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Water based extinguishing agent

水系灭火剂

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Water based extinguishing agent

1 Scope

This document defines the terms and definitions of water based fire extinguishing agents. It specifies the models, requirements, inspection rules, packaging, marking, transportation and storage of water based fire extinguishing agents, and describes the corresponding test methods.

This document applies to the research and development, production and inspection of water based fire extinguishing agents.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB 4351, *Portable fire extinguishers*

GB 5749, *Standards for drinking water quality*

GB/T 6003.1, *Test sieves - Technical requirements and testing - Part 1: Test sieves of metal wire cloth*

GB/T 6682, *Water for analytical laboratory use -- Specification and test methods*

GB 14924.3, *Laboratory animals -- Nutrients for formula feeds*

GB 15308, *Foam extinguishing agent [Including 2009XG1]*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 water based extinguishing agent

An extinguishing agent that adds additives such as penetrants and flame retardants to water to improve its fire extinguishing performance and other properties.

3.2 characteristic values

c) Place the sample sealed in the container at (60±2)℃ for 7 d. Then place it at (20±5)℃ for 1 d.

6.2 Solidification point

6.2.1 Instruments and equipment

The instruments and equipment used for the test shall meet the following requirements.

a) Solidification point tester: temperature control accuracy is ±1℃.

b) Platinum resistance: PT100, accuracy is ±0.1℃, outer diameter is 5.0 mm.

6.2.2 Test steps

To perform a solidification point measurement, follow these steps:

a) Turn on the solidification point tester. Make the temperature of the cold room lower than the solidification point of the sample (10±1)℃;

b) Inject the sample into the dry and clean inner tube. Make the liquid level 50 mm;

c) Fix the platinum resistor in the center of the inner tube with a cork or rubber plug. The lower end of the platinum resistor is 10 mm away from the bottom of the inner tube;

d) Place the inner tube with the sample in the outer tube. The distance from the bottom of the inner tube to the bottom of the outer tube is not more than 10 mm. Then put the outer tube into the cold room. The depth of the outer tube entering the cold room is not less than 100 mm;

e) Start the test. The instrument automatically records the temperature-time curve;

f) When the sample is completely solidified, the temperature at the platform of the curve is the solidification point.

6.2.3 Results

The higher value of the two test results with a difference of no more than 1°C shall be taken as the test result.

6.3 pH

6.3.1 Instruments and materials

The test equipment and materials shall meet the following requirements.

a) Acidity meter: accuracy is 0.01 pH.

b) Thermometer: graduation value is 1.0℃.

c) pH buffer.

6.3.2 Test steps

To perform a pH measurement, follow these steps:

a) Calibrate the acidometer with pH buffer;

b) Pour the sample into a dry, clean beaker. Immerse the electrode 30 mm below the sample and 10 mm above the bottom of the beaker. The electrode cannot touch the bottom and side walls of the beaker;

c) Measure the pH when the sample temperature is (20±2)℃.

6.3.3 Results

The average of two test results with a difference of no more than 0.1 pH is taken as the test result.

6.4 Sediment

6.4.1 Instruments and equipment

The test instruments and equipment shall meet the following requirements.

a) Electric centrifuge: centrifugal acceleration is (6000±600) m/s^2.

b) Graduated centrifuge tube: capacity is 50 mL, minimum graduation value is 0.1 mL.

c) Test sieve: in accordance with the requirements of GB/T 6003.1, pore size is 180 μm.

d) Electric heating blast drying oven: temperature control accuracy is ±2℃.

e) Stopwatch: graduation value is 0.1 s.

6.4.2 Test steps

To perform sediment measurement, follow the steps below:

a) Take two 50 mL graduated centrifuge tubes. Fill each with 50 mL (V_2) of sample. Then place them symmetrically in the centrifuge. Centrifuge at (6000±600) m/s^2 for (10±1) min;

b) Take out the graduated centrifuge tubes. Read the volume of the sediment (V_1);

g) Anhydrous ethanol: chemically pure.

6.6.2 Test steps

The corrosion rate measurement is performed according to the following steps.

a) Take 4 pieces of Q235A steel sheet and 4 pieces of 3A21 aluminum sheet. Grind with 200# water sandpaper to remove the oxide film. Then polish with 400# water sandpaper. Rinse and clean with a hard brush in tap water. Finally, wash with anhydrous ethanol and wipe dry. Put the treated test piece into an electric heated blast drying oven at (60±2)℃ for 30 min. Take it out and put it into a dryer to cool to room temperature. Weigh the mass (m_1) of each test piece and number it.

b) Use a vernier caliper to measure the length, width, and thickness of each test piece. Calculate the surface area (A) of each test piece.

c) Place the treated steel sheet and aluminum sheet into two conical bottles respectively. Pour the sample in. Make sure the test piece is completely immersed in the sample. There is no contact between the test pieces or between the test pieces and the conical bottle. Then seal the bottle mouth.

d) Place the conical flask in an electric heated air drying oven at (38±2)℃ for 21 d.

e) Take out the test piece from the conical flask. Use a hard brush to wash off the corrosion products in tap water (if it cannot be washed off, soak the steel piece in 10% diammonium hydrogen citrate aqueous solution and the aluminum piece in phosphoric acid-chromic acid aqueous solution). After washing, wash with anhydrous ethanol and wipe dry. Then put it in an electric heating blast drying oven at (60±2)℃ for 30 min. Take it out and put it in a dryer to cool to room temperature. Weigh the mass of each test piece (m_2).

6.6.3 Test results

The corrosion rate is calculated according to formula (2).

$$C=1\,000\times(m_1-m_2)/(t\times A) \qquad \cdots\cdots(2)$$

Where,

C - Corrosion rate, in milligrams per day per square decimeter [mg/(d·dm^2)];

m_1 - The mass of each test piece before immersion, in grams (g);

m_2 - The mass of each test piece after immersion, in grams (g);

A - The surface area of each test piece, in square decimeter (dm^2);

t - The time the test piece is placed in the electric hot air-drying oven, in days (d).

The average value of the test results of 4 steel sheets and 4 aluminum sheets is taken as the measurement result.

6.7 Acute toxicity to fish

6.7.1 Instruments, equipment and materials

The test instruments, equipment and materials shall meet the following requirements.

a) Balance: graduation value is 0.01 g.

b) Glass beaker: 1000 mL, 2000 mL.

c) Graduated cylinder: 50 mL.

d) Test animals: Zebrafish, with body length of (30±5) mm, weight of (0.3±0.1) g, selected from juvenile fish of the same size in the same acclimation pond. The fish shall be acclimated for at least two weeks at (20±2)℃ in continuously aerated water. The mortality rate of fish during acclimation shall not exceed 10%. Stop feeding 24 h before and during the test.

e) Laboratory Grade three water: meets the requirements of GB/T 6682.

f) Test dilution water: First prepare calcium chloride solution (dissolve 11.76 g of calcium chloride in Grade three water and dilute to 1 L), magnesium sulfate solution (dissolve 4.93 g of magnesium sulfate in Grade three water and dilute to 1 L), sodium bicarbonate solution (dissolve 2.59 g of sodium bicarbonate in Grade three water and dilute to 1 L), and potassium chloride solution (dissolve 0.23 g of potassium chloride in Grade three water and dilute to 1 L). Take 25 mL of each of the above 4 solutions and place them in a 1000 mL beaker. Dilute to 1000 mL with Grade three water and stir evenly. The pH of the newly prepared test dilution water is 7.8±0.2. The hardness is about 250 mg/L (calculated as calcium carbonate).

6.7.2 Test steps

The acute toxicity test for fish is carried out as follows:

a) Take two 2000 mL glass beakers. Clean them with clean water. Rinse them with test dilution water at least twice;

b) Add 2000 mL of test dilution water to one of the beakers. Then put 10 zebrafish in it;

c) Add 12 mL of sample (mixed solution) to another beaker. Dilute to 2000 mL with

of GB 5749. The feed shall meet the requirements of GB 14924.3.

6.9.2 Test steps

Eye irritation measurement is performed as follows.

a) Take 6 rats that meet the requirements of 6.9.1, half male and half female. Tilt the rat's head to the left, and let the right eye of the subject face diagonally upward. Gently lift the eyelids. Drop 0.1 mL of sample directly into the eye.

b) After dropping the sample, release the eyelids and let it open and close naturally. The left eye without the sample is used as a self-control.

c) Observe the opening and closing of the rat's right eye. The observation time is 60 min. Record the time when each rat's right eye is open.

6.9.3 Test results

The average opening time of the right eyes of the six rats is calculated as the eye irritation test result.

6.10 Permeability

6.10.1 Instruments, equipment and materials

The test instruments, equipment and materials shall meet the following requirements.

a) Steel cylindrical basket: 114 mm in diameter, 178 mm in height, with evenly spaced holes of 2 mm in diameter and 2 mm in spacing on the bottom.

b) Electronic balance: graduation value is 0.01 g.

c) Laboratory grade 3 water: in accordance with the requirements of GB/T 6682.

d) Steel plate: with a diameter larger than the steel cylindrical basket.

6.10.2 Test steps

To perform a permeability measurement, follow these steps:

a) Clean the steel plate and steel cylindrical basket. Place them in an electric hot air drying oven at (60±2)°C for 30 min. Take them out and place them in a dryer to cool to room temperature. Weigh the mass of the steel plate;

b) Weigh 50 g of un-degreased carded cotton. Compact and fill it to the bottom of the steel cylindrical basket;

c) Place the steel cylindrical basket on the steel plate;

d) Pour 500 g of laboratory Grade three water evenly on the cotton within 10 s. The poured Grade three water is collected on the steel plate through the cotton. Wait for 30 s and weigh the total mass of the steel plate and the collected Grade three water. Calculate the mass of Grade three water collected on the steel plate (m_3);

e) Replace 500 g of laboratory Grade three water with 500 g of sample (mixed solution) and follow steps a)~d). Calculate the mass of the sample collected on the steel plate (m_4).

6.10.3 Test results

The permeability is calculated according to formula (3).

$$T = m_3 - m_4 \qquad \cdots\cdots(3)$$

Where,

T - Permeability, in grams (g);

m_3 - The mass of laboratory Grade three water collected on the steel plate, in grams (g);

m_4 - The mass of the sample collected on the steel plate, in grams (g).

The average value of the two test results is taken as the measurement result.

6.11 Class A fire extinguishing performance

6.11.1 Instruments and equipment

The test instruments and equipment shall meet the following requirements.

a) Stopwatch: graduation value is 0.1 s.

b) Balance: graduation value is 1 g.

c) Graduated cylinder: graduation value is 10 mL.

d) Wood moisture meter: accuracy is ±1%.

e) Portable water based fire extinguisher: volume is (8±0.2) L, barrel height is (510±10) mm, barrel outer diameter is (150±5) mm, spray pipe inner diameter is (12±2) mm, spray pipe length is (420±5) mm, fire extinguishing agent filling volume is (6±0.2) L, and nitrogen filling pressure (gauge pressure) is (1.2±0.1) MPa. The nozzle structure is shown in Figure 1. If the 6 L portable water based fire extinguisher provided by the client is used, the effective spraying time and spraying distance shall comply with the provisions of GB 4351.

exceeding 25 t.

7.3 Type inspection

The type inspection items are all applicable items specified in 5.2, among which the fire extinguishing performance test shall use samples treated with temperature according to 6.1. Type inspection shall be carried out in any of the following cases:

a) When new products or old products are being tested for trial production or transfer to another factory;

b) When changes occur in the product design, key raw materials, production process, production conditions, etc. that may affect product quality;

c) When changes occur in the technical requirements specified in the product standards;

d) When production is resumed after a one-year or more suspension;

e) When the product quality supervision department requires type inspection;

f) Other situations where product quality can only be proven through type inspection.

7.4 Determination of test results

7.4.1 Determination of exit-factory inspection results

The exit-factory inspection results shall comply with the relevant technical requirements specified in 5.2. If any one of the requirements is not met, the product shall be deemed unqualified.

7.4.2 Determination of type inspection results

The type inspection results shall comply with all technical requirements specified in 5.2. If any one of the requirements is not met, the product shall be deemed unqualified.

8 Packaging, marking, transportation and storage

8.1 Packaging

The product shall be sealed in a plastic barrel or an iron barrel with an anti-corrosion treatment inside. The minimum packaging weight is 25 kg.

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