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THE DETERMINATION OF DEXTROSE IN CONCENTRATED SOLUTIONS.*

BY EDMOND E. MOORE.[1]

The determination of dextrose in solutions containing from 35 to 50 per cent of this compound is of much importance in pharmaceutical laboratories. The usual reduction of divalent copper requires considerable time and for that reason it is not entirely satisfactory for control work. The same objection holds for the determination of total solids: in this case we have the added objection that any foreign material such as buffer salts or preservatives in the solution will increase the weight. The specific gravity method is quick and accurate if there are no other substances present. The optical rotation is not affected by any of the usual preservatives or buffers and this method is, therefore, the most satisfactory for the assay of solutions made from C. P. or U. S. P. dextrose.

The U. S. P. X expresses most of its physical constants at 25° C. which is the temperature we have chosen for both our specific gravity and polariscopic determinations. It was necessary to secure the data used in these determinations in this laboratory, as none could be found in the literature for dextrose solutions of the concentrations with which we are dealing and at the temperature which we feel it is advisable to use.

Determinations.

Weighings.—All weighings were made with brass weights in air.

Specific Gravity (d^{25}_{4}).—A specific gravity bottle was used which had been calibrated with water at 25° C. and the volume of water at 4° C. calculated.

Optical Rotation (R_{25}).—A 200-mm. tube and a sodium light were used and the temperature was maintained at 25° C. The usual precautions were taken to prevent errors due to mutarotation.

Data.—Determinations on solutions of known strength made with Dextrose C. P. supplied by U. S. Bureau of Standards, and freshly distilled water.

DENSITY AND OPTICAL ROTATION OF CONCENTRATED DEXTROSE SOLUTION.

	Dextrose.			Polariscope.	
	Per cent.	Gm. per 100 cc.	(d^{25}_{4}).	Reading.	Degrees (R_{25}).
1	35.22	40.38	1.1468	43° 36′	43.60°
2	37.19	43.01	1.1566	46° 40′	46.67°
3	39.53	46.19	1.1682	50° 20′	50.33°
4	41.12	48.34	1.1760	52° 42′	52.70°
5	42.95	50.92	1.1854	55° 40′	55.66°
6	44.93	53.70	1.1953	58° 40′	58.66°
7	47.25	57.04	1.2071	62° 36′	62.60°
8	47.93	58.03	1.2105	63° 42′	63.75°

Neither the specific gravities nor the optical rotations of dextrose solutions are straight line functions of the concentrations. However, if the data given in the

* Division of Medicinal Chemistry, A. C. S., Atlanta meeting, April 1930.

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International Critical Table II, page 347, for concentrations of dextrose below 35% are examined, it will be noted that both of these values tend to approach straight line functions of the concentration as the latter becomes higher.

For practical purposes the curves plotted from the data given in the table above may be considered as straight lines, and on this assumption, equations for calculating the per cent of dextrose and the grams of dextrose per 100 cc., from either the specific gravity or the optical rotation, have been derived.

The equation of a straight line has the form—

$$y = mx + b.$$

In the following equations

x = Per cent dextrose in Equations No. 1 and No. 3
x = Dextrose, Gm. per 100 cc. in Equations No. 2 and 4
y = Optical rotation in Equations No. 1 and No. 2
y = Specific gravity (d^{25}_{4}) in Equations No. 3 and No. 4
m = Average slope in the range
b = Average constant.

Transposing the above equation

$$x = y\left(\frac{1}{m}\right) - b'.$$

The value of x for the corresponding value of y can be secured from the above table. The value of m may be determined from the curve. Example—A 50.33° optical rotation is given by a 39.53 per cent dextrose solution. The slope $\frac{y}{x}$ of the curve is $\frac{1}{0.633}$.

$$39.53 = (50.33°)\ (0.633) - b'$$
$$b' = -7.68.$$

No. 1 Dextrose per cent = $(R_{25})\ (0.633) + 7.68$.

In the same way Equations No. 2, No. 3 and No. 4 are derived.

No. 2 Dextrose, Gm. per 100 cc. = $(R_{25})\ (0.877) + 2.13$.

Where R_{25} is the rotation expressed in degrees, using a sodium light and a 200-mm. tube and maintaining the temperature at 25° C.

No. 3 Dextrose, per cent = $(d^{25}_{4})\ (199.0) - 192.95$.

No. 4 Dextrose, Gm. per 100 cc. = $(d^{25}_{4})\ (276.3) - 276.58$.

When dextrose which satisfies the U. S. P. requirements is used, the percentage as calculated by either of these two methods agrees well with that secured by the reduction method. Other substances in the solution may vitiate the results secured by any of the three methods. Preservatives or buffers of the usual type will not interfere with the polariscopic determination and hence this method is more generally applicable than the specific gravity determination.

Acetaldehyde vapor may have a future use in the preservation of fruit because it kills the spores of molds without injuring the fruit itself. This conclusion has been reached by two investigators who have worked on different sides of the question. R. G. Tompkins, of the Low Temperature Station, Cambridge, has shown that acetaldehyde vapor rapidly kills the spores of the molds and fungi which are likely to cause fruit spoilage. In the same laboratory, S. A. Trout has recently found that healthy fruits can absorb a certain amount of acetaldehyde vapor without any harmful effects. The acetaldehyde is used up by the tissues of the fruit and soon disappears, leaving no trace of flavor. The possibility of applying this work to the fruit industry is under investigation.—*Science*, Aug. 29, 1930.