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Maltose

麦芽糖

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Table of Contents

Foreword 3

1 Scope 5

2 Normative references 5

3 Product classification 5

4 Requirements 6

5 Test methods 7

6 Inspection rules 15

7 Marking, packaging, transportation and storage 17

Maltose

1 Scope

This Standard specifies the classification, requirements, test methods, inspection rules, marking, packaging, transportation and storage of maltose products.

This Standard applies to the production, inspection and sales of maltose products which are made through liquefaction, saccharification and refining by using starch or starchiness as raw material.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies to this document. For undated references, the latest edition (including any amendment) applies to this document.

GB/T 191, Packaging - Pictorial marking for handling of goods

GB/T 601, Chemical reagent - Preparations of reference titration solutions

GB/T 602, Chemical reagent - Preparations of standard solutions for impurity

GB/T 603, Chemical reagent - Preparations of reagent solutions for use in test methods

GB5009.3-2016, National Food Safety Standard - Determination of Moisture Content in Foods

GB/T 6682, Water for analytical laboratory use - Specification and test methods

GB 7718, National Food Safety Standard - Standard for nutrition labeling of prepackaged foods

GB 15203, Food safety national standard - Starch sugar

3 Product classification

3.1 According to the product form, it is divided into maltose syrup, maltose powder and crystallized maltose.

Products for food processing shall comply with the provisions of GB 15203.

5 Test methods

5.1 General provisions

The water used in this method shall meet the specifications for water in GB/T 6682 unless other requirements are specified; the reagents used shall be analytical reagents (AR) when no other specifications are specified. The standard titration solution, the standard solutions, preparations and products for impurity determination, which are used in the analysis, shall be all prepared in accordance with the provisions of GB/T 601, GB/T 602, and GB/T 603, when no other requirements are specified.

5.2 Sensory

5.2.1 State, color

Take an appropriate amount of sample; under natural light, observe the state and color of the sample, to see whether there is any impurity; make a record.

5.2.2 Odor, taste

5.2.2.1 Maltose syrup

Use boiled distilled water to prepare 100 mL of 4% (dry matter) maltose solution; smell it; rinse the mouth with water, and taste the solution.

5.2.2.2 Maltose powder, crystallized maltose

Take 20 g of the sample; put it in a 100 mL ground bottle; add 50 mL of water at 50 °C; cover it; shake it for 30 s; pour out the supernatant; smell it. After rinsing the mouth with water, take a small amount of sample and put it into the mouth; taste it carefully.

5.3 Maltose content

5.3.1 Method principle

The components entering the chromatographic column at the same time, due to the different effects such as distribution between the mobile phase and the stationary phase, size exclusion or coordination exchange, move at different speeds in the chromatographic column; they are separated from each other after passing through the chromatographic column of a certain length, and enter the detector in a certain order to generate response signals. The signals are collected by computer software and the data is processed, to obtain the chromatogram and the retention values and peak areas or peak heights of the components contained in the sample. According to the retention time, perform qualitative determination; according to the peak area or peak height, perform quantitative calculation of the content of each component.

5.3.2 Reagents and solutions

5.3.2.1 Water: Grade-I water in accordance with GB/T 6682.

5.3.2.2 Acetonitrile: chromatographic pure.

5.3.2.3 Maltose series standard solutions: Accurately weigh (accurate to 0.000 1 g, on a dry basis) an appropriate amount of standard maltose, and prepare 5 standard solutions of different concentrations within the range of 0.1 mg/mL ~ 10 mg/mL.

5.3.3 Instruments and apparatuses

5.3.3.1 High performance liquid chromatography (equipped with differential refraction detector and column constant temperature system).

5.3.3.2 Mobile phase vacuum filtration degassing device and 0.45 μm microporous membrane.

5.3.3.3 Analytical balance: accuracy 0.1mg.

5.3.3.4 Micro-injector: 20 μL.

5.3.4 Reference chromatographic conditions

5.3.4.1 Amino-bonded column chromatography conditions are as follows:

a) Chromatographic column: Waters SpHerisor 5 μm NH_2, ϕ4.6 mm × 250 mm, or a chromatographic column of equivalent analytical effect;

b) Mobile phase: acetonitrile:water = 75:25;

c) Detector temperature: 40 ℃;

d) Column temperature: 45 ℃;

e) Flow velocity: 1.0 mL/min;

f) Injection volume: 20 μL;

5.3.4.2 The calcium-type cation exchange resin column chromatographic conditions are as follows:

a) Chromatographic column: SCR101C, ϕ7.8 mm × 300 mm, or a chromatographic column of equivalent analytical effect;

b) Mobile phase: ultrapure water;

c) Detector temperature: 40 °C;

d) Column temperature: 75 °C;

The absolute difference between two independent determination results which are obtained under repeatability conditions shall not exceed 1% of the arithmetic mean.

5.4 Dry matter (solid matter)

5.4.1 Instruments and apparatuses

5.4.1.1 Abbe refractometer: accuracy 0.000 1 units.

5.4.1.2 Glass rod: bent and flattened at end.

5.4.2 Instrument calibration

At 20 °C, the refractive index of the refractometer corrected with grade-II water is 1.333 0, which is equivalent to zero dry matter (solid matter). The instrument shall be calibrated at least once a day.

5.4.3 Analysis steps

Place the refractometer in a well-lit position; adjust the temperature of the prisms of the refractometer to 20 °C; separate the two prisms; use a glass rod to add a small amount of sample (1 drop ~ 2 drops) on the surface of the fixed prisms (the glass rod must not touch the surface of the prisms, and the coating time shall be less than 2 s); immediately close the prisms and stay for a few minutes, so that the sample reaches the temperature of the prisms. Adjust the spiral of the prism until the field of view is divided into two parts: light and shade; turn the compensator turn-knob to eliminate the iridescence and make the dividing line between light and shade clear; continue to adjust the spiral so that the dividing line between light and shade is aligned with the cross line; read the content from the ruler; reread it again immediately; take the average value as a measurement value. Clean and dry the two prisms. The same sample shall be subjected to the second measurement as described above. Take the arithmetic mean of the two determinations and report the result.

5.4.4 Precision

The absolute difference between two independent determination results which are obtained under repeatability conditions shall not exceed 1% of the arithmetic mean.

5.5 Moisture

Measure according to Method II “Vacuum drying method” in GB 5009.3-2016.

5.6 pH

5.6.1 Instruments and apparatuses

Acidity meter: accuracy 0.01 pH, with glass electrode and calomel electrode (or composite electrode).

5.6.2 Analysis steps

Adjust and calibrate the pH meter according to the instrument instruction manual.

Weigh an appropriate amount of sample; use the boiled-and-cooled (carbon dioxide-removed) water of pH 5.0 ~ 7.0 to prepare a maltose test solution with a dry matter of 30%. Then, use water to rinse the electrode probe; use a filter paper to dry it gently; insert the electrode into the sample solution to be tested; adjust the temperature regulator so that the indicated temperature of the instrument is the same as the solution temperature; read after it is stable. Express the result obtained to one decimal place.

5.6.3 Precision

The absolute difference between two independent determination results which are obtained under repeatability conditions shall not exceed 3% of the arithmetic mean.

5.7 Light transmittance

5.7.1 Instruments and apparatuses

Spectrophotometry.

5.7.2 Analysis steps

According to the instrument manual, adjust the positions of “0” and “100%” of the instrument at a wavelength of 440 nm.

Weigh an appropriate amount of sample; use the freshly-boiled-and-cooled (carbon dioxide-removed) water of pH 5.0 ~ 7.0 to prepare a 30% maltose test solution. Then, inject the to-be-tested solution into a 1 cm cuvette; use a spectrophotometer, at a wavelength of 440 nm, to measure the light transmittance of the sample solution, with the same batch of water as a reference. Express the result obtained to one decimal place.

5.7.3 Precision

The absolute difference between two independent determination results which are obtained under repeatability conditions shall not exceed 1% of the arithmetic mean.

5.8 Sugaring-off temperature

5.8.1 Reagents and solutions

The preparation steps of Stanmer 5° stock solution are as follows:

a) No. I solution: Weigh 20 g of nickel sulfate ($NiSO_4 \cdot 7H_2O$); add 11 g of ammonium sulfate [$(NH_4)_2SO_4$]; use water to dissolve and dilute to 500 mL.

b) No. II solution: Weigh 20 g of cobalt chloride ($CoCl_2 \cdot 6H_2O$); add 11 g of ammonium sulfate; use water to dissolve and dilute to 200 mL.

5.9.3 Analysis steps

5.9.3.1 Preparation of sample solution

Weigh 1.0 g of the sample; add water to dissolve, and dilute to 10 mL.

5.9.3.2 Preparation of control solution

Draw 10.0 mL of chloride standard working solution; add 10 mL of dilute nitric acid and 1 mL of silver nitrate solution; add water to 25 mL. Shake well and place in the dark for 5 min.

5.9.3.3 Determination

Take 10.0 mL of the sample solution; add 10 mL of dilute nitric acid and 1 mL of silver nitrate solution; add water to 25 mL. Shake well and place in the dark for 5 min. Place it on the same black background as the control solution; observe and compare from the top of the colorimetric tube downwards.

5.9.3.4 Result determination

If the turbidity of the sample solution is not deeper than that of the control solution, the chloride content of the sample is ≤0.01%.

5.10 Sulfated ash

5.10.1 Reagents and solutions

5.10.1.1 Hydrochloric acid

5.10.1.2 Concentrated sulfuric acid.

5.10.2 Instruments and apparatuses

5.10.2.1 Crucible: 50 mL.

5.10.2.2 High temperature furnace: temperature control range (525 ± 25) °C.

5.10.2.3 Desiccator: silica gel as desiccant.

5.10.2.4 Analytical balance: accuracy 0.1 mg.

5.10.3 Analysis steps

First, use hydrochloric acid to heat and boil the crucible; then, use running water to wash it; then, use distilled water to clean it. Place the cleaned crucible in a high temperature furnace; burn at 525 °C ± 25 °C for 0.5 h; take it out and cool it at room temperature to 200 °C or below; put it in a desiccator and cool it to room temperature;

accurately weigh it; repeat the burning to constant weight (the difference between the two weighing before and after does not exceed 0.3 mg).

Weigh about 2 g of the sample (accurate to 0.000 1 g); put it into a crucible that has been ignited to constant weight; add 1 mL of concentrated sulfuric acid dropwise; turn it slowly to make it uniform; place it on an electric furnace to carefully heat it until it is completely carbonized. Then, put it into the high temperature furnace and burn at 525 °C ± 25 °C; keep this temperature until all the carbonization disappears (at least 2 h). Take it out and cool it; add a few drops of concentrated sulfuric acid to wet the residue; put it back into the high-temperature furnace and burn it until it is completely ashed; take it out and cool it to below 200 °C at room temperature; put it in a desiccator; cool it to room temperature; weigh it accurately; repeat burning until constant weight (the difference between the two weighing before and after does not exceed 0.3 mg).

5.10.4 Result calculation

The sulfated ash content of the sample is calculated according to Formula (2), and the value is expressed in %.

$$X_1 = \frac{m_1 - m_0}{m_2 - m_0} \times 100 \qquad \cdots\cdots(2)$$

Where:

X_1 – sulphated ash of the sample, %;

m_1 – mass of the crucible and the ash, in grams (g);

m_0 – mass of the crucible, in grams (g);

m_2 – mass of the crucible and the sample, in grams (g).

Express the result obtained to two decimal places.

5.10.5 Precision

The absolute difference between two independent determination results which are obtained under repeatability conditions shall not exceed 5% of the arithmetic mean.

5.11 Iodine test

5.11.1 Reagents and solutions

5.11.1.1 Iodine standard solution [$c(\frac{1}{2}I_2)$ = 0.1 mol/L].

5.11.1.2 Iodine standard working solution: Draw 20 mL of iodine standard solution and use water to dilute to 100 mL.

Where:

A – the number of packaging units that shall be draw-out, in bags;

N – the total number of packaging units in the batch, in bags.

Round the calculation result to an integer.

6.2.2.3 For the sampling of uniform samples, use a clean and dry sampling tool to take equal samples from each bag. The total amount of samples shall be no less than 1 kg. Quickly mix the taken samples; then, evenly divide them into two clean and dry containers; seal them, and indicate the product name, batch number, sampling time, and the name of the sampler. One is for testing and the other is sealed and kept for future reference.

6.3 Exit-factory inspection

6.3.1 Before the products leave the factory, the quality inspection department of the manufacturer shall be responsible for inspecting them batch by batch according to the provisions of this Standard. Only after passing the inspection can the products leave the factory.

6.3.2 The exit-factory inspection items are as follows:

a) Maltose syrup: sensory, dry matter (solid matter), maltose content, pH.

b) Maltose powder: sensory, maltose content, moisture, pH.

c) Crystallized maltose: sensory, maltose content, moisture, pH, chloride.

6.4 Type inspection

The inspection items are all the items specified in the requirements of this Standard. Generally, the type inspection is carried out once every six months. In any of the following cases, the type inspection shall also be carried out:

a) When there are major changes in raw and auxiliary materials;

b) When there are changes on critical processes or equipment;

c) When the production of a new trial product or a normal production product, which has been stopped for 3 months, is resumed;

d) When the exit-factory inspection is significantly different from the previous type inspection result;

e) When the national quality supervision and inspection institution carries out a spot inspection according to relevant regulations.

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