

SPECIFIC ROTATION

PRINCIPLE

When plane polarized light is passed through a sample solution, the plane of polarization is rotated as the result of optical activity of the carbohydrates. The extent of rotation, known as angular rotation (α) and specified in circular degrees, can be measured precisely with a polarimeter. Observed angular rotation (α), multiplied by 100 and mathematically adjusted to a concentration of 1% (w/v) and a cell depth of 1 dm, is known as the specific rotation ($[\alpha]$) (Note 1).

SCOPE

The method is applicable to corn syrups, dextrose, and all starch hydrolyzates prepared by acid or enzyme conversion and combinations thereof.

SPECIAL APPARATUS

Polarimeter: A polarimeter, capable of angular rotation measurements accurate to within 0.01 circular degrees, is recommended (Note 2). It should be equipped with sodium vapor lamp or equivalent monochromatic light source, and 2 dm observation tubes.

REAGENTS

Ammonia water, 10%: Dilute 40 mL of concentrated ammonia water (28-30% NH_3 sp g 0.90) to 100 mL with purified water. Assay by titration with 1.0 N HCl and adjust, if necessary, to 9.8-10.2% NH_3 .

PROCEDURE

For Liquid Samples:

Weigh accurately about 50 g of sample into a 250 mL beaker (Note 3). Add about 100 mL of purified water and heat on a steam bath for 5 mins. Transfer solution quantitatively to a 500 mL volumetric flask, cool to 25 °C, add 0.2 mL of 10% ammonia water, dilute to volume with purified water at 25 °C and mix thoroughly (Note 4).

For solid samples:

SPECIFIC ROTATION — continued

Weigh accurately about 50 g of dextrose into a 500 mL volumetric flask and dissolve in about 350 mL of purified water. Add 1.0 mL of 10% ammonia water, adjust to 25 °C, dilute to volume with purified water at 25 °C and mix thoroughly (Note 4).

Rinse and fill a clean 2-dm polarimeter tube with sample solution, place tube in polarimeter and measure the angular rotation (α). Check zero point of the instrument with a 2-dm tube filled with water and correct the observed sample reading accordingly, if necessary.

Determine dry substance concentration of the sample by an approved method.

CALCULATION

$$\text{Specific Rotation, } [\alpha]_D^{25^\circ\text{C}} = \frac{(a)(100)(1100)(500 \text{ mL})}{(2 \text{ dm})(\text{Sample Wt., g})(\text{Sample Dry Sub., \%})(100 \text{ mL})}$$

NOTES AND PRECAUTIONS

1. References supplying additional information concerning polarimeter theory and practice together with application to carbohydrate analyses are:
 - a. W. R. Fetzer, J. W. Evans and J. B. Longnecker, *Ind. Eng. Chem., Anal. Ed.*, 5, 81 (1933).
 - b. Bates and Associates, *Polarimetry, Saccharimetry and the Sugars*, Circular C440 of the National Bureau of Standards, U. S. Government Printing Office, Washington, D. C. (1942).
2. A saccharimeter, utilizing a quartz-wedge compensator, may be substituted for the polarimeter having a rotating analyzer. If an instrument with a Ventzke scale is employed, the Ventzke reading is divided by 2.888 to obtain angular rotation (α).
3. When analyzing dilute syrups or starch hydrolyzates, determine angular rotation on a solution containing approximately 8% dry substance, and amend calculation accordingly.

SPECIFIC ROTATION — continued

4. Corn syrup mutarotates when diluted with water; and, equilibrium must be established before measurement of the rotation. This may be accomplished by heating the sample solution on a steam bath or by the addition of ammonia water. Samples mutarotated with ammonia water should be measured within two hrs.

METHOD HISTORY

Combined the Specific Rotation methods for Corn Syrup (E-58) and Corn Sugar (F-52) on 4-15-2010.

Corn Syrup, Specific Rotation (E-58), Date of Acceptance 6-02-1960, Revised 3-01-1995.

Corn Sugar, Specific Rotation (F-52), Date of Acceptance 9-20-1971, Revised 3-01-1995.