NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB 1903.78-2025

National food safety standard - Food nutrition fortifier - Cupric citrate

食品安全国家标准 食品营养强化剂 柠檬酸铜

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1 Scope

GB 1903.78-2025 is a mandatory national food safety standard for copper citrate as a nutritional fortifier. Copper is an essential trace element - required for iron metabolism, connective tissue and the nervous system - and the margin between deficiency and toxicity is narrower than for most nutrients, which is why the form in which it is added matters as much as the amount. Copper citrate is chosen for bioavailability and for being less reactive in a food matrix than inorganic copper salts, which can catalyse the oxidation of fats and vitamins and spoil the product it was added to improve. Because it is added deliberately to food and because copper is toxic in excess, the standard is compulsory and is essentially a purity specification: what the substance is, how it must be made, what it must assay at, and what contaminants - other heavy metals above all - may be present alongside it. This standard applies to copper citrate as a food nutrition fortifier, prepared by reacting copper carbonate, copper oxide and citric acid, or copper sulfate and sodium citrate, in defined proportions. It is written for fortifier manufacturers, food and formula producers, and food safety regulators.

This standard applies to copper citrate, a food nutrition fortifier, prepared by reacting and processing copper carbonate, copper oxide, and citric acid, or copper sulfate and sodium citrate, in a certain proportion.

2 Chemical name, molecular formula, structural formula, and

relative molecular mass

2.3 Structural formula

2.4 Relative molecular mass 360.22 (based on the international relative atomic mass in 2022).

3 Technical requirements

3.1 Sensory requirements Sensory requirements shall comply with the provisions of Table 1.

Appendix A

Test methods A.1 Safety tips Some reagents used in this standard's testing methods are corrosive; handle with extreme caution! If splashed onto skin, immediately rinse with water; for severe cases, seek immediate medical attention. When using highly toxic substances, strictly adhere to relevant regulations; avoid inhalation or skin contact; if necessary, conduct the procedure in a fume hood. Personnel with open wounds shall not handle this substance. A.2 General provisions Unless otherwise specified, the reagents and water used in the test methods of this standard refer to analytical grade reagents and Grade III water as specified in GB/T 6682.Unless otherwise specified, the standard solutions, impurity standard solutions, preparations, and products used in the tests shall be prepared in accordance with the provisions of GB/T 601, GB/T 602, and GB/T 603.In the test, the solutions used, unless the solvent for preparation is specified, all refer to aqueous solutions. A.3 Identification test A.3.1 Reagents and materials A.3.1.1 Hydrochloric acid. A.3.1.2 Hydrochloric acid solution. 1+4(V1+V2). Measure 10 mL of hydrochloric acid and slowly add it to 40 mL of water, then mix well. A.3.1.3 Ammonia solution (10%). The preparation method is as per GB/T 603. A.3.1.4 Iron sheet. shiny and rust-free. A.3.1.5 Pyridine-acetic anhydride solution. 3+1(V1+V2). A.3.1.6 Potassium ferrocyanide (

0.10 g/mL). Weigh

1.0 g of potassium ferrocyanide and dissolve it in 10 mL of water. Prepare the solution fresh when using it. A.3.2 Instruments and equipment Infrared spectrometer. A.3.3 Identification method A.3.3.1 Identification of copper ions Take about 1 g of the sample, dissolve it in 20 mL of water, and add a small amount of hydrochloric acid to acidify the sample solution. Place a shiny, rust-free iron sheet into the acidified sample solution, and a reddish copper film will form on the surface of the iron sheet. Take about 1 g of the sample, dissolve it in 20 mL of water, and add excess ammonia solution; first, a blue precipitate is formed, and then it turns into a dark blue solution. Take about 1 g of the sample, dissolve it in 20 mL of water, and add potassium ferrocyanide solution; a reddish-brown precipitate is formed, and the precipitate is insoluble in hydrochloric acid solution. A.3.3.2 Identification of citrate ions Weigh 5 mg of the sample into 5 mL of pyridine-acetic anhydride solution, shake, and a yellow to red or purplish-red solution will be formed. A.3.3.3 Identification by infrared absorption spectroscopy The test shall be conducted using the potassium bromide pellet technique in accordance with GB/T 6040.The infrared spectrum of the sample shall be consistent with the reference spectrum (see Appendix B for the reference spectrum). NOTE. The CAS number for copper citrate referred to in this standard is 866-82-0. A.4

Determination of copper citrate content A.4.1 Method summary Under slightly acidic conditions, excess potassium iodide is added to the sample to react quantitatively with divalent copper. The precipitated iodine is titrated with a standard sodium thiosulfate titration solution, and starch is used as an indicator to determine the endpoint by the color change. A.4.2 Reagents and materials A.4.2.1 Glacial acetic acid. A.4.2.2 Potassium iodide. A.4.2.3 Sodium thiosulfate standard titration solution [c(Na2S2O3)=

0.1 mol/L, subject to actual concentration]. A.4.2.4 Ammonium thiocyanate solution (100 g/L). A.4.2.5 Starch indicator solution (10 g/L). A.4.3 Analysis steps Weigh

0.1 g~

0.2 g (accurate to 0.0001