

DEXTROSE EQUIVALENT

PRINCIPLE

Among methods commonly used for estimation of aldose and ketose type sugars, copper reducing methods are generally preferred. The Lane and Eynon method is described here, whereby a reducing sugar solution is used to titrate a fixed volume of standard copper sulfate in alkaline tartrate (Fehling) solution to methylene blue end point. Obtained titer is compared with the titer of pure D-glucose (dextrose) under identical conditions and Dextrose Equivalent (DE) is expressed as a "% of the reducing power of dextrose" on a dry basis.

SCOPE

The method is applicable to corn (glucose) syrups and all hydrolysates of starch obtained by acid and/or enzyme conversion. It is not applicable to syrups containing fructose or invert sugar (Note 1).

SPECIAL APPARATUS

1. Titrating Assembly: Mount a ring support on a stand 1-2 ins. above a gas burner and a second ring 6-7 ins. above the first. Place a 6-in. open wire gauze on the lower ring to support a 200 mL Erlenmeyer flask and a 4-in. watch glass with center hole on the upper ring to deflect heat. Attach a 25 mL buret to the stand so that the tip just passes through the watch glass centered above the flask. A funnel top buret with a diagonal TEFLON plug is recommended. Place an indirectly lighted white surface behind the assembly for observing the end point.

REAGENTS

1. Fehling Solution:
 - A. Dissolve 34.64 g of reagent grade copper sulfate pentahydrate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) in purified water and dilute to 500 mL in a volumetric flask.

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- B. Dissolve 173 g of reagent grade potassium sodium tartrate tetrahydrate ($\text{KNaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$) and 50 g of reagent grade sodium hydroxide in purified water and dilute to 500 mL in a volumetric flask.

Measure equal volumes of solutions A and B, and mix by adding solution B to A. Standardize immediately before use (Note 2), as follows:

Dry NIST anhydrous dextrose at 70 °C for 4 hrs. Dissolve 3.000 g in purified water, dilute to 500 mL and mix thoroughly. Pipet 25.0 mL of mixed Fehling solution into a 200 mL Erlenmeyer flask containing a few glass beads and titrate with standard dextrose solution as directed under Procedure. Adjust the concentration of Fehling solution A by dilution or by addition of copper sulfate so that the titration requires 20.0 mL of the 0.6% standard dextrose solution.

2. Methylene Blue Indicator: 1% aqueous solution

PROCEDURE

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

Weigh accurately 3.0 g of sample on a dry basis, so that after dilution the solution contains 0.6% of reducing sugars (Note 3). Transfer the syrup quantitatively to a 500 mL volumetric flask with the aid of hot purified water, cool to room temperature. Dilute to volume and mix thoroughly.

Pipet 25.0 mL of standardized mixed Fehling solution into a 200 mL Erlenmeyer flask containing a few glass beads. Add the sample solution within 0.5 mL of anticipated end point (this is estimated, if necessary, by preliminary titration). Immediately place the flask on the wire gauze of the titration assembly and adjust the gas burner so that the boiling point is reached in about 2 mins. Boil gently but steadily for 2 mins. As boiling continues, add 2 drops of methylene blue indicator and complete the titration within 1 min., by adding sample solution dropwise or in small increments until the blue color disappears. Allow for 5 secs. reaction time between drops at the end of the titration.

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CALCULATIONS

$$\% \text{ Reducing Sugars (as dextrose, as is)} = \frac{(500 \text{ mL})(0.1200)(100)}{(\text{Sample Titer, mL})(\text{Sample Wt., g})}$$

$$\text{DE} = \frac{(\% \text{ Reducing Sugars})(100)}{\% \text{ Dry Substances}}$$

NOTES AND PRECAUTIONS

1. Pure D-fructose responds to Fehling solution differently from D-glucose and its oligo- and polysaccharides. The method may be standardized against a mixture of saccharides of similar composition to the test sample and the results may be expressed as mg reducing sugars in the sample.
2. Mixed Fehling solution A + B is unstable, but may be retained for one week if standardization is confirmed before use.
3. Sample titer should be as close to 20 mL as possible. It may be as low as 15 mL and as high as 25 mL. Best precision is obtained when the range is within 2 mL (titer of 20 ± 1 mL).

REFERENCE

1. *Official Methods of Analysis (1990) Association of Official Analytical Chemists*, 15th Edition, Method 935.62, "Glucose in Sugars and Sirups, Chemical Methods, Final Action," p. 1017.
2. *Official Methods of Analysis (1990) Association of Official Analytical Chemists*, 15th Edition, Method 923.09, "Invert Sugar in Sugars and Syrups, Lane-Eynon General Volumetric Method, Final Action," p. 1016.