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National Food Safety Standard - Food Nutritional Fortification Substance - Ferrous Fumarate

食品安全国家标准

食品营养强化剂 富马酸亚铁

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1 Scope

This Standard is applicable to food nutritional fortification substance - ferrous fumarate, which is obtained through chemical synthesis and refining with fumaric acid and ferrous sulfate as the main raw materials.

2 Chemical Name, Molecular Formula, Structural Formula and Relative Molecular Mass

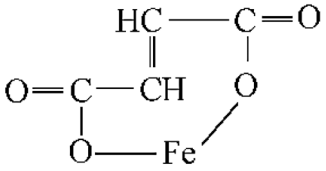
2.1 Chemical Name

(E)-2-ferrous butenedioate

2.2 Molecular Formula

$C_4H_2FeO_4$

2.3 Structural Formula



2.4 Relative Molecular Mass

169.90 (in accordance with the international relative atomic mass of Year 2018)

3 Technical Requirements

3.1 Sensory Requirements

The sensory requirements shall comply with the stipulations of Table 1.

Table 1 -- Sensory Requirements

A.2.2.2.2 Weigh-take about 1.5 g of the sample; add 25 mL of 6 mol/L hydrochloric acid solution; use water to dilute to 50 mL. Heat it up, until it completely dissolves, then, cool it down. Use G3 fine-pored sintered-glass filter crucible to filter it; use 2 + 100 hydrochloric acid solution to wash the precipitate; collect the filtrate. Take the above-mentioned filtrate; add 1 mol/L sodium hydroxide solution to generate green-white precipitate. While shaking it, the color quickly changes to green, and then, to brown.

A.2.2.2.3 Take 1 drop of the sample filtrate in A.2.2.2.2 on a spotting template; add 1 drop of potassium ferricyanide solution. Immediately, blue precipitate is generated.

A.2.2.2.4 Adopt the potassium bromide pellet technique; in accordance with the stipulations of GB/T 6040, conduct the test. The infrared absorption spectrum of the sample shall be consistent with the infrared absorption spectrum of the reference substance (see Figure B.1).

A.3 Determination of Ferrous Fumarate ($C_4H_2FeO_4$) Content (calculated as dry basis)

A.3.1 Method summary

In the acidic medium, use cerium sulfate standard solution for titration; use 1,10-phenanthroline-ferrous indicator to indicate the end point.

A.3.2 Reagents and materials

A.3.2.1 Sulfuric acid solution: $c\left(\frac{1}{2}\ H_2SO_4\right)=2\ mol/L$. Measure-take 55.4 mL of sulfuric acid; slowly pour it into 800 mL of water. Cool it down, then, use water to dilute to 1 L; shake it well.

A.3.2.2 Cerium sulfate standard titration solution: c [Ce $(SO_4)_2$] = 0.1 mol/L.

A.3.2.3 1,10-phenanthroline-ferrous indicator: weigh-take 1.485 g of 1,10-phenanthroline; add 0.965 g of anhydrous ferrous sulfate; dissolve it in 100 mL of water; shake it well. The solution shall be stored in a closed container.

A.3.3 Analytical procedures

Weigh-take about 0.5 g (accurate to 0.0001 g) of the sample; place it in a 250 mL conical flask. Add 25 mL of sulfuric acid solution; heat it up to dissolve it, then, let it cool down. Add 25 mL of water and mix it well; add a few drops of 1,10-phenanthroline-ferrous indicator. Use cerium sulfate standard titration solution to titrate it, until the color changes from red to light blue. Meanwhile, conduct a blank test.

A.3.4 Result calculation

The mass fraction w_1 of ferrous fumarate ($C_4H_2FeO_4$, calculated as dry basis) shall be

Weigh-take about 2 g of the sample (accurate to 0.0001 g), place it in an iodine flask. Add 40 mL of water and 4 mL of hydrochloric acid; heat it up, boil it and dissolve it. After it cools down, add 60 mL of water and 3 g of potassium iodide; use water to seal the stopper; shake to dissolve it. Place it in the dark for about 5 min. Then, extract the stopper and use a small amount of water to rinse the stopper cover. Use sodium thiosulfate standard titration solution for titration; when it becomes light yellow, add 1 mL of starch indicator solution. Then, continue the titration, until the blue color disappears, which is the end point. Meanwhile, conduct a blank test.

A.4.4 Result calculation

The mass fraction w_3 of trivalent iron (calculated as Fe^{3+}) shall be calculated in accordance with Formula (A.2):

$$w_3 = \frac{c \times (V - V_0) \times M}{m \times 1\,000} \times 100\% \qquad \cdots\cdots (A.2)$$

Where,

c---the concentration of the sodium thiosulfate standard titration solution, expressed in (mol/L);

V---the volume of the sodium thiosulfate standard titration solution consumed by the titration of the sample solution, expressed in (mL);

V_0---the volume of the sodium thiosulfate standard titration solution consumed by the blank test, expressed in (mL);

M---the molar mass of iron, expressed in (g/mol), [*M* (Fe) = 55.85];

m---the mass of the sample, expressed in (g);

1,000---conversion factor.

The test result shall be subject to the arithmetic mean value of parallel determination results. The absolute difference between two independent determination results obtained under repeatability conditions shall not exceed 10% of the arithmetic mean value.

A.5 Determination of Sulfate (calculated as SO_4)

A.5.1 Method summary

In the acidic medium, the sulfate ion in the sample reacts with barium ion to generate barium sulfate precipitate, which is compared with the sulfate radical standard solution treated by the same method for a limit test.

A.5.2 Reagents and materials

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