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Sodium Bicarbonate for Industrial Use

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Sodium Bicarbonate for Industrial Use

1 Scope

This Standard specifies the requirements, test methods, inspection rules, marking, labeling, packaging, transportation and storage of sodium bicarbonate for industrial use.

This Standard is applicable to sodium bicarbonate for industrial use. The product is mainly used in industries like cosmetics, daily chemicals, printing and dyeing, leather tanning, rubber and metal surface treatment, etc.

2 Normative References

The clauses of the following documents become clauses of this Standard through the normative references in this Standard. In terms of references with a specified date, all subsequent amendments (excluding errata content) or revisions do not apply to this Standard. However, the various parties that reach an agreement in accordance with this Standard are encouraged to explore whether the latest versions of these documents are applicable. In terms of references without a date, the latest versions apply to this Standard.

GB/T 191-2000 Packaging - Pictorial Marking for Handling of Goods (eqv ISO 780:1997)

GB/T 1250 Rules for Expression and Judgement of Limiting Values

GB/T 3049-2006 Chemical Products for Industrial Use - General Method for Determination of Iron Content - 1,10-Phenanthroline Spectrophotometric Method (ISO 6685:1982, IDT)

GB/T 3051-2000 Inorganic Chemical Products for Industrial Use - General Method for Determination of Chloride Content - Mercurimetric Method

GB/T 5009.74-2003 Method for Limit Test of Heavy Metals in Food Additives

GB/T 5009.76-2003 Determination of Arsenic in Food Additives

GB/T 6678 General Principles for Sampling Chemical Products

GB/T 6682-1992 Water for Analytical Laboratory Use - Specification and Test Methods (eqv ISO 3696:1987)

GB/T 9724-2007 Chemical Reagent - General Rule for the Determination of pH

HG/T 3696.1 Inorganic Chemicals for Industrial Use - Preparations of Standard Volumetric Solutions for Chemical Analysis

Sodium bicarbonate and sodium carbonate are strong alkali and weak acid salt. Hydrogen carbonate and carbonate are hydrolyzed in water to generate quantitative hydroxide. Use bromocresol green-methyl red as an indicator and use hydrochloric acid standard titration solution to perform titration; determine the total alkali content.

6.4.2 Reagents

6.4.2.1 Hydrochloric acid standard titration solution: c (HCl) ≈ 1 mol/L;

6.4.2.2 Bromocresol green-methyl red indicator solution.

6.4.3 Analytical procedures

Weigh-take about 2.5 g of specimen, accurate to 0.0002 g; place it in a 250 mL conical flask, and add 50 mL of water to dissolve it all. Dropwise add 10 drops of the bromocresol green-methyl red indicator solution; use the hydrochloric acid standard titration solution to titrate it, until the test solution turns from green to dark red, then, boil it for 2 min and cool to room temperature. Use the hydrochloric acid standard titration solution to continue to perform titration, until it turns dark red, which is the terminal point.

Meanwhile, conduct a blank test. The blank test shall be carried out in parallel with the determination, and the same analytical procedures shall be adopted; take the same amounts of all reagents (except the standard titration solution), but no specimen shall be added to the blank test.

6.4.4 Result calculation

The total alkali content, which is calculated as the mass fraction w_1 of sodium bicarbonate ($NaHCO_3$) and expressed in (%), shall be calculated in accordance with Formula (1):

$$w_1 = \frac{[(V - V_0)/1\,000]cM}{m} \times 100 \qquad \cdots\cdots\cdots\cdots (1)$$

Where,

V---the value of the volume of the hydrochloric acid standard titration solution consumed by the titration test solution, expressed in (mL);

V_0---the value of the volume of the hydrochloric acid standard titration solution consumed by the blank test, expressed in (mL);

c---the exact value of the concentration of the hydrochloric acid standard titration solution, expressed in (mol/L);

m---the value of the mass of the test portion, expressed in (g);

M---the value of the molar mass of sodium bicarbonate ($NaHCO_3$), expressed in (g/mol) (M = 84.01).

6.6 Determination of pH Value

6.6.1 Instrument

6.6.1.1 pH meter: with an accuracy of 0.02 pH unit.

6.6.2 Analytical procedures

Weigh-take 1.00 g ± 0.01 g of specimen and place it in a 150 mL beaker. Add about 100 mL of carbon dioxide-free water to dissolve the specimen. Within 10 min (starting from adding water), determine it in accordance with the stipulations of GB/T 9724-2007.

6.7 Determination of Chloride Content

6.7.1 Mercurimetric method (arbitration method)

6.7.1.1 Method summary

Same as Chapter 3 of GB/T 3051-2000.

6.7.1.2 Reagents

Same as Chapter 4 of GB/T 3051-2000.

6.7.1.3 Instruments and equipment

Same as Chapter 5 of GB/T 3051-2000.

6.7.1.4 Analytical procedures

Weigh-take about 2 g of specimen, accurate to 0.01 g. Place it in a conical flask and add 40 mL of water to dissolve it. Dropwise add 2 drops of bromophenol blue indicator solution; dropwise add nitric acid solution to neutralize it, until it turns yellow. Then, dropwise add sodium hydroxide solution, until it turns blue, then, use nitric acid solution to adjust it to just yellow, and drop 2 ~ 3 drops in excess. Add 1 mL of diphenyl azo carbazide indicator solution and use 0.02 mol/L mercury nitrate standard titration solution to titrate it, until the solution turns from yellow to purple, which is the terminal point.

Meanwhile, conduct a blank test. The blank test shall be carried out in parallel with the determination, and the same analytical procedures shall be adopted; take the same amounts of all reagents (except the standard titration solution), but no specimen shall be added to the blank test.

Save the waste solution after titration and handle it in accordance with the requirements of Appendix D in GB/T 3051-2000.

6.7.1.5 Result calculation

The chloride content, which is calculated as the mass fraction w_3 of chlorine (Cl) and expressed amount of water to dissolve it, then, transfer it all to a 100 mL volumetric flask. Use water to dilute to the scale and shake it well. Use a transfer pipette to transfer-take 25 mL of the above-mentioned test solution and place it in a 50 mL colorimetric tube; add 1 mL of 95% ethanol, 3 mL of nitric acid solution and 2 mL of silver nitrate solution; use water to dilute to the scale and gently shake it. After letting it stand still for 10 min, compare it with the standard turbidimetric solution under the black background, and the generated turbidity shall not be deeper than that of the standard turbidimetric solution.

The standard turbidimetric solution is to transfer-take the chloride standard solution in accordance with the following stipulations and handle it in the same way and at the same time as the test portion.

Category-I: 2.50 mL; Category-II: 5.00 mL; Category-III: 12.50 mL.

6.8 Determination of Iron Content

6.8.1 Method summary

Same as Chapter 3 of GB/T 3049-2006.

6.8.2 Reagents

6.8.2.1 Hydrochloric acid solution: 1 + 1;

6.8.2.2 The other reagents are the same as Chapter 4 of GB/T 3049-2006.

6.8.3 Instrument and equipment

6.8.3.1 Spectrophotometer: equipped with a 4 cm cuvette.

6.8.4 Analytical procedures

6.8.4.1 Drawing of working curve

In accordance with the stipulation of 6.3 in GB/T 3049-2006, use a 4 cm cuvette to draw a working curve with the iron content of 10 μg ~ 100 μg.

6.8.4.2 Determination

Weigh-take about 10 g of specimen, accurate to 0.01 g, and place it in a 250 mL beaker. Add 40 mL of water to dissolve it; dropwise add hydrochloric acid solution to neutralize it; heat it to boil. After cooling, transfer all to a 250 mL volumetric flask; use water to dilute to the scale and shake it well. Use a transfer pipette to transfer-take 50 mL of the test solution and place it in a 100 mL volumetric flask; use ammonia solution or hydrochloric acid solution to adjust the pH value of the test solution to 2 ~ 3 (use a precision pH test paper to check it). Follow the stipulations of 6.4 in GB/T 3049-2006 and start the operation from "if necessary, add water to 60 mL……". At the same time, handle the blank test solution in the same way. From the working curve, find out the corresponding iron mass.

Place the Gooch crucible on a suction filter bottle; respectively spread a layer of acid-pickling asbestos on the top and bottom of the sieve plate; while suctioning and filtering, use a flat-headed glass rod to press it; each layer is about 1 mm ~ 2 mm thick. Use hot water to wash it, until the filtrate does not contain asbestos wool. Move the crucible into an electric heating constant-temperature drying oven; at 110 °C ± 5 °C, dry it, then, weigh it. Repeat the washing and drying, until the mass is constant.

Weigh-take about 10 g of specimen, accurate to 0.01 g; place it in a beaker, add 200 mL of water to dissolve it, then, heat it to boil and maintain for 10 min. Use a Gooch crucible with a constant mass to filter it and use hot water to wash the water-insoluble matter, until the color presented after adding 2 drops of the phenolphthalein indicator solution to 20 mL of cleaning solution and 20 mL of water is consistent. Move the Gooch crucible, together with the water-insoluble matter, into the electric heating constant-temperature drying oven; at 110 °C ± 5 °C, dry it, until the mass is constant.

6.9.5 Asbestos filter paper method

Place the Gooch crucible on a suction filter bottle; spread a layer of asbestos filter paper under the sieve plate and spread two layers of asbestos filter paper on the sieve plate; while suctioning and filtering, use a flat-headed glass rod to press it; use hot water to wash the filter paper. Move the crucible into an electric heating constant-temperature drying oven; at 110 °C ± 5 °C, dry it, then, weigh it. Repeat the washing and drying, until the mass is constant.

Weigh-take about 10 g of specimen, accurate to 0.01 g; place it in a beaker, add 200 mL of water to dissolve it, then, heat it to boil and maintain for 10 min. Use a Gooch crucible with a constant mass to filter it and use hot water to wash the water-insoluble matter, until the color presented after adding 2 drops of the phenolphthalein indicator solution to 20 mL of cleaning solution and 20 mL of water is consistent. Move the Gooch crucible, together with the water-insoluble matter, into the electric heating constant-temperature drying oven; at 110 °C ± 5 °C, dry it, until the mass is constant.

6.9.6 Result calculation

The water-insoluble content, which is calculated as the mass fraction w_5 and expressed in (%), shall be calculated in accordance with Formula (5):

$$w_5 = \frac{m_1 - m_2}{m} \times 100 \qquad \cdots\cdots\cdots\cdots (5)$$

Where,

m_1---the value of the mass of the crucible and the water-insoluble matter, expressed in (g);

m_2---the value of the mass of the crucible, expressed in (g);

m---the value of the mass of the test portion, expressed in (g).

Take the arithmetic mean of the parallel determination results as the determination result. The absolute difference of two parallel determination results shall not be greater than 0.005%.

6.10 Determination of Sulfate Content

6.10.1 Method summary

In a slightly acidic medium, use barium chloride to precipitate sulfate ions; compare the turbidity with barium sulfate standard suspension.

6.10.2 Reagents

6.10.2.1 Hydrochloric acid solution: 1 + 2;

6.10.2.2 Barium chloride solution: 100 g/L;

6.10.2.3 Sulfate standard solution: 1 mL of solution contains 0.10 mg of sulfate (SO_4).

Transfer-take 10.00 mL of sulfate standard solution prepared in accordance with the requirements of HG/T 3696.2, place it in a 100 mL volumetric flask; use water to dilute to the scale and shake it well.

6.10.3 Instrument and equipment

6.10.3.1 Constant-temperature water bath: the temperature can be controlled at 40 °C ~ 50 °C.

6.10.4 Analytical procedures

6.10.4.1 Preparation of test solution A

Weigh-take 5.00 g ± 0.01 g of specimen and place it in a 100 mL beaker; add water to dissolve it, then, transfer it all to a 100 mL volumetric flask. Use water to dilute to the scale and shake it well. This solution is test solution A, which is used for the determination of sulfate content and calcium content.

6.10.4.2 Determination

Use a transfer pipette to transfer-take 10 mL of test solution A and place it in a 100 mL beaker. Add hydrochloric acid solution to neutralize it, until the pH value approaches 7 (use a pH test paper to check it) and add 5 drops in excess; boil it for 3 min ~ 5 min to drive off carbon dioxide and cool it down. Transfer it all to a 50 mL colorimetric tube and add 2 mL of barium chloride solution; add water to the scale and shake it well. Place it in a water bath at 40 °C ~ 50 °C; after 10 min, compare it, and the turbidity shall not be deeper than that of the standard turbidimetric solution.

The standard turbidimetric solution is to transfer-take the sulfate standard solution in accordance with the following stipulations and handle it in the same way and at the same time as the test portion.

Category-I: 1.00 mL; Category-II: 2.50 mL; Category-III: 25.00 mL.

6.11 Determination of Calcium Content

6.11.1 Method summary

In a slightly alkaline medium, use ammonium oxalate to precipitate calcium ions in the test portion; compare the turbidity with the calcium oxalate standard suspension.

6.11.2 Reagents

6.11.2.1 Glacial acetic acid solution: 1 + 19;

6.11.2.2 Ammonia solution: 1 + 1;

6.11.2.3 Ammonium chloride solution: 50 g/L;

6.11.2.4 Ammonium oxalate solution: 50 g/L;

6.11.2.5 Calcium standard solution: 1 mL of solution contains 0.10 mg of calcium (Ca).

Transfer-take 10.00 mL of the calcium standard solution prepared in accordance with the requirements of HG/T 3696.2, place it in a 100 mL volumetric flask; use water to dilute it to the scale and shake it well.

6.11.3 Analytical procedures

Use a transfer pipette to transfer-take 10 mL of test solution A (6.10.4.1) and place it in a 25 mL colorimetric tube. Use acetic acid solution to neutralize it to neutrality (use a pH test paper to check it); add 1 mL of ammonium chloride solution, 1 mL of ammonia solution and 1 mL of ammonium oxalate solution; shake it well. After 10 min, compare the turbidity, which shall not be deeper than that of the standard turbidimetric solution.

The standard turbidimetric solution is to transfer-take the calcium standard solution in accordance with the following stipulations and handle it in the same way and at the same time as the test portion.

Category-I and Category-II: 1.50 mL; Category-III: 2.50 mL.

6.12 Determination of Arsenic Content

6.12.1 Method summary

Same as Chapter 8 of GB/T 5009.76-2003.

6.12.2 Reagents

6.12.2.1 Hydrochloric acid solution: 1 + 3;

colorimetric solution.

Use a transfer pipette to transfer-take 1 mL of lead standard solution and place it in a 100 mL beaker. Start the operation from “add 8 mL of hydrochloric acid solution”. Handle it in the same way and at the same time as the test portion.

7 Inspection Rules

7.1 All the indicators specified in this Standard are exit-factory inspection items, which shall be inspected batch by batch.

7.2 The same category of sodium bicarbonate for industrial use produced by the production enterprise with the same materials and under basically the same production conditions continuously or in the same production team shall be considered as one batch. The output is one batch per day.

7.3 In accordance with the stipulations of GB/T 6678, determine the number of sampling units. During sampling, insert the sampler obliquely from the top of the packaging bag to 3/4 of the depth of the material layer to perform sampling. After evenly mixing the collected sample, adopt the quartering method to divide it into not less than 500 g; sub-pack it in two clean and dry wide-mouth bottles with stoppers or plastic bags, and seal them. Paste a label on the bottles or bags, and indicate: the name of the manufacturer, product name, category, batch No., sampling date and the name of the sampler. One is used as the laboratory sample, and the other is kept for future reference. The retention time is determined by the manufacturer in accordance with the actual demands.

7.4 The sodium bicarbonate for industrial use shall be inspected by the quality supervision and inspection department of the manufacturer in accordance with the stipulations of this Standard. The manufacturer shall ensure that each batch of exit-factory products comply with the requirements of this Standard.

7.5 The organization adopting the product has the right to conduct acceptance inspection on the received sodium bicarbonate for industrial use in accordance with the stipulations of this Standard. The acceptance inspection shall be carried out within one month from the date of arrival of the goods.

7.6 If one of the indicators in the inspection result does not comply with the requirements of this Standard, re-sampling shall be conducted from twice the size of packaging for a re-inspection. When one indicator in the re-inspection result does not comply with the requirements of this Standard, then, the entire batch of products shall be determined as disqualified.

7.7 Adopt the rounding-off value comparison method specified in GB/T 1250 to determine whether the inspection result complies with the Standard.

8 Marking and Labeling

8.1 On the packaging of the sodium bicarbonate for industrial use, there shall be a firm and clear mark, whose content includes: the name and address of the manufacturer, product name, category, net content, batch No. (or production date), shelf life, the serial No. of this Standard and the "AVOID EXPOSURE TO THE SUN" and "KEEP AWAY FROM RAINDROPS" signs specified in GB/T 191-2000.

8.2 Each batch of the exit-factory sodium bicarbonate for industrial use shall be accompanied by a quality certificate. The content includes: the name and address of the manufacturer, product name, category, net content, batch No. (or production date), shelf life, as well as a certificate of quality conformity to this Standard and serial No. of this Standard.

9 Packaging, Transportation and Storage

9.1 The sodium bicarbonate for industrial use shall adopt the following packaging modes.

9.1.1 Packaging with plastic woven bag: the inner packaging is made of polyethylene plastic film bag, and the inner bag is artificially tied with a vinylon rope or other ropes with an equivalent quality, or sealed in other equivalent modes; the outer packaging is made of plastic woven bag, and the outer bag is sewn with vinylon rope or other threads with an equivalent quality, the stitches are neat, the stitch length is uniform, and there are no leaks or skipped threads. Alternatively, align the openings of the inner and outer bags, fold the edges and sew them; use vinylon rope or other threads with an equivalent quality to sew the openings; the stitches are neat, the stitch length is uniform, and there are no leaks or skipped threads. The net content of each bag is 25 kg and 50 kg.

9.1.2 Packaging with laminated film bag: hem stitching, use vinylon rope or other threads with an equivalent quality to sew the openings; the stitches are neat, the stitch length is uniform, and there are no leaks or skipped threads. The net content of each bag is 25 kg and 50 kg.

9.1.3 In accordance with user requirements, negotiate and determine the packaging capacity and mode.

9.2 During transportation, the sodium bicarbonate for industrial use shall be covered, so as to prevent exposure to the sun, raindrops and moisture.

9.3 The sodium bicarbonate for industrial use shall be stored in a cool and dry place, and prevent exposure to the sun, raindrops and moisture.

9.4 On the premise of complying with the packaging, transportation and storage conditions of this Standard, the shelf life of the sodium bicarbonate for industrial use is 12 months from the date of production. If it passes the overdue inspection, it can still be used.

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