NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB 1903.72-2025

Replacing GB 22557-2008

National food safety standard - Food nutritional fortifier - Sodium iron ethylenediaminetetraacetate

食品安全国家标准 食品营养强化剂 乙二胺四乙酸铁钠

Issued on: March 16, 2025 **Implemented on: September 16, 2025**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

Table of Contents

1 Scope

1 The document applies to the food nutritional fortifier sodium iron ethylenediaminetetraacetate obtained by reacting an inorganic iron salt with a sodium salt of ethylenediaminetetraacetic acid.

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

2.1 The chemical name is sodium iron ethylenediaminetetraacetate.

2.2 The molecular formula is C10H12FeN2NaO8 with three molecules of water of crystallisation.

2.3 The structural formula is given as a figure, which the extracted text does not carry.

2.4 The relative molecular mass is 421.09, based on the 2022 international relative atomic masses.

3 Technical requirements

3.1 The sensory requirements are set in Table 1. The product is a pale yellow to yellowish brown powder or crystalline powder and is free of off-odour. The test method is to place a suitable quantity of the sample in a clean dry white porcelain dish, observe its colour and physical state in natural light and smell it.

3.2 The physico-chemical requirements are set in Table 2, which fixes for each characteristic a limit and the test method to be used. Iron, expressed as Fe, is to be 12.5% to 13.5% by mass and ethylenediaminetetraacetic acid, calculated as C10H16N2O8, 65.5% to 70.5% by mass, both determined by the annex. Moisture is not to exceed 13.5% by mass, determined by the fourth method of GB 5009.3 on a 0.1 g test portion. Free iron, expressed as Fe3 plus, is not to exceed 0.05% by mass, and nitrilotriacetic acid not to exceed 0.1% by mass, both by the annex. The pH of a 10 g/L aqueous solution is to be 3.5

to 5.5, measured according to GB/T 9724. Water-insoluble matter is not to exceed 0.1% by mass, determined according to GB/T 9738 on a 5 g test portion dissolved in 100 mL of water. Chloride, expressed as Cl, and sulfate, expressed as SO4, are each not to exceed 0.06% by mass, by the annex. Lead is not to exceed 1.0 mg/kg, determined according to GB 5009.12 or GB 5009.75, and total arsenic, expressed as As, not to exceed 1.0 mg/kg, determined according to GB 5009.11 or GB 5009.76.

A Annex A (normative) Test methods

A.1 A safety notice states that some of the reagents used in the test methods are toxic or corrosive and that suitable safety and health measures are to be taken. Splashes on the skin are to be washed off at once with water and serious cases treated immediately, and open flames are not to be used for heating when flammable materials are handled.

A.2 Unless otherwise specified the reagents are of analytical grade, the standard volumetric solutions, standard solutions for the determination of impurities, preparations and products are prepared according to GB/T 601, GB/T 602 and GB/T 603, and the water complies with the requirements for grade three water in GB/T 6682. Where no solvent is stated, the solutions referred to are aqueous.

A.3 Identification is by two tests. In the colour reaction, 0.05 g of sample is dissolved in 5 mL of water, ammonium thiocyanate solution is added and the colour of the solution is not to change; hydrochloric acid solution is then added and mixed, and the solution is to turn deep red. In the ultraviolet absorption test a sample solution of 20 micrograms per millilitre is scanned over the range 190 nm to 700 nm and is to show its absorption maximum at 256 nm plus or minus 2 nm.

A.4 Iron is determined iodometrically. Under strongly acid conditions the Fe3 plus released reacts quantitatively with excess potassium iodide to liberate iodine, which is titrated with sodium thiosulfate standard volumetric solution of 0.1 mol/L. About 0.5 g of sample, weighed to the nearest 0.0001 g, is dissolved in 40 mL of water in an iodine flask, 3 g of potassium iodide and 20 mL of hydrochloric acid are added, the stoppered flask is left in the dark for about 5 min, and the titration is taken to a pale yellow, starch indicator solution is added and the titration continued until the blue colour disappears. A blank is titrated alongside. The mass fraction of iron is calculated by formula (A.1), whose terms are the titration volumes for the sample and the blank, the concentration of the thiosulfate solution, the molar mass of iron taken as 55.85 g/mol, the sample mass and a conversion factor of 1000. The mean of two parallel determinations is reported, and under repeatability conditions the absolute difference between them is not to exceed 2% of their arithmetic mean.

A.5 Ethylenediaminetetraacetic acid is determined by complexometric titration. After Fe3 plus has been masked with triethanolamine, calcium ion titrates the sodium iron ethylenediaminetetraacetate in alkaline solution at pH 12.5 to 13.0, forming a stable

complex with the ethylenediaminetetraacetic acid present; the excess calcium then combines with the hydroxynaphthol blue indicator and the end point is wine red. A calcium acetate monohydrate standard volumetric solution of 0.25 mol/L is first standardised against reference grade ethylenediaminetetraacetic acid at pH 11.0 to 12.0, the solution turning from blue to red at the end point; its concentration is calculated by formula (A.2), whose terms are the mass of the ethylenediaminetetraacetic acid, the titration volume, its molar mass taken as 292.24 g/mol and a conversion factor of 1000. For the determination, 0.8 g to 1.0 g of sample is dissolved in 75 mL of distilled water, brought to pH 9.0 with triethanolamine to mask the Fe3 plus and then to pH 12.5 to 13.0 with sodium hydroxide solution, at which point the solution becomes colourless and clear, and titrated after adding 30 mg of the indicator; a blank is titrated alongside. The mass fraction is calculated by formula (A.3) from the two titration volumes, the concentration and molar mass of the calcium acetate solution, the sample mass and the conversion factor. Under repeatability conditions the absolute difference between two parallel determinations is not to exceed 2% of their arithmetic mean.

A.6 Free iron is determined as a limit test. The unchelated Fe3 plus in the sample reacts with sodium catechol-3,5-disulfonate and the absorbance is measured at 670 nm. A 0.2 g sample is dissolved and made up to 20 mL, and three tubes A, B and C are prepared according to Table A.1, which fixes the volumes added to each: 5 mL of sample solution to tubes A and B and none to C; no water to A, 1 mL to B and 4 mL to C; iron standard solution only to C, 1 mL; and 1 mL of colour reagent to A and to C and none to B. The absorbance of tube A is measured against tube B, and that of tube C against water. If the absorbance of tube A is not greater than that of tube C, the free iron content of the sample does not exceed 0.05%.

A.7 Nitrilotriacetic acid is determined by high performance liquid chromatography with ultraviolet detection. The nitrilotriacetic acid in the sample is dissolved and made up with copper nitrate solution under alkaline conditions, separated on the column and detected, and the limit is established by means of a spiked sample solution. The reference chromatographic conditions are a C8 guard column of 4.6 mm by 10 mm and 5 micrometre particle size; a mobile phase prepared from tetrabutylammonium hydroxide methanol solution adjusted to pH 7.5 plus or minus 0.1 with phosphoric acid and made up with methanol and water, filtered through a 0.45 micrometre membrane and degassed; a C18 column of 4.6 mm by 150 mm and 5 micrometre particle size or an equivalent; a detection wavelength of 244 nm; an injection volume of 20 microlitres; and a flow rate of 2.0 mL/min. The standard solution is measured three times and the relative standard deviation of the three results is not to exceed 2.0%. If the response of the nitrilotriacetic acid peak in the sample solution does not exceed the difference between the responses obtained for the standard solution and the sample solution, the nitrilotriacetic acid content of the sample is not more than 0.1%. The detection limit of the method is 20 mg/kg.

A.8 Chloride, expressed as Cl, is determined by potentiometric titration. In acid medium,

with a silver electrode as the measuring electrode and a calomel electrode as reference, the sample is titrated with silver nitrate standard volumetric solution of 0.1 mol/L and the end point is found from the potential jump. A 5 g test portion is dissolved in water, one drop of bromophenol blue indicator is added, the colour is adjusted to yellow with sodium hydroxide or nitric acid solution and the solution is made up to 100 mL to give solution A; 20 mL of solution A is titrated, and a blank is titrated alongside. The mass fraction is calculated by formula (A.4) from the two titration volumes, the concentration of the silver nitrate solution, the sample mass, the factor 0.03545 g of chloride corresponding to 1.00 mL of the silver nitrate solution and the dilution factor 5.

A.9 Sulfate, expressed as SO4, is determined as a turbidimetric limit test. In acid medium the sulfate in the sample forms a barium sulfate precipitate, and the turbidity is compared with that of a sulfate standard solution treated in the same way. A 1.8 g test portion is dissolved in 30 mL of water, sodium hydroxide solution is added, the mixture is stirred for 15 min, made up to 50 mL and filtered; 20 mL of the filtrate is taken, treated with the indicator solution, titrated with hydrochloric acid solution until the yellow colour disappears, brought to pH 2.0 after the addition of zinc chloride solution, made up to 50 mL and mixed with 5.0 mL of solution A. The comparison solution is prepared in the same way from 20 mL of water with the addition of sulfate standard solution. The turbidity is observed axially against a black background, and if the turbidity of the sample solution is not deeper than that of the comparison solution, the sulfate content is not greater than 0.06%.

B Annex B (normative) Reference chromatogram of nitrilotriacetic acid

B The annex carries the reference chromatogram of nitrilotriacetic acid as Figure B.1.