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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 320-2025

Replacing GB/T 320-2006

Synthetic hydrochloric acid for industrial use

工业用合成盐酸

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1 Scope

Warning. If suitable precautions are not taken, synthetic hydrochloric acid for industrial use may present hazards during production, transport, loading and unloading, storage and use. This document does not set out to advise on all the safety problems connected with synthetic hydrochloric acid for industrial use. Before using this document the user is responsible for establishing suitable safety and protective measures and for determining the applicability of the relevant regulatory limits.

This document specifies the technical requirements, the sampling, the test methods, the inspection rules, the marking, labelling and accompanying documents, and the packaging, transport and storage of synthetic hydrochloric acid for industrial use.

This document applies to the production, use and quality control of synthetic hydrochloric acid for industrial use, obtained by absorbing in water the hydrogen chloride gas synthesised from chlorine and hydrogen.

4 Technical requirements

Appearance. Synthetic hydrochloric acid for industrial use is a colourless or pale yellow transparent liquid.

The technical indicators of synthetic hydrochloric acid for industrial use shall meet the requirements of Table 1. Expressed as mass fraction in per cent, the total acidity calculated as HCl shall be not less than 31.0; the iron calculated as Fe not more than 0.002; the ignition residue not more than 0.10; the free chlorine calculated as Cl not more than 0.008; and the sulfate, calculated as the sulfate ion, not more than 0.035.

5 Sampling

Batching. The product is inspected by batch. For the producer, a batch is the synthetic hydrochloric acid produced in one finished-product tank or in one production cycle. For the user, a batch is the acid of one and the same lot received at one time.

Sampling requirements. When sampling from a tank car or a storage tank, equal representative portions shall be taken in accordance with GB/T 6680 from three points inside the tank car or tank, at the top, in the middle and at the bottom. The producer may also mix the acid in the tank car or tank and take a representative sample at the sampling point, or take a representative sample automatically or by hand on the finished-product pipeline during steady continuous production. Where the supplier and the purchaser dispute the quality of the product, the representative samples taken in accordance with GB/T 6680 from the top, the middle and the bottom of the tank car or tank shall prevail.

When sampling from plastic drums or ceramic jars, random sampling shall be carried out on the number of sampling units specified in GB/T 6678, and equal representative portions shall be taken in accordance with GB/T 6680 from the top, the middle and the bottom inside the drum or jar.

The portions taken shall be mixed and divided into two clean, dry plastic or glass bottles, which are then sealed. One portion is used for testing and the other is retained for check testing; each portion shall be not less than 500 mL.

Sample label. The sample bottles shall carry a label stating the name of the producer, the name of the product, the batch number or the date of production, the quantity of sample and the date of sampling.

6 Test methods

General. Unless otherwise stated, the reagents and the water used in this document are analytical grade reagents and grade three water as specified in GB/T 6682, or water of equivalent purity. The standard volumetric solutions, the standard solutions used for the determination of impurities and the preparations and products used in the test methods are all prepared in accordance with GB/T 601, GB/T 602 and GB/T 603.

Appearance is examined visually in daylight.

Total acidity calculated as HCl, method A, chemical titration, which is the referee method. The sample solution is titrated with standard sodium hydroxide solution using bromocresol green as indicator until the solution turns from yellow to blue, which is the end point; the reaction is that of a hydrogen ion with a hydroxide ion to give water. The reagents are standard sodium hydroxide titration solution at a concentration of 1 mol/L and bromocresol green indicator at 1 g/L. The apparatus is a burette of 50 mL nominal capacity with a smallest scale division of 0.1 mL, and a 100 mL conical flask with a ground stopper. To

prepare the sample solution, 3 mL of sample is measured into a conical flask containing 15 mL of water that has already been weighed to 0.0001 g, then mixed and weighed again to 0.0001 g. For the determination, two to three drops of bromocresol green indicator are added and the solution is titrated with the standard sodium hydroxide solution until it turns from yellow to blue.

The total acidity calculated as HCl, expressed as a mass fraction in per cent, is obtained from the volume of standard sodium hydroxide solution consumed in millilitres, the concentration of that solution in moles per litre, the molar mass of hydrogen chloride, which is 36.461 g/mol, and the mass of the test portion in grams. The absolute difference between two parallel determinations shall not be greater than 0.2 %, and the arithmetic mean of the two is reported as the result.

Total acidity, method B, potentiometric titration. An indicator electrode and a reference electrode are immersed in the solution under test; as titrant is added continuously the potential of the indicator electrode changes continuously, and around the stoichiometric point a small change in the concentration of the substance being determined causes an abrupt change in that potential, the break point being the end point of the titration. The reagent is standard sodium hydroxide titration solution at 1 mol/L. The apparatus is an automatic potentiometric titrator with a combined glass electrode, or a glass electrode together with a saturated calomel electrode. For the sample solution, 1 mL of sample is measured into a 100 mL beaker containing 50 mL of water already weighed to 0.0001 g, then mixed and weighed again to 0.0001 g. The titration is carried out following the manual of the instrument, the electrode following the change of potential during the titration and the titrator giving the end point volume automatically. The calculation of the result and the permitted difference are the same as for method A.

Iron calculated as Fe, method A, spectrophotometry. Hydroxylamine hydrochloride reduces the ferric iron in the test portion to ferrous iron, which in a buffer system at pH about 4.5 reacts with 1,10-phenanthroline to form an orange-red complex whose absorbance is measured with a spectrophotometer. The reagents are hydrochloric acid solution 1 plus 10; ammonia solution 1 plus 1; hydroxylamine hydrochloride solution at 100 g/L, made by dissolving 10.0 g of hydroxylamine hydrochloride in water and diluting to 100 mL; acetic acid and sodium acetate buffer solution at pH about 4.5; an iron standard solution at 0.1 mg/mL; a working iron standard solution at 2 micrograms per millilitre, made before use by transferring 1 mL of the stock solution with a one-mark pipette into a 50 mL volumetric flask and diluting to the mark; and 1,10-phenanthroline solution at 2 g/L, which is kept in the dark and used only while it is colourless.

For the working curve, 0.0 mL, 1.0 mL, 2.0 mL, 4.0 mL, 8.0 mL and 10.0 mL of the working iron standard solution are placed in six 50 mL volumetric flasks with a graduated pipette; 10 mL of hydrochloric acid solution and 10 mL of water are added to each, the pH is adjusted to 2 to 3 with ammonia solution, then 1 mL of hydroxylamine hydrochloride solution, 5 mL of

buffer solution and 2 mL of 1,10-phenanthroline solution are added, the flasks are diluted to the mark, shaken and left to stand for 15 min. The absorbance is measured in a 5 cm cell at a wavelength of 510 nm, the zero of the spectrophotometer being set with the blank solution. The curve is drawn with the mass of iron in the 50 mL flask, in micrograms, on the horizontal axis and the corresponding absorbance on the vertical axis, or a linear regression equation is established.

For the sample solution, 8.6 mL of sample is measured, weighed to 0.01 g and placed in a 100 mL volumetric flask containing 50 mL of water, diluted to the mark with water and shaken. The blank solution is prepared without sample solution, with 10 mL of hydrochloric acid solution, using exactly the same steps and the same quantities of reagents. For the determination, 10 mL of the sample solution is transferred with a one-mark pipette into a 50 mL volumetric flask, 10 mL of water is added, the pH is adjusted to 2 to 3 with ammonia solution, then 1 mL of hydroxylamine hydrochloride solution, 5 mL of buffer solution and 2 mL of 1,10-phenanthroline solution are added, the flask is diluted to the mark, shaken and left to stand for 15 min, and the absorbance is measured in a 5 cm cell at 510 nm against the blank. The result is calculated from the mass of iron in the 10 mL of sample solution read from the working curve, in micrograms, and the mass of the test portion in grams. The absolute difference between two parallel determinations shall not be greater than 0.0005 %.

Iron, method B, inductively coupled plasma emission spectrometry, which is the referee method. The intensity of the iron spectral line in the treated solution is measured with an inductively coupled plasma emission spectrometer and quantified by the standard addition method. The water used in this method is grade two water as specified in GB/T 6682 or water of equivalent purity; the standards are an iron stock solution at 0.1 mg/mL and a working solution at 5 micrograms per millilitre made by diluting a suitable quantity of the stock twenty times before use. For the sample solution, 50 mL plus or minus 2 mL of sample is measured, weighed to 0.01 g and placed in a 100 mL volumetric flask to which 30 mL of water has already been added, diluted to the mark with water and shaken. Into each of four 50 mL volumetric flasks are added, with a graduated pipette, 0.0 mL, 1.0 mL, 2.0 mL and 4.0 mL of the working iron standard solution, then 20 mL of the sample solution with a one-mark pipette, and each flask is diluted to the mark and shaken. The best wavelength is chosen according to the performance of the instrument, 259.940 nm being recommended. Where the iron mass concentration measured by the instrument is greater than 0.4 micrograms per millilitre, the amount of sample or the volume of sample solution added shall be reduced and the determination repeated. The absolute difference between two parallel determinations shall not be greater than 0.0002 %.

Ignition residue. A weighed test portion is evaporated, treated with sulfuric acid so that the salts are converted into sulfates, ignited at 800 degrees Celsius plus or minus 50 degrees Celsius and weighed. The reagent is sulfuric acid; the apparatus is a high-temperature furnace, or equivalent, controllable at that temperature, a sand bath crucible or equivalent, and a 100 mL porcelain crucible. The porcelain crucible is placed in the furnace and ignited