NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB 1886.350-2021

National food safety standard - Food additive - Nitrous oxide

食品安全国家标准 食品添加剂 氧化亚氮

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1 Scope

The standard applies to the food additive nitrous oxide obtained from ammonium nitrate as raw material by thermal decomposition.

2 Chemical name, molecular formula, structural formula and relative molecular mass

2.1 Chemical name: nitrous oxide (dinitrogen monoxide).

2.2 Molecular formula: N2O.

2.3 Structural formula: printed as a linear nitrogen-nitrogen-oxygen chain; the bond symbols were flattened by the extractor and the bond orders are not reported.

2.4 Relative molecular mass: 44.01, on the 2018 international relative atomic masses.

3 Technical requirements

3.1 Sensory requirements, Table 1. Colour: colourless. State: gaseous, liquid under high pressure. Test method: connect a transparent colourless hose to the pressure-reducing outlet of the cylinder, open and close the valve briefly, and observe the colour and state in the line in daylight.

3.2 Physico-chemical indexes, Table 2, each with its test method. Nitrous oxide content, volume fraction, not less than 99.0 %, by A.3 of Annex A. Moisture not more than 0.15 µL/L, by GB/T 5832.1 or GB/T 5832.2. Carbon monoxide not more than 10.0 µL/L, by GB/T 8984 or A.4. Carbon dioxide not more than 300.0 µL/L, by GB/T 8984 or A.4. Oxygen, volume fraction, not more than 0.2 %, by A.4 or A.5. Nitrogen, volume fraction, not more than 0.8 %, by A.4 or A.5. Halogens, as chlorine, not more than 1.0 µL/L, by A.6. Ammonia not more than 25.0 µL/L, by A.7. Nitric oxide not more than 1.0 µL/L, by A.8. Nitrogen dioxide not more than 1.0 µL/L, by A.8. The unit of the moisture row was later altered by Amendment sheet No. 1.

A Annex A Test methods

Warning: some of the operations laid down in the test methods may give rise to hazardous situations. The operator is to take suitable safety and protective measures. Provision is to be made during the tests for treating the nitrous oxide off-gas.

A.1 General. Where no other requirement is stated, the reagents used are analytical grade and the water is grade three water as laid down in GB/T 6682. Where no solvent is stated, the solutions used are aqueous.

A.2 Identification test. Principle: nitrous oxide makes a glowing splint burst into flame, while it does not turn an alkaline pyrogallol solution brown when passed into it. Reagents and materials: wooden splints; pyrogallol (1,2,3-trihydroxybenzene); potassium hydroxide; alkaline pyrogallol solution, prepared by dissolving 0.5 g of pyrogallol in 2 mL of water and mixing to give solution A, and dissolving 12 g of potassium hydroxide in 8 mL of water and mixing to give solution B, a saturated potassium hydroxide solution; A and B are mixed immediately before use and the preparation is carried out in a vacuum glove box. Apparatus: vacuum glove box. Procedure: connect the sample gas to a gas pressure-reducing valve, open the valve, pass the gas into a clean reagent bottle, close the sampling valve, cover the bottle quickly with a watch glass and put a glowing splint into the bottle of nitrous oxide, where it is to burn; and, in the vacuum glove box, pass the product into the alkaline pyrogallol solution, where no brown colour is to appear. Where both conditions are met the identification test is passed.

A.3 Determination of the nitrous oxide content. Principle: the nitrous oxide content is the total gas less the content of impurities such as carbon monoxide. Calculation: the nitrous oxide content phi, as a volume fraction expressed in %, is calculated by formula (A.1). The symbols are phi 1, the moisture content in microlitres per litre (μL/L); phi 2, carbon monoxide in μL/L; phi 3, carbon dioxide in μL/L; phi 4, nitrogen in %; phi 5, oxygen in %; phi 6, halogens in μL/L; phi 7, ammonia in μL/L; phi 8, nitric oxide in μL/L; phi 9, nitrogen dioxide in μL/L; together with two conversion factors, 100 and 10 to the power minus 4. The result is kept to 3 significant figures. The printed equation came out of the extractor with its exponents flattened and is not reproduced here.

A.4 Determination of carbon monoxide, carbon dioxide, nitrogen and oxygen. Principle: gas chromatography is used; the carrier gas takes the test sample into the column and, after separation, into a helium discharge ionization detector. Reagents and materials: high purity helium as chromatographic carrier gas; standard sample made up in helium of purity greater than 99.9999 % as balance gas, the target components being carbon monoxide, carbon dioxide, oxygen and nitrogen at contents close to those in the sample. Apparatus: gas chromatograph fitted with a helium discharge ionization detector. Reference chromatographic conditions: column about 1.5 m long, stainless steel tube of 4 mm internal diameter packed with 5A molecular sieve of 0.25 mm to 0.4 mm particle size, or another

equivalent column; carrier gas helium of purity above 99.999 % at a flow rate of 10 mL/min; detector temperature 45 °C; oven temperature 50 °C; purge gas flow rate 10 mL/min; supply voltage 500 V to 650 V; purifying gas helium of purity above 99.999 % at 300 °C to 400 °C. Procedure: start the instrument according to its operating manual and set the parameters until it works normally; for calibration, connect the standard sample to the instrument through the sampling line, purge the sampling system with the sample until a representative sample is drawn, switch the sampling valve to inject, measure the instrument response as peak area or peak height, and repeat the injection at least twice until the relative deviation of the responses is below 5 %, taking their mean As; carry out the measurement under conditions identical to the calibration, connecting the sample gas through the sampling line and obtaining the mean response Ai in the same way. Calculation: the content phi i of carbon monoxide, carbon dioxide, oxygen or nitrogen, in microlitres per litre (μL/L), is calculated by formula (A.2), where phi s is the content of component i in the standard sample in μL/L, Ai is the mean response of component i in the sample as peak area or peak height, As is the mean response of component i in the standard sample, and i is carbon monoxide, carbon dioxide, oxygen or nitrogen. The result is kept to 3 significant figures.

A.5 Determination of nitrogen and oxygen. Principle: gas chromatography is used; the carrier gas takes the sample into the column and, after separation, into a thermal conductivity detector, quantification being by the external standard method. Reagents and materials: high purity helium as carrier gas, of purity greater than 99.999 %; standard sample made up in helium of purity greater than 99.9999 % as balance gas, containing 0.2 % oxygen and 0.8 % nitrogen by volume fraction. Apparatus: gas chromatograph fitted with a thermal conductivity detector. Reference chromatographic conditions: column about 1.5 m long, stainless steel tube of 2 mm internal diameter packed with 13X molecular sieve of 0.25 mm to 0.4 mm particle size, or another equivalent column; carrier gas helium above 99.999 % at 10 mL/min; detector temperature 160 °C; oven temperature 30 °C; make-up gas flow rate 5.0 mL/min. Procedure: as for A.4, with calibration and measurement each repeated at least twice until the relative deviation of the responses is below 5 %, taking the means As and Ai. Calculation: the content phi i of oxygen or nitrogen is calculated by formula (A.3), where phi s is the content of component i in the standard sample in %, Ai is the mean response of component i in the sample, As is the mean response of component i in the standard sample, and i is oxygen or nitrogen. The result is kept to 3 significant figures.

A.6 Determination of halogens. Principle: when a given quantity of gas passes through the detector tube, the gas under test diffuses and is adsorbed on the surface of the indicating powder, where it reacts chemically with the colour-forming reagent and changes the colour of the powder; the length of the coloured column varies with the concentration of the gas. Materials: halogen (chlorine) detector tube with a measuring range in volume fraction of 0.5 parts per million to 8 parts per million, or another suitable range. Procedure: start timing

when the nitrous oxide is injected into the detector tube; control the sample volume and sample flow rate and read the colour change according to the instructions for the tube; obtain the halogen content from the length of the colour change.

A.7 Determination of ammonia. Principle: as for A.6. Materials: ammonia detector tube with a measuring range in volume fraction of 1 part per million to 30 parts per million, or another suitable range. Procedure: as for A.6, the ammonia content being obtained from the length of the colour change.

A.8 Determination of nitric oxide and nitrogen dioxide. A.8.1 Detector tube method. Principle: as for A.6. Apparatus: nitrogen oxides detector tube with a measuring range in volume fraction of 0.2 parts per million to 5 parts per million, or another suitable range. Procedure: as for A.6, the total nitrogen oxides content being obtained from the length of the colour change. A.8.2 Chemiluminescence method. Principle: chemiluminescence is used to determine the nitric oxide and nitrogen dioxide in the nitrous oxide. Apparatus: nitrogen oxides analyser. Conditions: zero gas of high purity nitrogen whose nitric oxide and nitrogen dioxide volume fraction is below 0.01 part per million; oxygen fed to the ozone generator whose nitric oxide and nitrogen dioxide volume fraction is below 0.01 part per million; gas standard sample with a component content of 1 part per million by volume fraction and nitrogen as balance gas. Procedure: pass in the zero gas and set the instrument to zero with the zero adjustment; pass in the gas standard sample and adjust with the span control until the output reading agrees with the concentration of the standard; repeat the steps until the reproducibility of the reading is better than 1 part in 100 of full scale; then pass in the test sample and read the nitric oxide and nitrogen dioxide contents.

AM1 Amendment sheet No. 1

Amendment sheet No. 1 to GB 1886.350-2021 National food safety standard - Food additive - Nitrous oxide was approved by the National Health Commission and the State Administration for Market Regulation in Announcement No. 2 of 16 March 2025 and takes effect from the date of approval.

The amendment: in Table 2 the unit of the moisture row is changed from μL/L to mL/L.