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Standard for safety evaluation of equipment and protective materials in drinking water system

生活饮用水输配水设备及防护材料的安全性评价标准

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Standard for safety evaluation of equipment and protective materials in drinking water system

1 Scope

This standard specifies the hygiene and safety evaluation standards for drinking water distribution equipment (water distribution systems, equipment, and mechanical components of water supply system) and protective materials.

This standard applies to substances and products that are in direct contact with drinking water and drinking water treatment agents. These substances and products refer to the water distribution pipes, equipment and mechanical components used in drinking water supply systems (e.g., valves, chlorination dosage equipment, water treatment reagent addition device) and protective materials (such as paints, linings).

2 References

The provisions contained in the following standards are incorporated into this standard and constitute the provisions of this standard. At the time of publication, the editions indicated are valid. All standards will be revised and all parties using this standard shall explore the possibility of using the latest version of the following standards.

GB 5749-85 Sanitary standard for drinking water

GB/T 5750-85 Standard examination methods for drinking water

GB 7919-87 Procedures and methods of safety evaluation for cosmetics

GB/T 5009.69-1996 Method for analysis of hygienic standard of epoxy phenolic coatings for inner wall of food cans

GB 11934-89 Standard method for hygienic examination of acetaldehyde and acrolein in drinking water sources - Gas chromatography

3 Hygiene requirements

3.1 All water distribution equipment and protective materials in contact with drinking water must not pollute the water quality, the quality of the peripheral water of the pipe network must meet the requirements of GB 5749.

Appendix A

(Normative)

Drinking water distribution equipment hygiene standard test method

A1 Sample pretreatment

A1.1 Sampling

In order to comply with the application conditions as much as possible, the final products of the water distribution pipes or related products shall be used in the soaking test. When the volume of the final product is too large, it can be appropriately reduced in accordance with the specific conditions.

A1.2 Pretreatment

The sample is cleaned with tap water and rinsed continuously for 30 min, then soaked in water immediately.

A1.3 Soaking test

A1.3.1 Soaking water preparation

A1.3.1.1 Reagents

A1.3.1.1.1 Pure water: Distilled or deionized water, conductivity of 2 μS/cm.

A1.3.1.1.2 0.025mol/L chlorine stock solution: TAKE 7.3 mL reagent grade sodium hypochlorite (5% NaOCl), USE pure water to dilute it to 200 mL, STORE it in a stoppered brown bottle, STORE it at 20°C in the dark. PREPARE it freshly every week.

Determination of chlorine content: TAKE 1.0 mL of chlorine stock solution, USE water to dilute it to 1.0 L, immediately ANALYZE the total residual chlorine, RECORD this value as “A”.

Determination of the required residual chlorine: In order to obtain 2.0 mg/L residual chlorine, the amount of chlorine stock solution needed to be added to the soaking water is calculated in accordance with formula (A1):

$$V=\frac{2.0\times B}{A} \quad \cdots\cdots (A1)$$

Where:

V - Volume of chlorine stock solution to be added, mL;

A2.10 Arsenic: It is implemented in accordance with Chapter 22 of GB/T 5750-85.

A2.11 Mercury: It is implemented in accordance with Chapter 24 of GB/T 5750-85.

A2.12 Cadmium: It is implemented in accordance with Chapter 25 of GB/T 5750-85.

A2.13 Chromium (hexavalent): It is implemented in accordance with Chapter 26 of GB/T 5750-85.

A2.14 Lead: It is implemented in accordance with Chapter 27 of GB/T 5750-85.

A2.15 Evaporation residue:

A2.15.1 Determination of evaporation residue in water distribution pipe and relevant product soaking water by gravimetric method.

A2.15.2 Method principle

The sample is soaked in soaking water and dried at a certain temperature. The resulting solid residue is an evaporation residue, which indicates the amount of dissolving out amount in the soaking water.

A2.15.3 Instruments

A2.15.3.1 Analytical balance, the sensitivity is one ten thousandth gram.

A2.15.3.2 Water bath.

A2.15.3.3 Evaporation dish.

A2.15.3.4 Electric thermostatic drying oven.

A2.15.3.5 Dryer: Use silica gel as a desiccant.

A2.15.4 Determination procedure

A2.15.4.1 WASH the evaporating dish clean, PUT it in an oven at 105 °C ± 3 °C to dry it for 30 min, TAKE it out and PLACE it in a desiccator to cool it for 30 min. WEIGH it, BAKE it again, WEIGH it until it reaches constant weight.

A2.15.4.2 TAKE 200 mL soaking solution, PLACE it in a evaporating dish which has reached constant weight, EVAPORATE it dry on a water bath, DRY it in an oven at 105 °C for 2 h; TAKE it out and COOL it in a desiccator for 30 min, DRY it at 105 °C for 1 h, WEIGH it to constant weight.

A2.15.5 Calculation, as shown in (A2)

$$C(\frac{1}{5}KMnO_4)=\frac{0.1000\times 25.00}{V} \quad \cdots\cdots (A3)$$

Where:

C - Concentration of potassium permanganate solution, mol/L;

V - Consumption amount of potassium permanganate solution, mL.

A2.16.3.5 Potassium permanganate solution [c(1/5$KMnO_4$) = 0.0100 mol/L]: Accurately PIPETTE the calibrated potassium permanganate solution, DILUTE it in accordance with the required amount, so that the concentration of potassium permanganate solution is 0.0100 mol/L.

A2.16.4 Instruments

A2.16.4.1 50mL burette.

A2.16.4.2 250mL flask.

A2.16.5 Determination procedures

A2.16.5.1 Conical flask pretreatment: TAKE 50 mL of pure water, PLACE it in a 250 mL conical flask, ADD 1 mL of sulfuric acid solution (2.19.3.1) and a small amount of potassium permanganate solution (2.19.3.5), HEAT and BOIL it for a few minutes, TAKE out the conical flask, USE oxalic acid solution (2.19.3.3) to titrate it to slight reddish color, POUR it out.

A2.16.5.2 TAKE 100 mL of soaking water in the treated conical flask, ADD 5 mL of sulfuric acid solution (2.19.3.1), USE burette to add 10 mL of potassium permanganate solution (2.19.3.5), PLACE it in the boiled water bath for 30 min. TAKE it out and ADD 10 mL of oxalic acid solution (2.19.3.3) when it is hot, SHAKE it thoroughly to let the red color fades, then USE potassium permanganate solution (2.19.3.5) to titrate it to slight reddish, RECORD the amount of potassium permanganate V_1.

A2.16.5.3 TAKE another 100 mL of pure water, MAKE reagent blank in accordance with the same steps as above.

A2.16.6 Calculation, as shown in formula (A4)

$$c=\frac{(V_1-V_2)\times 0.316\times 1\ 000}{100} \quad \cdots\cdots (A4)$$

Where:

c - Consumption of potassium permanganate in soaking water, mg/L;

V_1 - Volume of potassium permanganate solution for titration of soaking

Appendix B

(Normative)

Hygiene standard test method for protective materials in contact with drinking water

B1 Sample pretreatment

B1.1 Preparation of samples

B1.1.1 PREPARE the sample in accordance with the conditions of use provided by the manufacturer (e.g., coating thickness, drying time after coating, etc.). The coating may be applied to a glass sheet. If the glass sheet is not suitable, it may be selected in accordance with the manufacturer's recommendations.

B1.1.2 TAKE 70 mm × 300 mm glass sheet, WASH it clean and DRY it. On the 70 mm x 120 mm area on both sides of the glass sheet, APPLY coating to the actual use thickness. DRY it naturally in a dry place, MAKE it into a paint sheet.

B1.1.3 Pretreatment: USE tap water to rinse the sample paint sheet clean, immediately PERFORM the soaking test.

B1.2 Soaking test

B1.2.1 Preparation of soaking water: Same as in clause A.3.1 of Appendix A.

B1.2.2 Soaking conditions: The ratio of the surface area of the sample to the volume of soaking water is 50 cm^2/L. If it is a multi-layer coating, each layer of coating is separately applied on a glass sheet (or selected in accordance with the manufacturer's recommendations) and fixed in the soaking water. The volume ratio of each paint sample and soaking water is calculated as 50 cm^2/L.

B1.2.3 Soaking

B1.2.3.1 INSERT the test piece without protective coating into the glass holder placed in the glass container, so that the sample piece is kept perpendicular and does not touch each other, or otherwise HANG the test piece in a glass container. SOAK it in an airtight dark condition at 25 °C ± 5 °C. COLLECT all soaking water at the 1^{st}, 3^{rd}, 5^{th}, 10^{th}, 20^{th} and 30^{th} days after soaking for testing and analysis. In order to observe the attenuation of the dissolved contaminant concentration, the concentration of contaminants in the soaking water on the 30^{th} day is used to evaluate whether it complies with the provisions of this hygiene standard. While collecting the soaking water, REPLACE it with new soaking water.

Appendix C

(Normative)

Hygiene toxicological evaluation procedures and methods for drinking water distribution equipment and protective materials

C1 Scope

This procedure and method are applicable to the hygiene toxicological evaluation of drinking water distribution equipment (including all equipment in contact with drinking water) and protective materials. When the maximum allowable concentration of dissolved substances in drinking water distribution equipment and protective materials in water is not specified, toxicological tests shall be carried out in accordance with this method to determine their limits in drinking water.

C2 General requirements

C2.1 Producers must provide the following information:

C2.1.1 Product application conditions, application scope, physical and chemical properties;

C2.1.2 Formulations and production methods;

C2.1.3 Chemical structure formula, impurity composition and content of the ingredients of the formulation;

C2.1.4 Substances and estimated concentrations that may be dissolved during drinking water soaking process.

C2.2 Producers must prepare samples and provide test samples based on actual application conditions.

C3 Toxicological evaluation procedure

Based on the concentration of dissolved substances from the drinking water and water distribution equipment and protective materials, toxicological tests are performed at four levels to determine the maximum allowable concentration in water.

C3.1 Level I: USE it when the concentration of dissolved substances in water is < 10 μg/L.

C3.1.1 Test items: Two genetic toxicological tests.

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