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National Food Safety Standard – Determination of Hydrogen Peroxide Residual Quantity in Foods

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National Food Safety Standard – Determination of Hydrogen Peroxide Residual Quantity in Foods

1 Scope

This Standard specifies methods of determining hydrogen peroxide residual quantity in foods.

This Standard is applicable to the determination of hydrogen peroxide residual quantity in foods, such as prepackaged milk, beverage, soy product, waterish logged product and chicken feet, etc.

Method I -- Iodometric Method

2 Principle

Strong oxide in foods oxidizes potassium iodide in diluted sulfuric acid and generates quantitative iodine. In the generated iodine, starch is taken as the indicator; sodium thiosulfate standard solution is titrated to obtain the total quantity of strong oxide. Add catalase decomposition to remove hydrogen peroxide in the sample; sodium thiosulfate standard solution is titrated to remove the content of other oxides other than hydrogen peroxide. The difference of the result of two titrations can be adopted to obtain the content of hydrogen peroxide in the sample.

3 Reagents and Materials

Unless otherwise indicated, the reagents adopted under this method are of analytical purity. The water is third-grade water as specified in GB/T 6682.

3.1 Reagents

3.1.1 Sodium thiosulfate ($Na_2S_2O_3$).

3.1.2 Soluble starch [$(C_6H_{10}O_5)_n$].

3.1.3 Potassium iodide (KI).

3.1.4 Sulfuric acid (H_2SO_4).

3.1.5 Ammonium molybdate [$(NH_4)_6Mo_7O_{24}{\cdot}4H_2O$].

3.1.6 Catalase (unit vitality>200,000 U/mL): store under -20 °C.

4 Instruments and Equipment

4.1 Electronic balance: division value: 0.01 g.

4.2 High-speed grinder.

5 Analytical Procedures

5.1 Preparation of Samples

5.1.1 Solid sample

Weigh-take 10 g (accurate to 0.01 g) of edible part from grinded and homogenized sample, add an appropriate amount of water to dissolve it, then, transfer it into 100 mL volumetric flask. 5 mL of zinc acetate solution and 5 mL of potassium ferrocyanide solution can be added to samples with relatively high content of protein and fat; add water to dilute to the constant volume (V_1), shake it up. Soak it for 30 min, use filter paper to filter it. Reserve the filtrate as sample solution for later usage.

5.1.2 Liquid sample

Weigh-take 25 g (accurate to 0.01 g) of sample and place it in 100 mL volumetric flask. 5 mL of zinc acetate solution and 5 mL of potassium ferrocyanide solution can be added to samples with relatively high content of protein and fat; add water to dilute to the constant volume (V_1), shake it up. Use filter paper to filter it. Reserve the filtrate as sample solution for later usage. If any color shows up in the sample filtrate, add 1 g of activated carbon, shake it for 1 min; use dry filter paper to filter it, remove the primary filtrate and reserve the filtrate for later usage.

5.2 Determination

Respectively take 25.0 mL (V_2) of the filtrate and place it in two 250 mL iodine volumetric flasks (A and B); add 0.5 mL of 0.1% catalase solution to volumetric flask A, put on the lid and mix it up; place it evenly for 10 min (shake it for several times during this period). Respectively add 5.0 mL of 10% sulfuric acid solution and 5.0 mL of potassium iodide to volumetric flask A and B, and 3 drops of 3% ammonium molybdate solution. Mix it up, place it in the dark for 10 min. Respectively add 50 mL of water, and adopt sodium thiosulfate standard solution to titrate it, till it turns yellowish. Add 0.5 mL of starch indicator and continue the titration, till blue vanishes. Respectively record the volume of sodium thiosulfate standard solution consumed in volumetric flask A and B.

6 Expression of Analysis Results

The content of hydrogen peroxide in the sample shall be calculated in accordance with

10.3.1 Potassium permanganate standard solution [c($\frac{1}{5}$KMnO$_4$)=0.100 mol/L]: prepare and calibrate in accordance with the method stipulated in GB/T 601.

10.3.2 Hydrogen peroxide standard stock solution: take 1 mL of 30% hydrogen peroxide solution and place it in 100 mL volumetric flask; add water to the constant volume, mix it up.

Take 20.00 mL of hydrogen peroxide standard stock solution and place it in 250 mL conical flask; add 25 mL of 10% sulfuric acid solution (3.2.3); adopt potassium permanganate standard solution [c($\frac{1}{5}$KMnO$_4$)=0.100 mol/L] to titrate it till it turns reddish.

The concentration of hydrogen peroxide standard stock solution shall be calculated in accordance with Formula (2):

$$X = \frac{17.01 \times c \times V}{20.00} \qquad \cdots\cdots(2)$$

Where:

X - The concentration of hydrogen peroxide standard stock solution, expressed in (mg/mL);

17.01 - The mass of hydrogen peroxide equivalent with potassium permanganate standard solution [c($\frac{1}{5}$KMnO$_4$)=0.100 mol/L] per mL, expressed in (mg);

c - The concentration of potassium permanganate standard solution [c($\frac{1}{5}$KMnO$_4$)=0.100 mol/L], expressed in (mol/L);

V - The volume of potassium permanganate standard solution [c($\frac{1}{5}$KMnO$_4$)=0.100 mol/L] for titration, expressed in (mL).

10.3.3 Hydrogen peroxide standard working solution: dilute hydrogen peroxide standard stock solution to 20 μg/mL in accordance with the calibration result in 10.3.2.

11 Instruments and Equipment

11.1 Electronic balance: division value: 0.01 g.

11.2 High-speed grinder.

11.3 Spectrophotometer: equipped with 5 cm colorimetric ware.

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