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Invert Sugar

Invert Sugar Syrup

CAS RN®: 8013-17-0.

DEFINITION

Invert Sugar is an aqueous solution of inverted or partly inverted, refined or partly refined sucrose containing dextrose (glucose), fructose, and sucrose. It is produced by the hydrolysis or partial hydrolysis of sucrose with suitable acids or enzymes. Total Invert Sugar contains NLT 90.0% of dextrose and fructose, and medium Invert Sugar contains NLT 45.0% and NMT 55.0% of dextrose and fructose, both calculated on the total solids basis.

IDENTIFICATION

• A.

Mobile phase: Acetonitrile and water (80:20, v/v)

Standard solution: 10 mg/mL each of [USP Fructose RS](#), [USP Dextrose RS](#), and [USP Sucrose RS](#)

Sample solution: 50 mg/mL of Invert Sugar

Chromatographic system

(See [Chromatography \(621\)](#), [System Suitability](#).)

Mode: LC

Detector: Refractive index

Column: 4.6-mm × 15-cm; 5-μm packing L8

Temperatures

Column: 45°

Detector: 40°

Flow rate: 2.0 mL/min

Injection volume: 15 μL

Analysis

Samples: *Standard solution* and *Sample solution*

[NOTE—The relative retention times for fructose, dextrose, and sucrose are about 0.5, 0.6, and 1.0, respectively.]

Compare the retention times for fructose, dextrose, and sucrose given in the two chromatograms.

Acceptance criteria: The retention times of the fructose, dextrose, and sucrose peaks of the *Sample solution* correspond to those of the *Standard solution*.

ASSAY

• PROCEDURE

Apparatus: Mount a ring support on a ring stand 1–2 in above a gas burner and mount a second ring 6–7 in above the first. Place a 6-in open-wire gauze on the lower ring to support a 400-mL conical flask, and place a 4-in watch glass with a center hole on the upper ring to deflect heat. Attach a 50-mL buret to the ring stand so that the tip just passes through the watch glass centered above the flask. Place an indirectly lighted white surface behind the assembly for observing the endpoint.

Sample solution: 2.5–4.0 mg/mL of Invert Sugar

Analysis: Conduct a preliminary test to ascertain the volume of water to be added to the 20.0 mL of standardized cupric tartrate, alkaline, solution VS to obtain a final total volume of 75.0 mL when the endpoint of the titration is reached. The invert sugar content of the *Sample solution* should be between 250 and 400 mg per 100.0 mL so that a titer between 25 and 40 mL is needed to achieve the endpoint. Calculate the amount of water to be added to the cupric tartrate, alkaline, solution VS as the difference:

Result = 75.0 – (20.0 mL of cupric tartrate, alkaline, solution VS + number of mL of preliminary titration)

Transfer 20.0 mL of cupric tartrate, alkaline, solution VS to a 400-mL flask containing a few glass beads or boiling chips. Rapidly add the *Sample solution* to within 0.5 mL of the endpoint, and mix by swirling at ambient temperature. Immediately place the flask on the wire gauze of the *Apparatus*, and adjust the burner flame so that the boiling point of the solution is reached in about 2 min. Boil gently but steadily for 2 min. As boiling continues, add 3–4 drops of methylene blue solution (1 in 100). Complete the titration within 1 min by adding the *Sample solution* dropwise until the blue color disappears. Allow a 5-s reaction time between drops at the end of titration. Calculate the percentage of invert sugar in the sample taken:

$$P_1 = [W/(C_s \times V_s)] \times 100$$

W = amount of invert sugar equivalent to 20.0 mL of cupric tartrate, alkaline, solution VS, 100 mg

C_s = concentration of the *Sample solution* (mg/mL)

V_s = volume of the *Sample solution* used in the titration (mL)

Calculate the percentage of invert sugar on the total solids basis:

$$P_2 = (P_1/D) \times 100$$

D = percentage of total solids corrected for the percentage of invert sugar and temperature as obtained in *Total Solids*

Acceptance criteria

Total Invert Sugar: NLT 90.0% of dextrose and fructose on the total solids basis

Medium Invert Sugar: 45.0%–55.0% of dextrose and fructose on the total solids basis

IMPURITIES

• [RESIDUE ON IGNITION \(281\)](#)

Analysis: Weigh a portion of Invert Sugar in a platinum dish. Heat gently until the sample ignites, then allow the sample to burn until it self-extinguishes. Cool, then wet the residue with 2 mL of concentrated sulfuric acid, and heat the sample over a low flame until dry. Ignite to constant weight in a muffle furnace at $800 \pm 25^\circ$ for 30 min, or longer if necessary for complete ignition; cool in a desiccator; and weigh.

Acceptance criteria: NMT 0.2%

SPECIFIC TESTS

• [pH \(791\)](#): 3.0–5.5

• **TOTAL SOLIDS**

Instrumental conditions

(See [Refractive Index \(831\)](#).)

Mode: Refractometer, operating at 589 nm, equipped with a jacket for water circulation or some other mechanism for maintaining the sample at $20 \pm 0.1^\circ$ or some other fixed temperature. Before proceeding with measurements, ensure that the sample and the prism have reached the equilibrium temperature and that the instrument has been properly checked and calibrated against a standard provided by the manufacturer.

Analysis: Measure the refractive index of Invert Sugar, and convert the value to the approximate percentage of solids (uncorrected for invert sugar) by using [Table 1](#). Correct for invert sugar and temperature:

$$D = (S + T) + (P_1 \times F)$$

S = approximate percent solids determined from the refractive index table (see [Table 1](#))

T = temperature correction derived from the temperature correction table (see [Table 2](#)) if the refractometer was operated at other than 20°

P_1 = percentage of invert sugar determined as directed in the Assay

F = deWhalley factor, 0.022

Table 1^a