastewater and domestic sewage.

4.Instrument: UV spectrophotometer, pH meter

5.Reagent configuration: The water used for reagent preparation should be ammonia-free water.

1. Nessler's reagent

(1) Weigh 20g of potassium iodide and dissolve it in about 25mL of water, add a small amount of mercury dichloride ($HgCL_2$) crystalline powder (about 10g) while stirring, and add saturated dichloride instead of a vermillion-red precipitate when it is difficult to dissolve. Dissolve the mercury solution and stir thoroughly. When there is a trace of vermilion precipitation that no longer dissolves, stop adding the mercury dichloride solution.

Separately weigh 60 g of potassium hydroxide dissolved in water and dilute to 250 mL . After cooling to room temperature, slowly pour the above solution into the potassium hydroxide solution while stirring, dilute to 400 mL with water, and mix well. Let it stand overnight, transfer the supernatant into a polyethylene bottle, and store it tightly.

(2) Weigh 16g of sodium hydroxide, dissolve it in 50mL, and fully cool to room temperature. Separately weigh 7g potassium iodide and 10g mercury iodide (HgL_2) dissolved in water, then slowly pour this solution into the sodium hydroxide solution under stirring, dilute with water to 100mL, store in a polyethylene bottle, tightly stoppered for storage.

2. Potassium and sodium tartrate solution

Weigh 50g of potassium sodium tartrate ($KNaC_4H_4O_6 \cdot 4H_2O$) and dissolve in 100mL of water, heat and boil to remove ammonia, let cool, and dilute to 100mL.

3. Ammonium standard stock solution

Weigh 3.819g of ammonium chloride (NH_4Cl) dried at 100°C, dissolve in water, and dilute to the mark. This solution contains 1.00mg ammonia nitrogen per milliliter.

4. Ammonium standard use solution

Pipette 5.00mL ammonium standard stock solution into a 500mL volumetric flask and dilute to the mark with water. This solution contains 0.010mg ammonia nitrogen per milliliter.

6.Experimental steps:

1. Drawing of calibration curve

Pipette 0, 0.50, 1.00, 3.00, 5.00, 7.00, and 10.0 mL of ammonium standard use solution into a 50 mL colorimetric tube, and add water to the mark. Add 1.0mL potassium sodium tartrate solution and mix well. Add 1.5mL Nessler's reagent and mix well. After standing for 10 minutes, measure the absorbance at a wavelength of 4250nm using a 20mm cuvette with an optical path length of water as a reference.

After subtracting the absorbance of the zero-concentration blank tube from the measured absorbance, the corrected absorbance is obtained, and a calibration curve is drawn from the ammonia nitrogen content (mg) to the corrected absorbance.

2. Determination of water samples

(1) Take an appropriate amount of water sample pretreated by flocculation precipitation (to make the ammonia nitrogen content not exceed 0.1mg), add it to a 50mL colorimetric tube, dilute to the mark, and add 1.0mL potassium sodium tartrate solution.

(2) Take an appropriate amount of distillate pretreated by distillation, add it to a 50mL colorimetric tube, add a certain amount of 1mol/L sodium hydroxide solution to neutralize boric acid, and dilute to the mark. Add 1.5mL Nessler's reagent and mix well. After standing for 10 minutes, measure the absorbance in the same way as the calibration curve.

3. Blank test: replace the water sample with ammonia-free water, and make a blank test in the whole procedure.

7.Calculation: After subtracting the absorbance of the blank test from the absorbance measured by the water sample, check the ammonia nitrogen content (mg) from the calibration curve.

Ammonia nitrogen (N, mg/L)=m/V×1000

In the formula, m-the amount of ammonia nitrogen (mg) obtained from the calibration curve;

V-Water sample volume (mL).

Precision and accuracy

Three laboratories analyzed spiked water samples containing 1.14~1.16mg/L ammonia nitrogen, and the relative standard deviation of a single laboratory did not exceed 9.5%; the spiked recovery rate ranged from 95 to 104%.

Four laboratories analyzed spiked water samples containing 1.81~3.06mg/L ammonia nitrogen, and the relative standard deviation of a single laboratory did not exceed 4.4%; the spiked recovery rate ranged from 94 to 96%.

Precautions

(1) The ratio of mercury iodide to potassium iodide in Nessler's reagent has a greater impact on the sensitivity of the color reaction. The precipitate formed after standing should be removed.

(2) The filter paper often contains trace amounts of ammonium salt, so be careful to wash it with ammonia-free water when using it. The glassware used should be free from ammonia contamination in the laboratory air.

Spectrophotometry with salicylic acid

1. Principle of the method: In the presence of sodium nitroferricyanide, ammonium reacts with salicylate and hypochlorite ions to form a blue compound with a maximum absorption at a wavelength of 697nm.

2. Interference and elimination: ammonium chloride is quantitatively determined under this condition. The interference of cations such as calcium and magnesium can be masked by adding potassium and sodium tartrate.

3. Scope of application: The lowest detectable concentration of this method is 0.01 mg/L, and the upper limit of determination is 1 mg/L. It is suitable for the determination of ammonia nitrogen in drinking water, domestic sewage and most industrial wastewater.

4. Instrument: UV spectrophotometer, dropper bottle (dropper flows out of liquid, equivalent to 20±1 drop per milliliter).

5. Reagent configuration: All reagents are prepared with ammonia-free water.

1. Ammonium standard stock solution

Weigh 3.819g of ammonium chloride (NH_4Cl) dried at 100°C and dissolve it in water, transfer it into a 1000mL volumetric flask, and dilute to the mark. This solution contains 1.00mg ammonia nitrogen per milliliter.

2. Ammonium standard intermediate solution

Pipette 10.00mL ammonium standard stock solution into a 100mL volumetric flask and dilute to the mark. This solution contains 0.10mg ammonia nitrogen per milliliter.

3. Ammonium standard liquid

Pipet 10.00mL ammonium standard intermediate solution into a 1000mL volumetric flask and dilute to the mark. This solution contains 1.00μg ammonia nitrogen per milliliter. Provisioning during temporary use.

4. Chromogenic fluid

Weigh 50g of salicylic acid ($C_7H_6O_3$), add 100mL of water, and then add 160mL of 2mol/L sodium hydroxide solution, stir to make it completely dissolved. Separately weigh 50g potassium sodium tartrate and dissolve it in water, combine with the above solution, transfer it into a 1000mL volumetric flask, and dilute to the mark. Stored in a brown glass bottle, this reagent is stable for at least one month.

Note: If the salicylic acid is not completely dissolved, add a few milliliters of sodium hydroxide solution until it is completely dissolved. The pH of the final solution is 6.0-6.5.

5. Sodium hypochlorite solution

Take the sodium hypochlorite solution, after calibration, dilute it with sodium hydroxide solution into a sodium hypochlorite solution containing an available chlorine concentration of 0.35% (m/V) and a free alkali concentration of 0.75 mol/L (as NaOH). Stored in a brown dropper bottle, this reagent is stable for one week.

6. Sodium nitrosoferricyanide solution

Weigh 0.1g of sodium nitrosoferricyanide $Na2[Fe(CN)_6NO]\cdot 2H_2O$ in a 10mL colorimetric tube with stopper, dissolve in water, and dilute to the mark. Prepare this solution just before use.

7. Cleaning solution

Weigh 100g potassium hydroxide and dissolve it in 100mL water, mix it with 900mL 95% (V/V) ethanol after cooling, and store it in a polyethylene bottle.

6.Experimental steps

1. Drawing of calibration curve

Pipette 0, 1.00, 2.00, 4.00, 6.00, 8.00 mL of ammonium standard use solution in a 10 mL colorimetric tube, dilute to 8 mL with water, add 1.00 mL of color developing solution and 2 drops of sodium nitroferricyanide solution, and mix. Add 2 drops of sodium hypochlorite solution, dilute to the mark, and mix thoroughly. After standing for 1 hour, at a wavelength of 697nm, use a cuvette with an optical path of 10mm and take water as a reference to measure the absorbance.

After subtracting the absorbance of the blank tube from the measured absorbance, the corrected absorbance is obtained, and a calibration curve of ammonia nitrogen content (μg) versus corrected absorbance is drawn.

2. Determination of water samples

Dilute an appropriate amount of pretreated water sample (to make the ammonia nitrogen content not more than 8μg) into a 10mL colorimetric tube, add water to dilute to 8mL, perform the same operation as the calibration curve, perform color development and measure absorbance.

3. Blank test: replace the water sample with ammonia-free water, and perform color development and measurement according to the same steps as the sample determination.

7.Calculation

After subtracting the absorbance of the blank test from the absorbance measured by the water sample, check the ammonia nitrogen content (μg) from the calibration curve.

Ammonia nitrogen (N, mg/L)=m/V

In the formula, m-the amount of ammonia nitrogen obtained from the calibration curve (μg); V-the volume of the water sample (mL).

Note: When the water sample is pretreated by distillation, sulfuric acid solution should be used as the absorption liquid, and sodium hydroxide solution should be added to neutralize it before color development.

8.3 Atomic Absorption Spectroscopy and Atomic Fluorescence Spectrometry

Heavy metal, metals with a density above 4.5g/cm3 are called heavy metals. There are 60 kinds of natural metal elements with atomic numbers ranging from 23 (V) to 92 (U). Except for 6 of them, the density of the remaining 54 kinds is greater than 4.5g/cm3, so in the sense of density, these 54 kinds Metals are heavy metals. However, in the classification of elements, some of them belong to rare earth metals, and some are classified as refractory metals. In the end, there are 10 metal elements that are actually classified as heavy metals in the industry: copper, lead, zinc, tin, nickel, cobalt, antimony, mercury, cadmium and bismuth. These 10 kinds of heavy metals have no other special commonalities except that they have metal commonalities and a density greater than 4.5g/cm3, and each heavy metal has its own properties.

Whether it is air, soil, or even drinking water contains heavy metals, such as free radicals that cause aging, particles that are harmful to the skin, dust in the air, car exhaust, etc., even tap water brings heavy metals to

the skin, and even some skin care products Some heavy metal raw materials such as moisturizers, such as cadmium, are also one of them.

Water pollution by heavy metal ions refers to the pollution caused by pollutants containing heavy metal ions entering the water body. Heavy metal wastewater (containing chromium, cadmium, copper, mercury, nickel, zinc and other heavy metal ions) produced in industrial production processes such as mining and metallurgy, machinery manufacturing, chemicals, electronics, and instrumentation is the industry that pollutes the most water bodies and harms humans the most One of waste water. The heavy metals in wastewater cannot be decomposed and destroyed by various common water treatment methods, but can only transfer their location and change their physical and chemical state.

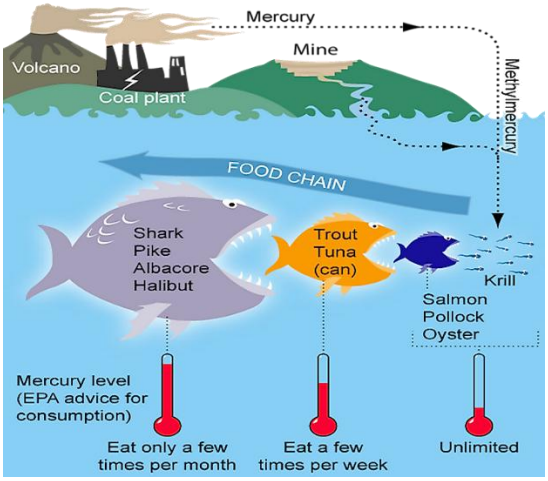

Figure 10. Heavy metal ions cause Minamata disease in the food chain

Therefore, heavy metal wastewater should be treated on-site at the place where it is produced, and not mixed with other wastewater. If sludge and wastewater containing heavy metal ions are used as fertilizers and irrigated farmland, soil will be contaminated, resulting in the accumulation of heavy metal ions in aquatic organisms in crops and after entering water bodies, and serious harm to the human body through the food chain. The Japanese pollution diseases that shocked the world in the 1960s-Minamata Disease and Toinai Disease, were caused by mercury-containing wastewater and cadmium-containing wastewater polluting water bodies.

Metal Ions	WHO Limit mg/L (ppm)	Effects
Cu(II)	2	Alliergies, anaemia, kidney disorder
Zn(II)	3	Respiratore disorder, neuronal disorder, prostate cancer
Ni(II)	0.07	At hig level may be toxic, even carcinogenic
Cd(II)	0.003	Renal toxicity, hypertension, lymphocytosis, pulmonary fibrosis, lung cancer, osteoporosis, hyperuricemia
Pb(II)	0.05	Penetrates through protective blood brain barrier, Alzheimer's disease and senile dementia, neuro degenerative diseases, kigney damage
Fe(III)	3	At high level may be originated hemochromatosis, damage cell in the hear liver
As(III)	0.05	Causes effect on central nervous system, cardio vascular and pulmonary diseases, anorexia, gastrointestinal disease, hyper pigmentation, skin cancer
Ag(I)	0.1	Argyria, gastroenteritis, neuronal disorder, mental fatigue, rheumatism
Cr(VI)	0.05	Reproductuve toxicity, embryotoxicity, mutagenicity, carcinogenicity, lung cancer, dermatitis, skin ulcers
Hg(II)	0.001	Impared neurologic development, effects on digestive system, immune system, hypertension

Figure 11. Limit of various heavy metal ions in drinking water according to World Health Organiztion (WHO).

(1.)Atomic Absorption Spectroscopy

Atomic Absorption Spectroscopy (AAS), also known as atomic spectroscopy, is based on the absorption of the characteristic spectral lines of the ground state atomic vapor of the element to be measured, and is treated

by the characteristic of the characteristic spectral line and the degree of weakening of the spectral line An instrumental analysis method for qualitative and quantitative analysis of measuring elements.

Depending on the element to be tested or the shape of the sample, flame atomic absorption spectrometry (FAAS), graphite furnace atomic absorption spectrometry (GFAAS), electrothermal atomic absorption spectrometry (ETAAS) and cold light source atomic absorption spectrometry (CVAAS) can be selected. Since the content of heavy metals in the water environment is usually trace or ultra-trace, it is often necessary to enrich the heavy metals in the sample when performing atomic absorption analysis.

Features of Atomic Absorption Spectroscopy:

1. Fast speed and high accuracy. Atomic absorption spectroscopy can detect through the outer layer of atoms, so the inspection speed is faster and the accuracy is higher.

2. Strong anti-interference ability. The anti-interference ability mainly means that when the atomic absorption spectrometry is used for detection, it is less interfered by other factors, and can effectively avoid unnecessary factors from interfering with the detection results.

3. Wide application range. Atomic absorption spectrometry can detect a variety of different trace elements, among which flame method, graphite furnace method and hydride detection method can all detect a variety of elements. The main principle of the atomic absorption spectroscopy method is that the electrons in the outer layer of the atom can effectively absorb a certain wavelength of light radiation, and the type of element can be judged based on the wavelength equal to the spectral wavelength emitted by the atom when it is stimulated; this method is used When performing detection, the selectivity of atoms can absorb the spectrum of the detected object, and then by calculation, the content of trace elements to be measured can be obtained, which is an important instrument in water quality inspection.

4. Strong selectivity, this is because the atomic absorption bandwidth is very narrow. Therefore, the determination is relatively quick and easy, and has the conditions to realize automatic operation. In emission spectrum analysis, when the radiation of coexisting elements or molecular radiation cannot be separated from the radiation of the element to be measured, it will cause the change of apparent intensity.

Application of Atomic Absorption Spectrometry in Water Quality Inspection (Determination of Cadmium)

Taking the determination of the content of cadmium in water quality as an example, the application of atomic absorption spectrometry in water quality inspection is analyzed. The graphite furnace atomic absorption spectrometry (GFAAS) can be used to detect the content of cadmium in the water, and the heavy metal cadmium content in the water can be determined based on the refraction luminosity of the residue after the water sample is evaporated in the graphite furnace. The water quality sample is about 20μL in a single measurement, and a current of about 45mA is applied to the water body, and the boiling and excessive evaporation of the water body are avoided to ensure the accuracy of the determination of the heavy metal content.

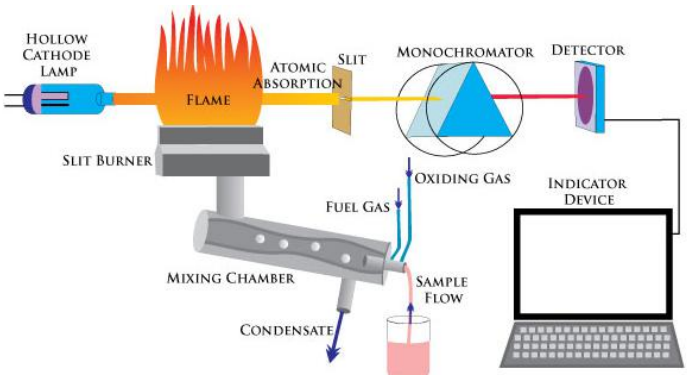

Figure 11. Principle of Atomic Absorption Spectroscopy

1.Principle: It is converted to a medium current until the water body is carbonized. In the atomization stage, a large current is used to achieve the atomization of the elements, and the effect of the flame is used to absorb the electromagnetic radiation of the light source, and the luminosity of the standard water quality sample can be compared to determine the heavy metal cadmium content.

Figure 11. Instruments of Atomic Absorption Spectroscopy

2.Instruments: Atomic absorption spectrophotometer, oil-free gas compressor, atomic fluorescence spectrophotometer, transverse heating graphite furnace system, cadmium hollow cathode lamp, autosampler, pyrolytic coating graphite tube.

3.Reagent configuration: cadmium standard stock solution with a concentration of 1000μg/ml, GR grade concentrated nitric acid, cadmium standard solution with a concentration of 20μg/L, triple filtered deionized water, ultrapure water, ammonium dihydrogen phosphate (20g/L)+ The matrix improver of nitrate (2g/L) + magnesium nitrate (0.8g/L).

In the process of water quality inspection by atomic absorption spectroscopy, the matrix improver selected is ammonium dihydrogen phosphate (20g/L) + nitrate (2g/L) + magnesium nitrate (0.8g/L), When preparing the matrix improver, take two clean beakers with a volume of 50ml, numbered A and B respectively, take 0.1g of spectral pure metal target in beaker A and dissolve it in 3ml of pure nitric acid, seal and place

The metal target is completely dissolved in a ventilated place; 0.06g magnesium nitrate and 1.2g ammonium dihydrogen phosphate are dissolved in deionized water in beaker B, and placed in a ventilated place until completely dissolved. Finally, mix the solutions in beakers A and B into a 100ml beaker, and use deionized water to make the volume constant. After that, the matrix modifier is prepared and placed in a low-temperature environment and sealed for storage, which is convenient for later inspection and use.

4.Experimental procedure: In the experiment, the wavelength of the spectrometer is set to 294.27nm, the slit width is 0.6nm, the peak area integration method is used, the Zeeman background correction technology is introduced, the high-purity hydrogen is used as the shielding gas, the matrix modifier is introduced into the graphite tube, and the automatic feeding is adopted. The sampler injects samples at a time. The temperature rise in the graphite furnace is carried out in stages under program control: in the first stage, the temperature is raised to 110°C and kept for 25s; in the second stage, the temperature is raised to 130°C and kept for 10s; in the third stage, the temperature is raised to 1050°C, And keep it for 10s; in the fourth stage, heat up to 1600℃, to atomization, and keep it for 2s; finally heat up to 2450℃, keep it for 3s, pay attention to filling the protective gas during the heating process, control the airflow flow rate of 260ml/min, when the temperature rises When it reaches the atomized state, stop the protective gas flow. Inject the collective improver, cadmium standard solution and nitric acid solution into the corresponding positions of the autosampler, and obtain the standard solution after automatic dilution, and measure the calibration curve.

(2.) Atomic Fluorescence Spectrometry

Atomic Fluorescence Spectroscopy (AFS) is a spectral analysis technique between Atomic Emission Spectroscopy (AES) and Atomic Absorption Spectroscopy (AAS). Its basic principle is that the ground state atoms (generally in the vapor state) absorb radiation of a suitable specific frequency and are excited to a high energy state, and then emit fluorescence with a characteristic wavelength in the form of optical radiation during the excitation process.

Under normal circumstances, a substance with a relatively stable temperature is placed at a predetermined location for wavelength irradiation, and then its own valence electrons will usually show excitation, but the excitation state shown at this time is not fixed, and the valence electrons Usually it will continue to weaken in a relatively short period of time, and will eventually change to the ground state. Excited atoms emit photoelectric radiation of a fixed wavelength when they eliminate excitation, which is usually called atomic

fluorescence. The analytical method developed by this physical situation is called atomic fluorescence spectroscopy. Driven by the rapid development of science and technology, hollow cathode lamp excitation light sources and shielded quartz furnace atomizers have been developed, which has promoted the continuous improvement of atomic photochemical efficiency and led to the improvement of detection quality. Hydride atomic fluorescence photometer It is widely used in every corner by people. With the aid of atomic fluorescence analysis, the environmental water quality can be understood more accurately, which can help the staff in the later stage to improve the water quality.

The outstanding feature of this method is that it is very easy to operate, but the disadvantage is that it is less flexible and has higher requirements for the use environment.

1.Principle: The mercury ions in the water sample are reduced to elemental mercury by a reducing agent to form mercury vapor. The ground state mercury atoms are excited by ultraviolet light with a wavelength of 2537 nm, and when the excited state mercury atoms are de-excited, they emit fluorescence of the same wavelength. Under given conditions and within a lower mass concentration range, the fluorescence intensity is directly proportional to the mass concentration of mercury.

2.Scope of application: This standard is applicable to the determination of mercury in surface water, groundwater and water samples with low chloride ion content. The lowest detection mass concentration of the method is 0.0015 μg/L, the lower limit of determination is 0.0060 μg/L, and the upper limit of determination is 1.0 μg/L. Reference standard *Water quality—Determination of mercury—cold atomic fluorescent pectrophotometry (HJ/T 341—2007).*

3.Instruments: 1. Digital fluorescence mercury measuring instrument. 2. Data processing systems such as recorders, monitors, and computers. 3. Far-infrared radiation drying oven (oven), which is small in size and suitable for the digestion of mercury-containing water samples. 4. 1.0 ml and 10 μl micro-injector. 5. High purity argon or nitrogen.

4.Elimination of interference: This method uses high-purity argon or nitrogen as carrier gas. In order to avoid air entering during the measurement operation, a sealed reduction bottle sampling technique is adopted. Excited mercury atoms collide with irrelevant particles, such as O_2, CO_2, CO, etc., and energy transfer occurs, causing fluorescence quenching, thereby reducing the sensitivity of mercury measurement.

5.Reagent preparation: The mercury content in the reagent should be as little as possible, and the experimental water is newly prepared deionized water. If the reagent used causes the blank value to be too high, you should switch to a higher-level reagent or choose a reagent with a lower mercury content produced by some factories, or purify it yourself. Prepare reagents or dilute samples to a constant volume, all use mercury-free distilled water (1.), and all reagents are contained in ground glass reagent bottles.

1. Mercury-free distilled water: Double redistilled water or electrodialysis deionized water can usually achieve this purity.

2. Sulfuric acid: $\rho(H_2SO_4)20$ = 1.84 g/ml, pure grade.

3. Nitric acid: $\rho(HNO_3)$ 20 = 1.42 g/ml, pure class of excellence.

4. Hydrochloric acid: ρ(HCl) 20 = 1.18 g/ml, pure class of excellence.

5. Washing solution: Dissolve 2 g of potassium permanganate ($KMnO_4$, premium grade) in 950 ml of water, and add 50 ml of sulfuric acid (2.).

6. Fixing solution: Dissolve 0.5 g of potassium dichromate ($K_2Cr_2O_7$, pure superior grade) in 950 ml of water, and add 50 ml of nitric acid (3.).

7.50 g/L potassium permanganate solution: Dissolve 50 g of potassium permanganate ($KMnO_4$, premium grade pure, recrystallized and refined if necessary) with distilled water (1.) and dilute to 1,000 ml.

8. 100 g/L hydroxylamine hydrochloride solution: Dissolve 10 g hydroxylamine hydrochloride ($NH_2OH{\cdot}HCl$) with distilled water (1.) and dilute to 100 ml. This solution was added to 10 ml of dithizone ($C_{13}H_{12}N_4S$) 20 mg/L of benzene (C_6H_6) solution for extraction 3 to 5 times.

9. 100 g/L stannous chloride solution: add 10 g of stannous chloride ($SnCl_2.2H_2O$) to a mercury-free fume hood, add 20 ml of hydrochloric acid (4.), heat slightly to aid the dissolution, and continue to dissolve Heat for a few

minutes to remove mercury, or use air washed with the washing solution to ventilate the solution at a flow rate of 2.51 L/min for about 1 h to remove mercury, and then dilute to 100 ml with distilled water (1.).

10. Mercury standard stock solution: Weigh 0.1354 g mercuric chloride ($HgCl_2$) placed overnight in a silica gel desiccator, dissolve it with a fixed solution (6.), and transfer it into a 1,000 ml volumetric flask (Grade A) Dilute to the mark with the fixative solution (6.) and shake well. This solution contains 100 μg mercury per milliliter.

11. Intermediate mercury solution: draw an appropriate volume of the mercury standard stock solution (10.), dilute it with a fixed solution to 10 μg mercury per ml, and shake it well.

12. Mercury standard solution: absorb the intermediate solution of mercury (11.) and dilute it step by step with a fixed solution (6.) to contain 100 ng mercury per milliliter.

13. Glassware: The glassware used for measuring mercury should be soaked and boiled for 1 hour in the washing solution. In order to avoid the possibility of brown manganese dioxide spots on the glass wall, take out the glassware while it is hot and rinse it with water for later use.

6.Experimental steps: 1. After the newly collected water sample is fully shaken, 10 ml is immediately sucked accurately and injected into the 10 ml colorimetric tube with stopper.

2. Add 0.1 ml of concentrated sulfuric acid (2.) (add 4 drops with a dropper) and 0.1 ml of potassium permanganate solution (7.) (add 1 to 2 drops with a dropper) to the colorimetric tube to If the water sample can be kept purple-red), if the purple cannot be maintained for at least 15 minutes, add an appropriate amount of potassium permanganate solution after mixing to keep the color purple. Stopper and shake well, put it on a metal rack, and put it in a special oven. Add a porcelain plate cover on the colorimetric tube to prevent the water sample from jumping out of the heating tube plug. Digest it at 105°C for 1 hour, then take it out and cool it.

3. When approaching the measurement, add 0.05 ml of hydroxylamine hydrochloride solution (8.) dropwise while shaking, and shake until the excess potassium permanganate is just faded. Take 1.0 ml and measure it on the computer.

Element	Phototube negative pressure / V	Carrier gas Ar flow rate / (ml / min)	Shield Ar flow/(ml/min)	Instrument measurement (block)	Recorder/ mV	Injection volume/ml
Hg	550	120	500	×5	10	1.0

Tableau 4.Instrument working parameters for reference

Adjust the instrument according to the working conditions in the table, preheat it for 1 hour, turn the control valve (valve for short) to the ready stop, use a 1 ml syringe to inject 1.0 ml of distilled water (1.) into the injection port, and press Tin button, that is, add 0.2 ml of stannous chloride solution (9.) to clean the mercury generator and its pipes. Repeat the measurement until the water blank value is about 5 digits before the reagent blank, mercury standard curve series solution and water sample can be measured. Draw a mercury standard curve and calculate the mercury content in the water sample.

7.Calibration: standard curve method, take 6 10 ml colorimetric tubes with stopper (grade A), add 10 ml distilled water (1.), add 100 ng/ml mercury standard solution (11.) 0, 2, 4, 6, 8, 10 μl, shake well. Add 4 drops of sulfuric acid (2.) and 1 drop of potassium permanganate (7.) respectively, and shake well. Then use 1 drop of hydroxylamine hydrochloride solution (8.) to determine after reduction.

8.Calculation: The mass concentration of mercury is calculated as follows:

$$\rho\ (Hg) = mV$$

In the formula: ρ(Hg)—the mass concentration of mercury, μg/L;

m—The amount of mercury in the water sample calculated according to the calibration curve, ng;

V—Sampling volume, ml.

9.Precision and accuracy: Surface water and groundwater samples with a mercury concentration of 10 to 100 ng/L were measured 11 times, and the relative standard deviation was less than 3%. The standard amount of mercury is added to the water sample, and the final mass concentration is 20 to 100 ng/L, and the recovery rate is 90% to 110%

8.4 Reference project

Distribution Characteristics and Risk Assessment of Heavy Metals in the Dishui Lake and Its Diversion Channels *(DOI: 10.19741/j.issn.1673.4831.2018.0738)*

1.Abstract: Based on the analysis of the Cu, Pb, Cd, and C content in the sediments of the Dishui Lake and its diversion channel and its direct distribution characteristics, the geo-accumulation index and potential ecological risk method are used for heavy metal risk assessment, and combined with the negative body The analysis of bioaccumulation characteristics and edible risks is mainly based on the residue situation, and finally the source of heavy metals in the sediments is analyzed by the method of multiple regression and principal component analysis. The results show that, using the background value of heavy metals as a reference, the content of Cu and Cd in the surface sediments of the Dishui Lake tidal area and the diversion channel are 1.3 and 13.0 times the back value, but compared with other lakes, the sediments of the Dishui Lake water system The level of heavy metal pollution is low. The distribution of heavy metals in the sediments shows that the concentration of heavy metals decreases as the depth of the sediments increases, and Cd exhibits a characteristic of accumulation. The risk assessment results show that Cd is the main contributor to heavy metal pollution in the sediments of the Dishui Lake. Although the heavy metals in organisms do not show the risk of eating, Cu and Cd have shown bio-accumulation characteristics. The sources of C, Pb and Cr in the sediments are similar, and they are mainly derived from traffic activities; Cd is mainly derived from human factors such as agricultural activities.

2.Environment introduction

Dishui Lake is located in the main urban area of Lingang New City, Pudong New District, Shanghai. It is a large artificial lake excavated on the basis of tidal flat reclamation. It is currently the largest artificial lake in the country. . In recent years, following the construction of the Shanghai Free Trade Zone and the Yangshan Port Shipping Center, the development of Lingang New City has been intensified, and the density of human activities has increased sharply. It will be discharged into the water diversion channel of Dishui Lake, causing pollutants including heavy metals to be discharged into the lake area. Since Dishui Lake is a relatively closed body of water with poor fluidity, pollutants are likely to accumulate in the lake area and pose a threat to the ecosystem. At present, research on Dishui Lake mainly focuses on lake water quality, phytoplankton survey, and spatial distribution characteristics of heavy metals and organic pollutants. However, the characteristics of heavy metal pollution in the sediments of Dishui Lake are rarely reported. Research on the vertical deposition, pollution status and potential ecological risks of heavy metals in the Dishui Lake and its diversion channel has important practical significance for the environmental management of the Dishui Lake.

Taking the water system of Dishui Lake as the research object, on the basis of investigating the concentration of four heavy metals in the columnar sediments (Cu, Pb, Cd and Cr, the vertical distribution characteristics and sources of heavy metals are analyzed, and the geoaccumulation index method and potential ecological risks are used. The index method evaluates the pollution level of heavy metals in sediments and the potential ecological risks. At the same time, combined with the heavy metal residues in fishes, we thoroughly discuss the impact of heavy metals in surface sediments on the water environment of Dishui Lake, with a view to rational utilization of the aquatic biological resources of Dishui Lake. The environmental protection management and ecological restoration of Dishui Lake provide data support.

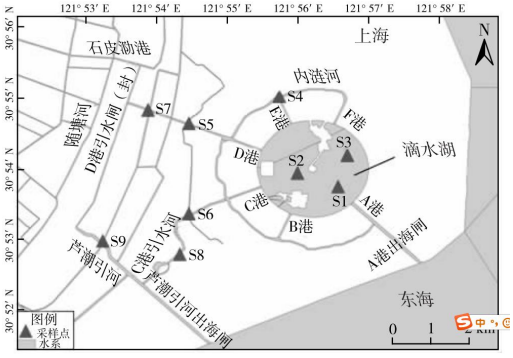

Figure 12. Distribution of sampling points in Dishui Lake and its diversion channel

3.Sample collection: From July 2017 to July 2018, samples of sediment and fish were collected at nine sampling points in the Dishui Lake area (S1-S3) and diversion channel (S4-S9) four times.

The sampling method refers to Water quality-Guidance on sampling techniques from lakes, natural and man-made (GB/T 14581-1993), using a Kajak sediment column sampler with a length of 100 cm and an inner diameter of 5 cm (KC-Denmark, Denmark), randomly collect two 20 cm long sediment column samples at each sampling point and press 0~5,> 5~10, >10~15 and >15~20 cm are layered on site, 2 samples of the same layer are mixed and put into a polyethylene fresh-keeping bag, air is discharged, sealed and marked and placed in an incubator with ice packs. Fish samples were randomly picked from the water, and adult fish of the same size were selected, wrapped in aluminum foil, and marked and placed in an incubator with ice packs. After all samples were transported back to the laboratory on the day of sampling, the sediment samples were stored in a refrigerator at -20 ℃. The fish samples were decapitated, eviscerated, deboned and skinned, and the abdominal, back and tail muscles were minced with a tissue masher After mixing, store in -80 ℃ refrigerator for subsequent analysis.

4.Sample processing and data analysis:

The adult fish collected included silver carp (Hypophthalmichthys molitrix), Ergthroculter iishaeformis, crucian carp (Carassis auratus) and flowerbone fish (Hemibarbus maculatus). After the sediment and fish samples were freeze-dried, they were ground in a mortar and passed through a 0.075 mm sieve to remove impurities and mix, and store them in a desiccator for later use. The four heavy metal indicators of Cu, Pb, Cd and Cr were detected on sediment and fish samples respectively. The analysis method of sediment samples refers to *Marine Monitoring Specification Part 5: Sediment analysis(*GB 17378.5-2007*)*, and fish sample analysis methods refer to Preliminary research in the laboratory, using graphite furnace atomic absorption spectrophotometry to determine. The correlation coefficient of the standard working curve of the heavy metal analysis results of each sample is greater than 0.9995, the relative standard deviation of the parallel samples is less than 5%, and the recovery rate is 97%-115%. The method performance parameters meet the quality control requirements. The reagents used in the experiment are all premium grade pure, and the experimental water is ultrapure water.

Heavy metal	Background values w/(mg•kg^{-1})	Lake District w/(mg•kg^{-1})				Excessive multiple	Lake District w/(mg•kg^{-1})				Excessive multiple
		Maximum value	Minimum value	Standard deviation	Average value		Maximum value	Minimum value	Standard deviation	Average value	
Cu	17.43	28.36	11.52	9.12	22.0	1.26	25.29	7.47	6.35	15.00	0.86
Pb	20.14	3.63	1.35	1.03	2.70	0.13	3.46	1.51	0.92	2.50	0.12
Cd	0.09	1.31	ND	0.15	1.20	13.33	1.73	0.43	0.45	0.97	10.74
Cr	28.27	1.57	ND	0.02	1.40	0.05	1.81	ND	0.38	1.37	0.05

Tableau 5. The content of heavy metals in the surface sediments of the Dishui lake and its diversion channels

(ND means no detected)

5.Results and discussion

Through the obtained sampling point data, refer to the ground accumulation index (I_{geo}) method, the potential ecological risk index (RI, I_R) method, the biological sediment accumulation factor (BSAF, F_{BSA}), and use the health risk assessment to obtain the sediment in the drip lake water system Distribution characteristics of heavy metals

The average contents of Cu, Pb, Cd, and Cr in the surface sediments of the Dishui Lake area were 22, 2.7, 1.2 and 1.4 mg·kg^{-}, respectively. Compared with the background values, the average contents of Cu and Cd in the surface sediments of the lake area exceeded the background values. , Respectively 1.3 and 13.0 times. Through research on the heavy metal content in the surface sediments of the Yangtze River Delta and East China coastal beaches, it is found that the Cd content in the tidal flats and sediments of Shanghai and Zhejiang exceeds the standard, and it is seriously affected by human activities, so road traffic sources can be inferred. It is the most important factor affecting the excessive Cu content in surface sediments of Lingang New City area.

Lake	w/(mg•kg^{-1})			
	Cu	Pb	Cd	Cr
Hazard Lake, Turkey	10~64	ND	——	17~79
Laguna Lake, philippines	9.7~19	17~23	0.02~0.09	——
Balaton Lake, Hungary	0.7~36	2.4~160	0.1~0.7	5.7~66
Manzala lake, Egypt	14~38	0.21~0.31	0.02~0.032	——
Texoma Lake, USA	9.0~136	5.0~15	1.0~3.0	12~51
Veernam Lake, India	65~125	20~41	0.20~3.9	40~150
Taihu Lake, China	16~135	5.5~69	0.03~3.3	9.4~465
South Four Lakes, China	21~40	19~34	0.11~0.45	38~86
Dishui Lake (this project)	7.47~28.36	1.35~3.63	ND~1.73	ND~1.81

ND means not detected. "—" means no data

Tableau 6. Heavy metal concentrations in lake surface sedi- ment samples from different countries

With the construction of the Shanghai Free Trade Zone and the Yangshan Port Shipping Center. The traffic flow around the study area is increasing. When the encirclement is lowered, land-based pollutants will enter the lake area along with the runoff formed by rain erosion, causing the Cu content in the lake area to exceed the standard. The content of Pb and Cr did not exceed the background value, which may be related to the higher background value. In addition, compared with the lake area, except for the average content of Cr in the surface sediments of the diversion channel, the average content of other heavy metals in the surface sediments of the diversion channel is significantly lower. This is because the lake area of Dishui Lake is a water collection area and is relatively closed, and the water body has poor fluidity and exchangeability with external water bodies, so heavy metals are more likely to be enriched in the lake area.

Compared with the content of heavy metals in the sediments of other lakes, the content of other heavy metals in Dishui Lake is low except that the content of Cd is medium. In general, the content of heavy metals in the sediments of the Dishui Lake system is relatively low, but considering the large multiple of the Cd over-background value, it is necessary to further analyze and evaluate the pollution level of heavy metals in the sediments of the study area.

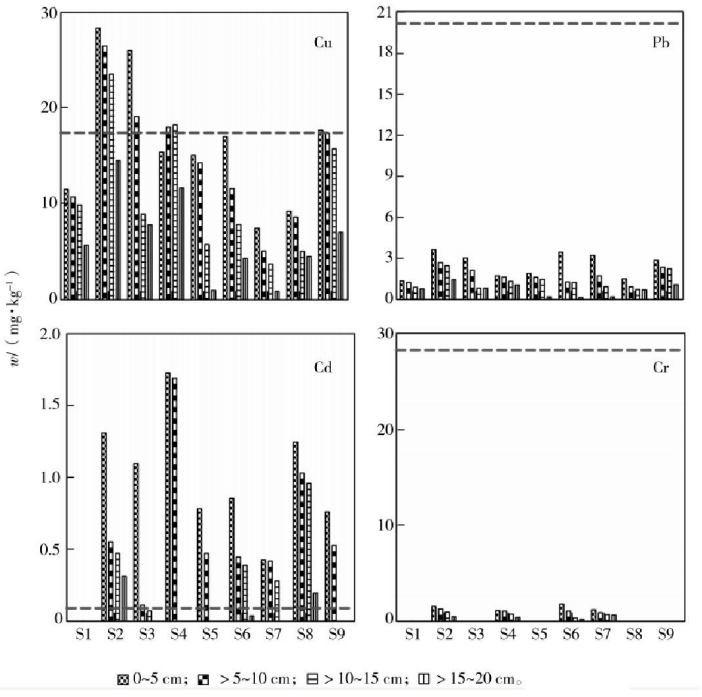

Figure 13.Vertical distribution of heavy metal concentrations in the sediment

The vertical distribution characteristics of heavy metals in the sediments of the Dishui Lake water system

The profile characteristics of lake sediments can record the evolution of the geological environment of the lake basin and the changes of human activities, and it is an important source for obtaining historical information and pollution enrichment characteristics of the lake basin. The content of heavy metals in the sediments at different depths of the Dishui Lake water system is quite different (Figure 2), but the overall distribution of the heavy metal content is relatively consistent, that is, the surface accumulation phenomenon is more obvious, and the content rises with the depth of the sediment. Compared with the background value, the content of Pb and Cr in the sediments of the Dishui Lake water system did not exceed the background value; the Cu content of some samples (S2 and S3) in the lake area exceeded the background value, while the Cu content of the diversion channel did not exceed the background value.

In terms of the geographical location of the sample sites, the lake sample sites S2 and S3 are close to the Dishui Lake entertainment and commercial activity center, and the nearby human flow and traffic volume are relatively large, and land-source pollutants generated by traffic can easily enter the lake area through rainwater runoff. In addition, studies have shown that the distribution of heavy metals in tidal flat sediments is closely related to the depositional dynamics. Due to the weaker hydrodynamic conditions in the Dishui Lake area than in the diversion channel, Cu elements are more likely to be enriched in the lake area. Except that the Cd content of individual samples is close to the background value, the average over-background value multiple is 7.9, which is consistent with the generally higher Cd content in the sediments and soils of the Yangtze River Delta, and it is present in the vertical direction of the sediments in the Dishui Lake water system. Obvious pollution accumulation characteristics.

Analysis of the source of heavy metals in the sediments of the Dishui Lake water system

If there is a significant correlation between heavy metals, it means that the sources of them may be similar. Table 3 shows that, except for the significant correlation between Cu and Pb ($P<0.05$), and the extremely significant correlation between Pb and Cr ($P<0.01$), the correlation between other heavy metals is not significant ($P>0.05$), which indicates that the water system sedimentation of Dishui Lake The sources of Cu, Pb and Cr are similar to each other, and Cd has a separate source. Cu and Pb are the symbol elements of transportation activities, and Cd is generally used as the symbol element of agricultural activities such as the application of pesticides and chemical fertilizers. Therefore, the heavy metals Cu, Pb and Cr in the sediments of the Dishui Lake water system may originate from traffic activities, and Cd may originate from agriculture. Activity. Considering the heavy pollution of Cd and Cu in the sediments, it can be concluded that the heavy metals in the sediments of the Dishui Lake water system may be mainly affected by human factors such as transportation and agricultural activities in the SU area.

Conclusion: (1.) Compared with the background values of heavy metal elements in Shanghai tidal flats, both Cu and Cd in the surface sediments of the Dishui Lake area exceed the background values. However, compared with the heavy metal content in other lake sediments, the heavy metal content in the study area is lower. The vertical distribution of heavy metals in the sediments as a whole shows that the content of the surface layer is higher than the content of the lower layer, and Cd has a strong accumulation characteristic in the vertical direction, followed by Cu.

(2) Both the geoaccumulation index and potential ecological risk assessment results show that Cd is the main contributor to heavy metal pollution in the sediments of the Dishui Lake. Although heavy metals in fish do not cause food risks, Cu and Cd have been accumulated in organisms, which should cause concern.

(3) The sources of Cu, Pb and Cr in the sediments of the Dishui Lake water system are similar. They may come from traffic activities; the source of Cd is relatively independent and may come from agricultural activities. Cu, Pb, Cr, and Cd all merge into the diversion channel through surface runoff such as Longshui and eventually flow into the Dishui Lake area. rrounding areas. Dishui Lake Lake District.

9. Conclusion

The role of industry in my country's national economy is very huge, and it exerts a very critical influence in promoting social and economic progress and driving the development of social modernization. However, with the rapid development of the industrial production industry, it has also caused many environmental pollution problems. Especially in the water environment pollution level, because there are often many heavy metal elements in the water environment, these elements will cause certain damages to the quality of water bodies, and even pose many threats to the health of the people. In view of this, we are targeting When implementing environmental governance, it is necessary to carry out the analysis of environmental water quality, and pay special attention to the detection of heavy metals in the work, and use cutting-edge detection technology to ensure the quality of the detection.

Water is the source of life, and human beings cannot do without water in life and production activities. The quality of drinking water is closely related to human health. With the development of social economy, scientific progress and the improvement of people's living standards, people's requirements for the quality of drinking water have been continuously improved, and drinking water quality standards have also been continuously developed and improved accordingly. Since the formulation of drinking water quality standards is related to people’s living habits, culture, economic conditions, scientific and technological development level, water resources and the status of water quality and other factors, not only between countries, but also between different regions of the same country, There are differences in the requirements for drinking water quality.

Through this internship, I learned China's environmental testing standards, methods to deal with different testing items, and the application of these standards and methods in actual testing projects. The main content of my internship is about environmental water quality testing.

The implementation of efficient environmental water quality testing is very helpful to accurately determine the impurities and chemical substances in the water body. With the help of environmental testing, we can accurately and comprehensively understand the impurities in the water body, which can create a good foundation for the development of water quality testing. The essence of environmental water testing and protection work is to combine the information obtained from testing to formulate environmental protection plans, adhering to the principle of long-term development, and promoting the steady implementation of various tasks. The function of water quality testing is mainly to clarify the various indicators of water bodies. The quality standard of water quality is the water indicator. The information used in the water quality testing work is not just water indicators, but the standard for testing the quality of water resources. There are many, water indicators are the most basic one. Through water quality testing, it can provide people with a reference to the quality of water bodies.

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Annexes

Annexe1. Domestic sewage, industrial wastewater detection

Domestic sewage, industrial wastewater detection		
Index classification	Detection Indicator	Related standards
Conventional physical and chemical indicators	Water temperature, water level, flow rate and flow, chroma, odor, pH value, transparency. Total hardness, suspended matter, total residue, total soluble solids (filterable residue), alkalinity, acidity. Total phosphorus, conductivity, dissolved oxygen. Chemical oxygen demand, five-day biochemical oxygen demand. Permanganate Index, Ammonia Nitrogen, Total Nitrogen, Fufaphenol, Anionic Surfactant, Cyanide, Sulfide, High Chlorine (Active Chlorine), Total Chlorine (Total Residual Chlorine), Hexavalent Inscription, Petroleum , Animal and vegetable oils, fecal fat barrier group, total coliform, total number of bacteria, total salt. Oxidation-reduction potential, dumplings, fluoride, oxide. Nitrite, nitrate, sulfate, phosphate, Kelvin, carbonate, bicarbonate, hydroxide, salinity, chlorine dioxide, chlorous acid	Integrated wastewater discharge standard (GB 8978-1996) Discharge standard of pollutants for municipal wastewater treatment plant (GB1818-2002) Water quality standards for sewage discharged into urban sewers (GB/T 31962-2015) Discharge standard of water pollutants for medical organization (GB 18466-2005)
Inorganic metal index	Chromium, nickel, sodium, potassium, iron, manganese, copper, zinc, lead, cadmium, mercury, antimony, arsenic, bismuth, selenium, aluminum, boron	
Organic index	Formaldehyde, chlorophyll, chloroacetaldehyde, aniline, methanol, acrylonitrile, acrolein, acetaldehyde. Pyridine, turpentine, acrylamide, methylmercury, yellow catalyst, organophosphorus pesticides. Phenolic compounds, PCBs. Organochlorine pesticides, nitrobenzene compounds (nitrobenzenes), volatile organic compounds, bai Cao Qing, deltamethrin. Phthalic acid bacteria, benzidine,. Atrazine, polycyclic aromatic hydrocarbons, alkyl mercury, iodide. Benzene series, butyl lean acid, epichlorohydrin, methanol, acetone, ethyl ester, microcystis suture, mezalwei, benzo(a)pyrene, aniline, dimethoate, para-alkaline phosphorus, methyl Base-paraphosphate, malathion monument, pentachlorophenol, adsorbable organic halide, trifluoromethane, tetraoxide, trichloroethylene, tetrachloroethylene, benzene, toluene, ethylbenzene, xylene (m-to-ortho) , Chlorobenzene, dichlorobenzene (m-to-o), 2,4-dinitrochlorobenzene, phenol, m-cresol, 2,4-dichlorophenol, 2,4,6-trichlorophenol, o-benzene Dibutyl dicarboxylate, dioctyl phthalate	
Radioactive index	Total α radioactivity, total β radioactivity	

Annexe2. Domestic sewage, industrial wastewater detection

Drinking water and tap water testing (106 items)		
Index classification	Detection Indicator	Related standards
Sensory traits and general chemical indicators	Chromaticity, turbidity, odor and taste, visible to the naked eye, pH, aluminum, iron, manganese, copper, zinc, chloride, sulfate, total dissolved solids, total hardness (calculated as CaCO), oxygen consumption, Volatile phenols, anionic synthetic detergent, ammonia nitrogen, sulfide, sodium	Sanitary Standards of Drinking Water (GB 5749-2006)
Microbiological indicators	Total coliforms, heat-resistant coliforms, Escherichia coli, total number of colonies, Giardia, Cryptosporidium	
Toxicological Inorganic Index	Arsenic, cadmium, chromium (hexavalent), lead, mercury, selenium, antimony, barium, beryllium, boron, molybdenum, nickel, silver, thallium, antimony, cyanogen chloride, cyanide, fluoride, nitrate, bromate , Formaldehyde, chlorite, chlorate	
Toxicological organic index	Trichloromethane, carbon tetrachloride, monochlorodibromomethane, dichloromonobromomethane, dichloroacetic acid, 1,2-dichloroethane, methylene chloride, 1,1,1-trichloroethane, trichloroacetic acid , Chloroacetaldehyde, 2,4,6-Trichlorophenol, Tribromomethane, Heptachlor, Malathion, Pentachlorophenol, Hexachlor, Hexachlorobenzene, Dimethoate, Parathion, Dimethoate, Methyl parathion, chlorothalonil, carbofuran, lindane, chlorpyrifos, glyphosate, dichlorvos, atrazine, deltamethrin, 2,4-D, DDT, 1,1-dichloroethylene, 1, 2-dichloroethylene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, trichloroethylene, trichlorobenzene, hexachlorobutadiene, acrylamide, tetrachloroethylene, phthalic acid two (2 -Ethylhexyl) ester, epichlorohydrin, benzene, toluene, xylene	
Conventional indicators of disinfectants	Free chlorine, chloramine (total chlorine), ozone, chlorine dioxide	
Radioactive index	Total α radioactivity, total β radioactivity	

Annexe3. Surface water testing (109 items)

Surface water testing (109 items)		
Index classification	Detection Indicator	Related standards
Conventional physical and chemical indicators	pH, water temperature, dissolved oxygen, permanganate index, chemical oxygen demand, five-day biochemical oxygen demand, ammonia nitrogen, total phosphorus, total nitrogen, fluoride, sulfate, chloride, nitrate, hexavalent chromium, cyanide Chemicals, volatile phenols, petroleum, anionic surfactants, sulfides, fecal coliforms, active chlorine, yellow phosphorus	Environmental quality standards for surface water (GB 3838-2002,replacing GB 3838-88，GHZB 1-1999)
Inorganic metal index	Copper, zinc, selenium, arsenic, mercury, cadmium, lead, iron, manganese, nickel, barium, molybdenum, cobalt, beryllium, vanadium, titanium, boron, antimony, thallium	
Organic index	Trichloromethane, carbon tetrachloride, bromoform, dichloromethane, 1,2-dichloroethane, epichlorohydrin, vinyl chloride, 1,1-dichloroethylene, 1,2-dichloroethylene, three Vinyl chloride, tetrachloroethylene, chloroprene, hexachlorobutadiene, styrene, formaldehyde, acetaldehyde, acrolein, chloroacetaldehyde, benzene, toluene, ethylbenzene, xylene, cumene, chlorobenzene , 1,2-Dichlorobenzene, 1,4-Dichlorobenzene, Trichlorobenzene, Tetrachlorobenzene, Hexachlorobenzene, Nitrobenzene, Dinitrobenzene, 2,4-Dinitrotoluene, 2,4 ,6-Trinitrotoluene, nitrochlorobenzene, 2,4-dinitrochlorobenzene, 2,4-dichlorophenol, 2,4,6-trichlorophenol, pentachlorophenol, aniline, benzidine, Acrylamide, acrylonitrile, dibutyl phthalate, bis(2-ethylhexyl) phthalate, hydrazine hydrate, tetraethyl lead, methylmercury, pyridine, turpentine, picric acid, butyl Xanthogenic acid, DDT, lindane, heptachlor epoxide, parathion, methyl parathion, malathion, dimethoate, dichlorvos, trichlorfon, systemic phosphorus, chlorothalonil, carbaryl, bromine Cypermethrin, atrazine, benzene	

Annexe4. Groundwater detection (92 items)

Groundwater detection (92 items)		
Index classification	Detection Indicator	Related standards
Conventional physical and chemical indicators	Color, smell and taste, turbidity, visible to the naked eye, pH, total hardness, total dissolved solids, sulfate, chloride, iron, manganese, copper, zinc, aluminum, volatile phenol, anionic surfactant, oxygen consumption Amount, ammonia nitrogen, sulfide	Groundwater quality standards (GB/T 14848-2017)
Inorganic Toxicity Index	Nitrite, nitrate, cyanide, fluoride, iodide, arsenic, mercury, lead, cadmium, selenium, hexavalent chromium, beryllium, boron, antimony, barium, nickel, cobalt, molybdenum, silver, thallium	
Organic index	Trichloromethane, carbon tetrachloride, benzene, toluene, dichloromethane, 1,2-dichloroethane, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1, 2-Dichloropropane, tribromomethane (bromoform), vinyl chloride, 1,1-dichloroethylene, 1,2-dichloroethylene, trichloroethylene, tetrachloroethylene, chlorobenzene, 1,2-dichlorobenzene (O-dichlorobenzene), 1,4-Dichloro GB/T 14848-2017 Benzene (p-dichlorobenzene), trichlorobenzene, ethylbenzene, xylene, styrene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, naphthalene, anthracene, fluoranthene, benzo[b]Fluoranthene, benzo [a] pyrene, polychlorinated biphenyls, bis(2-ethylhexyl) phthalate, 2,4,6-trichlorophenol, pentachlorophenol, BHC, lindane , DDT, hexachlorobenzene, heptachlor, 2,4-D, carbofuran (carbofuran), dichlorvos, methyl parathion, malathion, dimethoate, chlorpyrifos, chlorothalonil, atrazine, Glyphosate	
Microbiological indicators	Total coliforms, total number of bacteria	
Radioactive index	Total α radioactivity, total β radioactivity	

Annexe5. Ambient air detection

Ambient air detection		
Index classification	Detection Indicator	Related standards
Basic index	Sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, PM10, PM2.5	Ambient air quality standards (GB 3095—2012,replacing GB 3095—1996 GB 9137—88)
Other indicators	Total suspended particulate matter, nitrogen oxides, lead, benzo(a)pyrene, cadmium, mercury, arsenic, hexavalent chromium, fluoride	

Annexe6. Industrial waste gas detection

Industrial waste gas detection		
Index classification	Detection Indicator	Related standards
Conventional indicators	Sulfur dioxide, nitrogen oxides, nitrogen dioxide, nitrogen monoxide, carbon monoxide, particulate matter, formaldehyde, aniline, hydrogen chloride, methanol, phosphorus pentoxide, acetaldehyde, hexavalent chromium, phosgene, sulfuric acid mist, chlorine, fluoride, smoke Gas blackness, pitch fume, hydrogen cyanide, ozone, chromic acid mist, acetaldehyde, oil fume, oil mist	Comprehensive emission standard of air pollutants (GB 16297-1996) Emission Standard of Air Pollutants for Industrial Furnaces (GB 9078-1996) Boiler Air Pollutant Emission Standard (GB 13271-2014)
Heavy metal index	Silver, aluminum, barium, beryllium (beryllium and its compounds), bismuth, calcium, vanadium, cobalt, chromium, copper, iron, potassium, magnesium, manganese, sodium, nickel (nickel and its compounds), zinc, antimony, tin (Tin and its compounds), strontium, titanium, boron, lithium,	
Organic index	Acrylonitrile, vinyl chloride, chlorobenzene compounds, total hydrocarbons, non-methane total hydrocarbons, methane, benzene series, epichlorohydrin, nitrobenzene compounds, volatile organic compounds, benzo(a)pyrene, acetone, and more Cyclic aromatic hydrocarbons, PCBs, organochlorine pesticides, anilines, acrolein, phenolic compounds, benzene, toluene, xylene	
Malodorous gas index	Odor concentration, methyl mercaptan, methyl sulfide, dimethyl disulfide, trimethylamine, styrene, carbon disulfide, ammonia, hydrogen sulfide	

Annexe7. Volatile organic compounds (V0CS) detection

Volatile organic compounds (V0CS) detection	
Detection Indicator	Related standards
Non-methane total hydrocarbons, benzene, toluene. M-xylene, p-xylene, o-xylene, styrene, 1,1-two-cylinder Z ene, 1,1,2-trichloro-12,2-trifluoroethane, cyanopropene, dichloride Methane, 1,1-dichloroethane, cis-1,2-dichloroethylene, chloroform, 1,1,1-trichloroethane, 1,2-dichloroethane, trichloroethylene, 1,2-Dichloropropane, trans 1,3-dioxypropene, cis 1,3-dichloropropene, 1,1,2-trioxyethane, tetrasteel ethylene, 1,2-dibromoethane Alkane, chlorobenzene, ethylbenzene, 1,1,2,2-tetrachloroethane, 4-ethyltoluene, 1,3-dichlorobenzene, 1,4-dichlorophenylbenzyl chloride, 1,2- Dichloromethane, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene hexafluorobutadiene	Emission Standard of Volatile Organic Compounds from Stationary Pollution Sources in Sichuan Province (DB 51/2377-2017)

Annexe8. Indoor air detection

Indoor air detection		
Index classification	Detection Indicator	Related standards
Physical index	Temperature, indoor wind speed, relative humidity, fresh air volume	Indoor air quality standard (GB/T 18883-2002)
Chemical index	Sulfur dioxide, nitrogen dioxide, ammonia, benzene, toluene, inhalable particulate matter, formaldehyde, radon in the air, TVOC (total volatile organic compounds), carbon monoxide, carbon dioxide, ozone, xylene, benzo(a)pyrene	
Biological indicators	Total number of colonies	
Radioactive index	222Rn	

Annexe9. Soil environmental quality inspection for construction land

Soil environmental quality inspection for construction land		
Index classification	Detection Indicator	Related standards
Heavy metal index	Arsenic, cadmium, chromium (hexavalent), copper, lead, mercury, nickel	Soil Environmental Quality Construction Land Soil Pollution Risk Management and Control Standards (GB 36600-2018)
Volatile Organic Compound Index	Carbon tetrachloride, chloroform, methyl chloride, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethylene, trans-1, 2-Dichloroethylene, methylene chloride, 1,2-dichloropropane, 1,1,1,2,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethylene, 1, 1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethane =) ene, 1,2,3-trichloropropane, vinyl chloride, benzene, chlorobenzene, 1,2-di Chlorobenzene, 1,4-dichlorobenzene, ethylbenzene, benzene	
Semi-volatile organic compound index	Nitrobenzene, aniline, 2-chlorophenol, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, sucrose, dibenzo 【a, h 】Anthracene, indeno 【1,2,3-cd】Pyrene, naphthalene	

Annexe10. Soil environmental quality inspection of agricultural land

Soil environmental quality inspection of agricultural land		
Index classification	Detection Indicator	Related standards
Heavy metal index	Cadmium, mercury, arsenic, lead, chromium, copper, nickel, zinc	Soil environmental quality Risk control standard for soil contamination of agricultural land (GB 15618—2018,replacing GB 15618—1995)
Volatile Organic Compound Index	Total DDT (p,p'-DDT, P,p'-DDT, 0,p'-DDT, P,p'-DDT), total BHC (α-BHC, β - Six six six, γ- six six six)	
Semi-volatile organic compound index	Benzo【a】pyrene	

Annexe11. Solid waste leaching toxicity test

Solid waste leaching toxicity test		
Index classification	Detection Indicator	Related standards
Inorganic element and compound index	Copper, zinc, cadmium, lead, chromium, hexavalent chromium, beryllium, barium, nickel, silver, arsenic, selenium, inorganic fluoride, alkyl mercury	Identification standards for hazardous wastes-Identification for extraction toxicity (GB 5085.3—2007,replacing GB 5085.3—1996)
Organic pesticide index	DDT, BHC, dimethoate, parathion, methyl parathion, malathion, chlordane, hexachlorobenzene, mirex, toxaphene	
Non-volatile organic compound index	Phenol, 2,4-dichlorophenol, 2,4,6-trichlorophenol, benzo【a 】pyrene, dibutyl phthalate, dioctyl phthalate, polychlorinated biphenyls, pentachloro Phenol, nitrobenzene, dinitrobenzene, p-nitrobenzene	
Volatile Organic Compound Index	Benzene, toluene, ethylbenzene, xylene, chlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, carbon tetrachloride, trichloroethylene, tetrachloroethylene, trichloromethane (chloroform), propylene Nitriles, PCBs, pentachlorophenol, nitrobenzene, dinitrobenzene, p-nitrobenzene, 2,4-dinitrochlorobenzene	

Annexe12.Other testing of solid waste

Other testing of solid waste		
Index classification	Detection Indicator	Related standards
Physical and chemical indicators	pH value, water content, fluoride ion, cyanate, fluoride, bromate, chloride, nitrite, bromide, nitrate, phosphate, sulfate, hexavalent chromium, fly density	Environmental monitoring technical requirements for sanitary landfills of domestic waste (GB/T 18772-2017) Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB 16889-2008)
Inorganic metal index	pH value, water content, fluoride ion, cyanate, fluoride, bromate, chloride, nitrite, bromide, nitrate, phosphate, sulfate, hexavalent chromium, fly density	
Organic index	Polycyclic aromatic hydrocarbons, total phosphorus, organophosphorus pesticides, organochlorine pesticides, phenolic compounds, aniline, semi-volatile organic compounds, carbofuran, aldicarb, glyphosate, herbicide, volatile organic compounds, benzene series, propylene	

Annexe13. Municipal sludge testing

Municipal sludge testing		
Index classification	Detection Indicator	Related standards
Physical and chemical indicators	pH, organic matter, moisture content, sludge concentration, fatty acid, total alkalinity, phenol (volatile phenol), cyanide, mineral oil, total number of bacteria, coliform, roundworm eggs, total nitrogen, total phosphorus	Determination method for municipal sludge in wastewater treatment plant (GB/T 221-2005)
Inorganic metal index	Zinc and its compounds, copper and its compounds, lead and its compounds, nickel and its compounds, chromium and its compounds, cadmium and its compounds, total mercury, arsenic and its compounds, boron and its compounds, total potassium	

Annexe14. Noise and vibration

Noise and vibration		
Index classification	Detection Indicator	Related standards
Noise	Aircraft noise around the airport, wind farm noise, railway boundary noise, sound barrier insertion loss, road traffic noise, industrial enterprise factory boundary environmental noise, construction site environmental noise, social life environmental noise, acoustic environmental noise, structure propagation fixed equipment indoor noise	Measurement of aircraft noise around airport (GB 9661-88) Wind farm noise standards and noise measurement methods (DL/T 1084-2008) Emission Standards and Measurement Methods of Railway noise on the Boundary Alongside Risky Line (GB 12525-90)
Vibration	Urban area environmental vibration, railway environmental vibration	Technical Regulations for Environmental Noise Measurement along the Railway (TB/T 3050-2002) Norm on Acoustical Design and Measurement of Noise Barriers (HJ/T 90-2004) Environmental Noise Emission Standards at the Boundary of Industrial Enterprises (GB 12348-2008) Environmental noise emission standards for construction sites (GB 12523-2011) Emission standard for community noise (GB 22337—2008) Acoustic environmental quality standards (GB3096-2008) Technical Specifications for Environmental Noise Monitoring Structure-borne Indoor Noise From Associated Facilities(HJ 707-2014) Technical Specifications for Environmental Noise Monitoring Structure-borne Indoor Noise From Associated Facilities (GB/T 10071-1988)

(4ème de couverture)

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2020-2021

Utilisation et application des instruments de test de la qualité de l'eau

Résumé : China's environmental testing standards and general water quality testing instruments, commonly used testing methods in water quality testing, and their application in the Shanghai Dishui Lake project

Mots Clés : Water environment, water quality testing, heavy metals

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