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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 20882.4-2021

Quality requirements for starch sugars - Part 4: High fructose syrup

淀粉糖质量要求 第4部分：果葡糖浆

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Table of Contents

1 Scope

China's national quality requirements for high fructose syrup. It is Part 4 of GB/T 20882 and specifies the quality requirements for high fructose syrup, together with the classification, the test methods, the inspection rules and the labelling, packaging, transport and storage. High fructose syrup is made from starch, not from sugar cane or beet: the starch is liquefied and saccharified enzymatically to glucose, and part of that glucose is then converted to fructose by glucose isomerase. Because fructose is far sweeter than glucose, the isomerisation is what makes the product a viable sugar replacement, and the fructose percentage is what defines the grade - the ordinary commercial types running at around 42 and 55 per cent fructose, with higher grades made by chromatographic enrichment. Those grades are not interchangeable: a soft drink formulated on one and made with another tastes different and costs differently, and the difference cannot be seen or easily tasted in the syrup itself. So the fructose content, the glucose content and the total dry substance are the central requirements of the document, with the sensory characteristics, the colour, the pH, the ash, the transmittance and the microbiological limits around them. Storage matters more for this product than for crystalline sugar and is specified accordingly, because a high fructose syrup is a concentrated aqueous solution: too cold and it crystallises out of solution, too warm or too long and it darkens and develops off-flavours through the Maillard reaction with the traces of nitrogen it carries. Issued on 31 December 2021 and in force since 1 July 2022.

This document specifies the quality requirements for high fructose syrup, including terms and definitions, product classification, requirements, test methods, inspection rules, labeling, packaging, transportation, and storage. This document is applicable to the production, inspection, and sale of high fructose syrup.

2 Normative references

The following documents contain the provisions which, through normative reference in this document, constitute the essential provisions of this document. For the dated referenced documents, only the versions with the indicated dates are applicable to this document; for the undated referenced documents, only the latest version (including all the amendments) is applicable 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

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

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 high fructose syrup fructose syrup Starch sugar products whose main components are fructose and glucose that are made The water used in this method shall meet the water specifications in GB/T6682 unless other requirements are specified, and the reagents used shall be analytical reagents unless other specifications are specified. The standard titration solution used in the analysis, the standard solution for the determination of impurities, preparations, and products, unless otherwise specified, shall be prepared in accordance with the provisions of GB/T 601, GB/T 602, and GB/T 603.

Note: Liquid products with crystals can be detected after heating and dissolving in an appropriate way.

6.2 Sensory requirements Take an appropriate amount of sample, observe the state and color of the sample under natural light, smell the odor, add pure water at room temperature to prepare a solution with 10% ~ 15% dry matter, and taste it.

6.3 Fructose and glucose content (calculated as dry matter)

6.3.1 Principle The components entering the chromatographic column at the same time, due to the different effects of distribution, size exclusion, or ligand exchange between the mobile phase and the stationary phase, move at different speeds in the chromatographic column. After flowing past a certain length of the chromatographic column, they are separated from each other, and enter the detector in a certain order to generate response signals; the signals are collected by computer software and processed, and then the chromatogram and the retention value and peak area or peak height of the components contained in the sample are obtained. According to the retention time, the qualitative analysis is carried out by the control method; according to the peak area, the content of each component is calculated quantitatively.

6.3.2 Reagents and solutions

6.3.2.1 Water: Grade I water in GB/T 6682.

6.3.2.2 Glucose standard (CAS No.: 492-62-6, purity >= 98%).

6.3.2.3 Fructose standard (CAS No.: 7660-25-5, purity >= 98%).

6.3.2.4 Serial standard solutions of glucose and fructose: Use each sugar standard to prepare 5 series of standard solutions with different concentrations in the range of

0.5 mg/mL~

6.3.3 Instruments and equipment

6.3.3.1 High-performance liquid chromatography: it shall be equipped with a differential refraction detector and a column constant temperature system.

6.3.3.2 Mobile phase vacuum filtration degassing device and 0.2 μm or 0.45 μm microporous membrane.

6.3.3.3 Electronic balance: The sense quantity shall be 0.0001 g.

6.3.3.4 Micro sampling syringe.

6.3.4 Reference chromatographic conditions

6.3.4.1 Chromatographic column: a cation exchange resin column (with a column length of 300 mm, an inner diameter of

7.8 mm, and a filler particle size of 5 μm or 9 μm), or a chromatographic column with an equivalent analytical effect.

6.3.4.2 Mobile phase: water.

6.3.4.3 Detector temperature: 45 °C.

6.3.4.4 Column temperature: 85 °C.

6.3.4.5 Flow rate:

0.5 mL/min.

6.3.4.6 Injection volume: 10 μL.

6.3.5.1 Preparation of the sample solution Weigh

0.5 g of the sample (calculated as dry matter; the content of various sugar components shall be within the range of the standard solution series, otherwise the sampling amount can be added or reduced appropriately), and the weight shall be accurate to 0.0001 g; dissolve it in water, transfer it to a 50 mL volumetric flask, and dilute it to the mark with water; shake well, filter it with 0.2 μm or 0.45 μm aqueous microporous membrane, and leave the filtrate for later use.

6.3.5.2 Drawing of the standard curve After the series of standard solutions of glucose and fructose are injected respectively, draw the standard curve according to the concentration of the series of standard solutions versus the peak area. The linear correlation coefficient shall be above 0.9990.

6.3.5.3 Determination of samples Inject the prepared sample solution. Qualitatively analyze the chromatographic peaks of various sugar components in the sample according to the retention time of the standard. According to the peak area of the sample, calculate the