

CRITICAL DATA TABLES

CORN SWEETENERS, STARCHES AND OTHER CORN CARBOHYDRATE PRODUCTS

Corn Refiners Association, Inc.

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PREFACE
To the Fourth Edition of the
CRITICAL DATA TABLES

The Critical Data Tables, originally published in 1954, have been updated and several tables deleted which are available elsewhere or are no longer relevant. The data contained in the tables have been digitized and are available in Excel spreadsheet format from the CRA upon request.

The data tables are grouped according to the following categories:

- Corn Syrups
- Corn Sugars
- Dextrose and Sucrose
- Starch and Dextrin
- Feed and Grain
- Factors, Corrections and Conversion Tables
- Humidity and Water
- Miscellaneous
- Index

The contents of each section are shown at the beginning of the Section, and a complete cross reference index appears at the end of the book.

In all cases where text has been reproduced, permission has been obtained from the author or from the publication where such text appeared originally. In every instance, references are given at the end of each table where possible.

If, after using the tables, anyone finds that additional data should be included, please advise the CRA, and those additions will be considered for inclusion in future editions.

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CORN SYRUPS

Adsorption and Desorption Equilibrium Values for Corn Syrup and Corn Sugar Syrups

AT 25-30 °C

* Water on Dry Substance Basis

Rel. Hum. %	<u>Corn Syrups</u>				<u>Corn Sugars</u>			Invert syrup	Glycerol
	<u>32.8 D.E.</u>	<u>42.0 D.E.</u>	<u>55.0 D.E.</u>	<u>64.0 D.E.</u>	<u>83.4 D.E.</u>	<u>90.7 D.E.</u>			
Absorption Equilibrium values									
20	-	4.10	4.46	-	5.85	-	5.87	9.38	
35	7.24	7.60	8.57	8.85	10.20	11.59	10.90	18.24	
45	8.80	9.61	10.97	11.77	14.65	14.60	15.10	22.81	
52	10.70	11.88	13.53	13.75	17.40	17.92	18.20	28.28	
66	15.60	16.81	19.10	19.22	24.20	24.79	24.50	41.28	
78	23.50	26.54	30.73	30.28	40.05	40.16	42.00	70.11	
Desorption Equilibrium Values									
10	-	-	-	-	2.10	-	-	-	
20	-	4.05	-	-	5.91	-	5.97	9.29	
35	7.20	7.50	9.00	9.00	10.50	-	11.02	18.29	
45	-	9.54	12.02	12.02	14.35	-	14.95	22.64	
52	10.62	11.79	13.91	13.91	17.60	-	-	28.35	
66	-	16.75	19.40	19.40	24.35	-	24.80	-	
78	23.30	26.65	30.51	30.51	40.26	-	42.20	70.24	

Comparison of Data on Water Adsorption of Corn Syrups and Corn Sugars

Rel. Hum. %	<u>Corn Syrups</u>				<u>Corn Sugars</u>			Invert syrup	Glycerol
	<u>32.8 D.E.</u>	<u>42.0 D.E.</u>	<u>55.0 D.E.</u>	<u>64.0 D.E.</u>	<u>83.4 D.E.</u>	<u>90.7 D.E.</u>			
Lbs. of Material Required to adsorb 1 Lb. Water at Equilibrium									
20	-	24.40	22.40	-	17.10	-	17.04	10.66	
35	13.88	13.19	11.63	11.24	9.18	8.62	7.81	5.48	
45	11.36	10.42	9.09	8.47	6.62	6.85	7.04	4.38	
52	9.34	8.42	7.41	7.25	5.50	5.57	6.00	3.54	
66	6.41	5.94	5.24	5.21	4.08	4.03	3.85	2.42	
78	4.24	3.77	3.25	3.30	2.40	2.49	2.23	1.43	
Lbs. of Material to Equal 1 Lb. Glycerol in Water Adsorption at Equilibrium									
20	-	2.29	2.10	-	1.60	-	1.60	1.00	

35	2.54	2.42	2.13	2.06	1.67	1.58	1.43	1.00
45	2.59	2.38	2.08	1.93	1.51	1.56	1.61	1.00
52	2.64	2.38	2.09	2.05	1.55	1.57	1.69	1.00
66	2.65	2.45	2.17	2.15	1.69	1.67	1.59	1.00
78	2.97	2.64	2.27	2.31	1.68	1.74	1.56	1.00

	Dextrose <u>Equivalent</u>	Ash %		Dextrose <u>Equivalent</u>	Ash %
Corn syrup	32.8	0.28	70 corn sugar	83.4	0.41
Corn syrup	42.0	0.28	80 corn sugar	90.7	1.22
Corn syrup	55.0	0.30	Invert syrup(b)	-	0.10
Corn syrup (a)	64.0	0.33			

(a) Dual-conversion syrup, acid hydrolysis followed by enzyme hydrolysis.

(b) Made by invertase (Wallerstein) inversion. Rotation was -19.8 at 20°C., indicating essentially complete inversion.

*J. E. Cleland and W. R. Fetzer, Ind. and Eng. Chem. Vol. 36, 552, June 1944.

Boiling Point Elevation of Corn Syrups

Boiling Point Elevation of 30 DE Corn Syrup (1)

Percent Solids			20	40	60	70	80	85
Pressure mm. Hg	in. Hg	H ₂ O Boiling Point (°F)	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F
50	1.97	100.73	0.26	0.86	2.63	4.8	8.6	11.8
100	3.94	124.88	.28	.89	2.72	4.9	8.9	12.1
150	5.91	140.17	.29	.93	2.81	5.0	9.1	12.4
200	7.87	151.60	.31	.97	2.90	5.2	9.4	12.7
300	11.81	168.59	.33	1.02	3.04	5.4	9.8	13.2
400	15.75	181.32	.35	1.06	3.17	5.6	10.1	13.7
500	19.69	191.62	.37	1.10	3.28	5.8	10.4	14.1
600	23.62	200.32	.38	1.14	3.38	6.0	10.7	14.5
700	27.56	207.89	.39	1.17	3.47	6.2	11.0	14.9
760	29.92	212.00	.39	1.18	3.55	6.3	11.1	15.1
800	31.50	214.60	.40	1.20	3.58	6.3	11.2	15.3
900	35.43	220.65	.41	1.22	3.67	6.5		
1000	39.37	226.18	.42	1.24	3.76			

Boiling Point Elevation of 43 DE Corn Syrup (1)

Percent Solids			20	40	60	70	80	85
Pressure mm. Hg	in. Hg	H ₂ O Boiling Point (°F)	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F
50	1.97	100.73	0.41	1.20	3.56	6.1	10.4	13.7
100	3.94	124.88	.43	1.25	3.69	6.3	10.8	14.2
150	5.91	140.17	.45	1.30	3.80	6.5	11.1	14.6
200	7.87	151.60	.46	1.34	3.89	6.6	11.5	15.1
300	11.81	168.59	.48	1.40	4.09	7.0	12.1	16.0
400	15.75	181.32	.51	1.45	4.27	7.3	12.7	16.8
500	19.69	191.62	.53	1.50	4.43	7.6	13.2	17.8
600	23.62	200.32	.54	1.54	4.57	7.9	13.6	18.3
700	27.56	207.89	.56	1.58	4.73	8.2	14.1	19.0
760	29.92	212.00	.56	1.60	4.81	8.3	14.3	19.4
800	31.50	214.60	.57	1.62	4.88	8.4	14.5	19.7
900	35.43	220.65	.58	1.66	5.00	8.7		

1000	39.37	226.18	.59	1.69	5.15
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Boiling Point Elevation of 55 DE Corn Syrup (1)

Percent Solids			20	40	60	70	80	85
Pressure mm. Hg		H ₂ O Boiling Point (°F)	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F
in. Hg								
50	1.97	100.73	.56	1.57	4.36	7.2	11.7	15.1
100	3.94	124.88	.58	1.63	4.54	7.5	12.3	15.8
150	5.91	140.17	.61	1.69	4.70	7.7	12.7	16.4
200	7.87	151.60	.63	1.74	4.84	8.0	13.2	17.0
300	11.81	168.59	.66	1.82	5.09	8.4	14.0	18.0
400	15.75	181.32	.68	1.90	5.29	8.8	14.7	19.1
500	19.69	191.62	.71	1.96	5.49	9.2	15.4	20.0
600	23.62	200.32	.73	2.02	5.67	9.6	16.0	20.9
700	27.56	207.89	.75	2.07	5.87	9.9	16.6	21.8
760	29.92	212.00	.76	2.09	5.98	10.1	16.9	22.3
800	31.50	214.60	.76	2.11	6.05	10.2	17.1	22.6
900	35.43	220.65	.77	2.16	6.23	10.5		
1000	39.37	226.18	.78	2.20	6.43			

Boiling Point Elevation of 65 DE Corn Syrup (1)

Percent Solids			20	40	60	70	80	85
Pressure mm. Hg		H ₂ O Boiling Point (°F)	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F
in. Hg								
50	1.97	100.73	0.68	1.88	4.95	8.1	12.7	16.2
100	3.94	124.88	.71	1.95	5.20	8.3	13.3	16.9
150	5.91	140.17	.74	2.02	5.40	8.6	13.8	17.6
200	7.87	151.60	.76	2.08	5.58	8.9	14.3	18.2
300	11.81	168.59	.80	2.19	5.85	9.4	15.2	19.4
400	15.75	181.32	.83	2.28	6.08	9.9	16.0	20.5
500	19.69	191.62	.86	2.35	6.30	10.3	16.8	21.5
600	23.62	200.32	.88	2.42	6.52	10.7	17.5	22.4
700	27.56	207.89	.90	2.48	6.73	11.1	18.1	23.3
760	29.92	212.00	.91	2.51	6.86	11.3	18.5	23.8
800	31.50	214.60	.92	2.53	6.95	11.5	18.8	24.1
900	35.43	200.65	.94	2.58	7.15	11.8		
1000	39.37	226.18	.96	2.63	7.36			

Boiling Point Elevation of 80 DE Corn Syrup (1)

Percent Solids			20	40	60	70	80	85
Pressure		H ₂ O Boiling						
mm. Hg	in. Hg	Point (°F)	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F
50	1.97	100.73	0.86	2.33	5.81	9.1	14.1	17.6
100	3.94	124.88	.89	2.44	6.16	9.5	14.7	18.3
150	5.91	140.17	.93	2.53	6.43	9.9	15.3	19.0
200	7.87	151.60	.97	2.61	6.64	10.2	15.8	19.7
300	11.81	168.59	1.02	2.75	7.00	10.9	16.7	21.0
400	15.75	181.32	1.06	2.86	7.29	11.4	17.6	22.1
500	19.69	191.62	1.10	2.95	7.54	11.9	18.4	23.1
600	23.62	200.32	1.13	3.03	7.78	12.3	19.1	24.0
700	27.56	207.89	1.16	3.11	8.01	12.7	19.8	24.8
760	29.92	212.00	1.17	3.16	8.15	12.9	20.3	25.3
800	31.50	214.60	1.18	3.18	8.24	13.1	20.5	25.6
900	35.43	220.65	1.20	3.25	8.48	13.4		
1000	39.37	226.18	1.23	3.31	8.73			

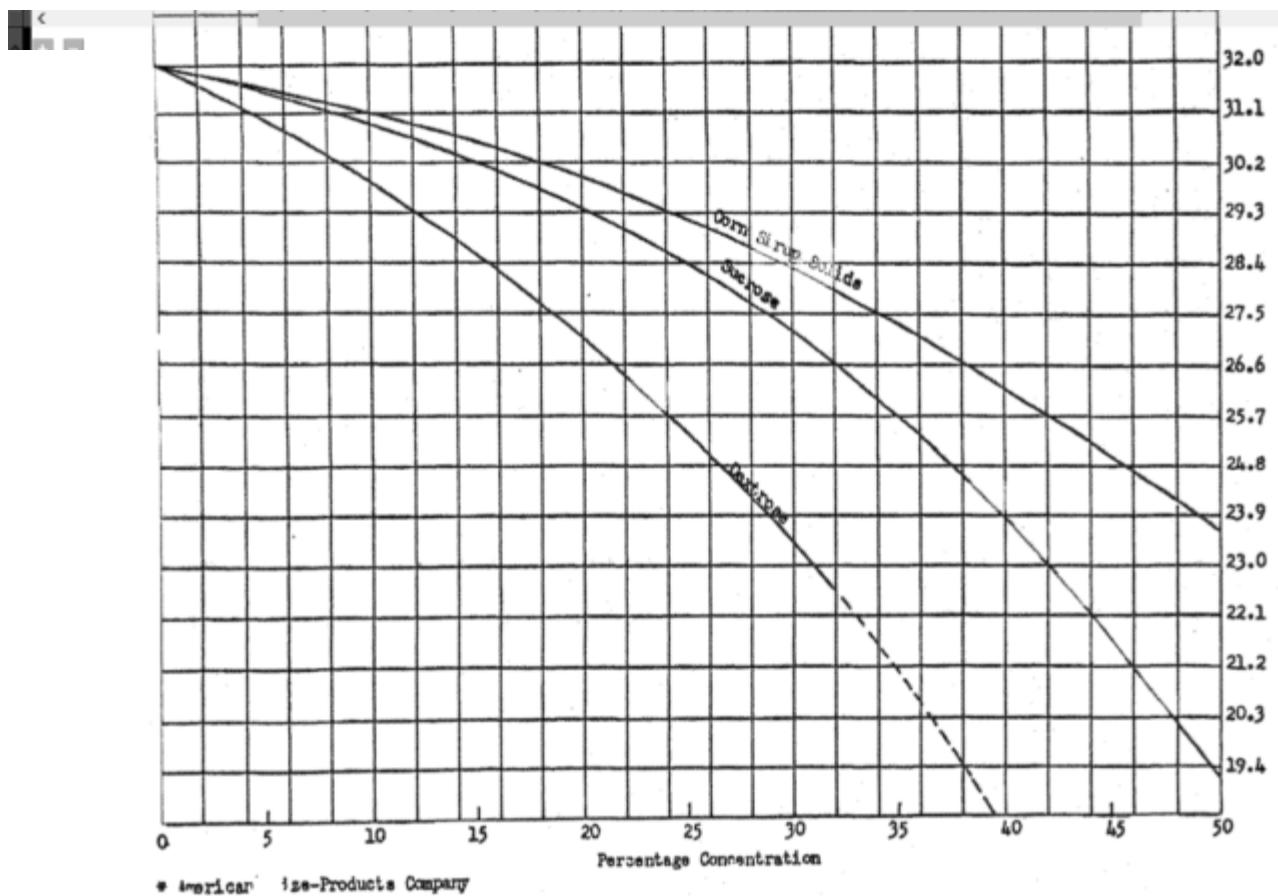
Boiling Point Elevation of 90 DE Corn Syrup (1)

Percent Solids			20	40	60	70	80	85
Pressure		H ₂ O Boiling						
mm. Hg	in. Hg	Point (°F)	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F	Δ°F
50	1.97	100.73	0.99	2.63	6.39	9.8	14.9	18.4
100	3.94	124.88	1.03	2.75	6.73	10.2	15.5	19.2
150	5.91	140.17	1.08	2.86	7.02	10.6	16.0	19.9
200	7.87	151.60	1.12	2.96	7.27	10.9	16.6	20.6
300	11.81	168.59	1.18	3.13	7.65	11.6	17.6	21.8
400	15.75	181.32	1.23	3.27	7.97	12.2	18.5	22.9
500	19.69	191.62	1.27	3.38	8.26	12.7	19.3	23.9
600	23.62	200.32	1.31	3.47	8.53	13.2	20.1	24.8
700	27.56	207.89	1.36	3.56	8.80	13.6	20.7	25.6
760	29.92	212.00	1.38	3.62	8.95	13.9	21.1	26.1
800	31.50	214.60	1.39	3.65	9.05	14.0	21.4	26.4
900	35.43	220.65	1.42	3.73	9.32	14.4		
1000	39.37	226.18	1.45	3.81	9.41			

The Freezing Point of Various Concentrations of Corn Syrup Solids(1)

<u>Per Cent Concentration</u>	<u>Freezing-Point In °C.</u>	<u>Freezing-Point In °F.</u>
2.482	-0.105	31.811
4.974	-0.218	31.6076
9.205	-0.480	31.136
15.778	-0.883	30.4106
23.680	-1.500	29.3
45.380	-4.020	24.764

(1) Technical Service Laboratories of the American Maize-Products Company.



Corn Syrup Analysis

Composition of Acid Converted Corn Syrup

Carbohydrate Dry Substance Basis (1)

	<u>Dextrose Equivalent</u>							
	25	30	35	40	45	50	55	60
	<u>Percent Conc</u>							
Dextrose	8.4	11.9	15.7	20.0	24.5	29.4	34.8	40.3
Maltose	9.4	13.0	16.5	19.7	22.6	25.1	27.0	28.3
Dextrins	53.1	48.2	43.5	38.9	34.5	30.4	26.5	23.2
Higher Sugars	29.1	26.9	24.3	21.4	18.4	15.1	11.7	8.2

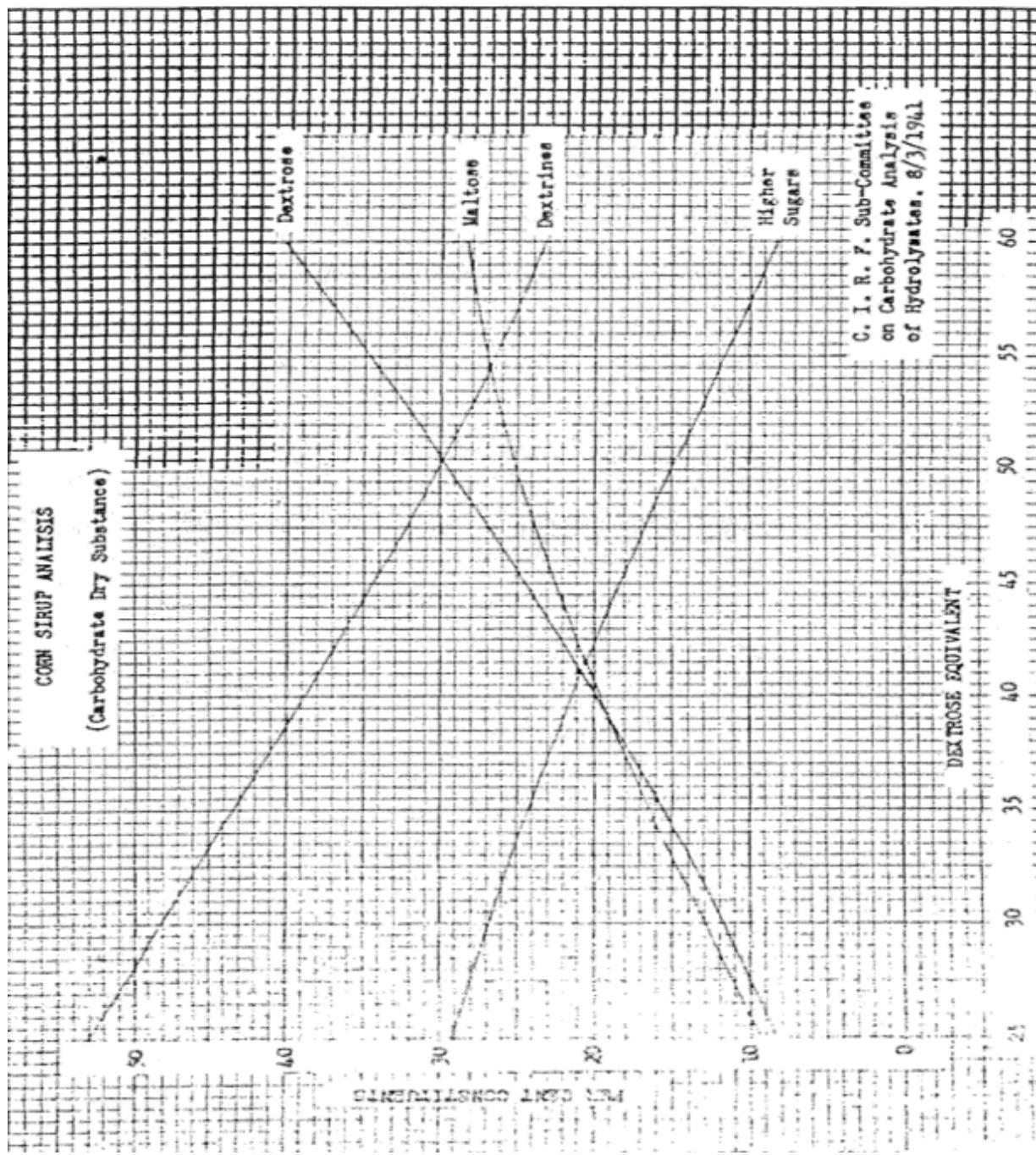
(1) C. I. R. F. Sub-Committee on Carbohydrate Analysis of Hydrolysates. 8/3/1941.

Composition of Acid-Enzyme Converted Corn Syrup

Dry Substance Basis (2)

	<u>Dextrose Equivalent</u>						
	60	61	62	63	64	65	66
	<u>Percent Conc</u>						
Dextrose	35.20	35.85	36.60	37.50	38.43	39.50	40.60
Maltose	32.60	33.20	33.80	34.22	34.63	35.00	35.20
Dextrins	14.60	13.75	12.90	12.18	11.52	10.90	10.40
Higher Sugars	17.60	17.20	16.70	16.10	15.42	14.60	13.80

(2) W. B. Bishop, A. E. Staley Mfg. Co.



Typical Compositions of Corn Syrups

Corn syrups and high fructose corn syrups are available in a wide variety of compositions depending on the end use of sweetener. Starch hydrolysis techniques used in today's modern corn refinery allow careful control of syrup composition, production of syrups to meet the specific needs of users. Across the broad spectrum of syrups possible, a number of major groups of products are widely produced by corn refiners. The following are the major types of syrups currently available:

<u>Designation</u>	<u>Ash</u>	<u>Fructose</u>	<u>Dextrose</u>	<u>Maltose</u>	<u>Maltotriose</u>	<u>DP4+</u>
28 DE	0.3	0	8	8	11	73
36 DE	0.3	0	14	11	10	65
34 HM (High Maltose)	0.3	0	9	34	24	33
43 HM (High Maltose)	0.3	0	9	43	18	30
43 DE	0.3	0	19	14	12	55
43 DE (Ion Exchanged)	0.03	0	19	14	12	55
53 DE	0.3	0	28	18	13	41
63 DE	0.3	0	36	31	13	20
63 DE (Ion Exchanged)	0.03	0	36	31	13	20
66 DE	0.3	0	40	35	8	17
95 DE	0.3	0	95	3	0.5	1.5
95 DE (Ion Exchanged)	0.03	0	95	3	0.5	1.5
HFCS 42	0.03	42.5	52.5	3.0	0.7	1.3
HFCS 55	0.05	55.4	40.3	3	0.4	0.9

Information on specific commercial products may be found in the product data sheets available from individual producers. Compositional data on company data sheets which differ from that shown above should be used in conjunction with the program RI-DS (available separately from the Corn Refiners Association) to generate tables in place of these pre-printed tables. Corn Refiners Association makes no representation that the products listed above may be available from any particular producer, or that individual products supplied by member companies adhere to the typical compositions listed above.

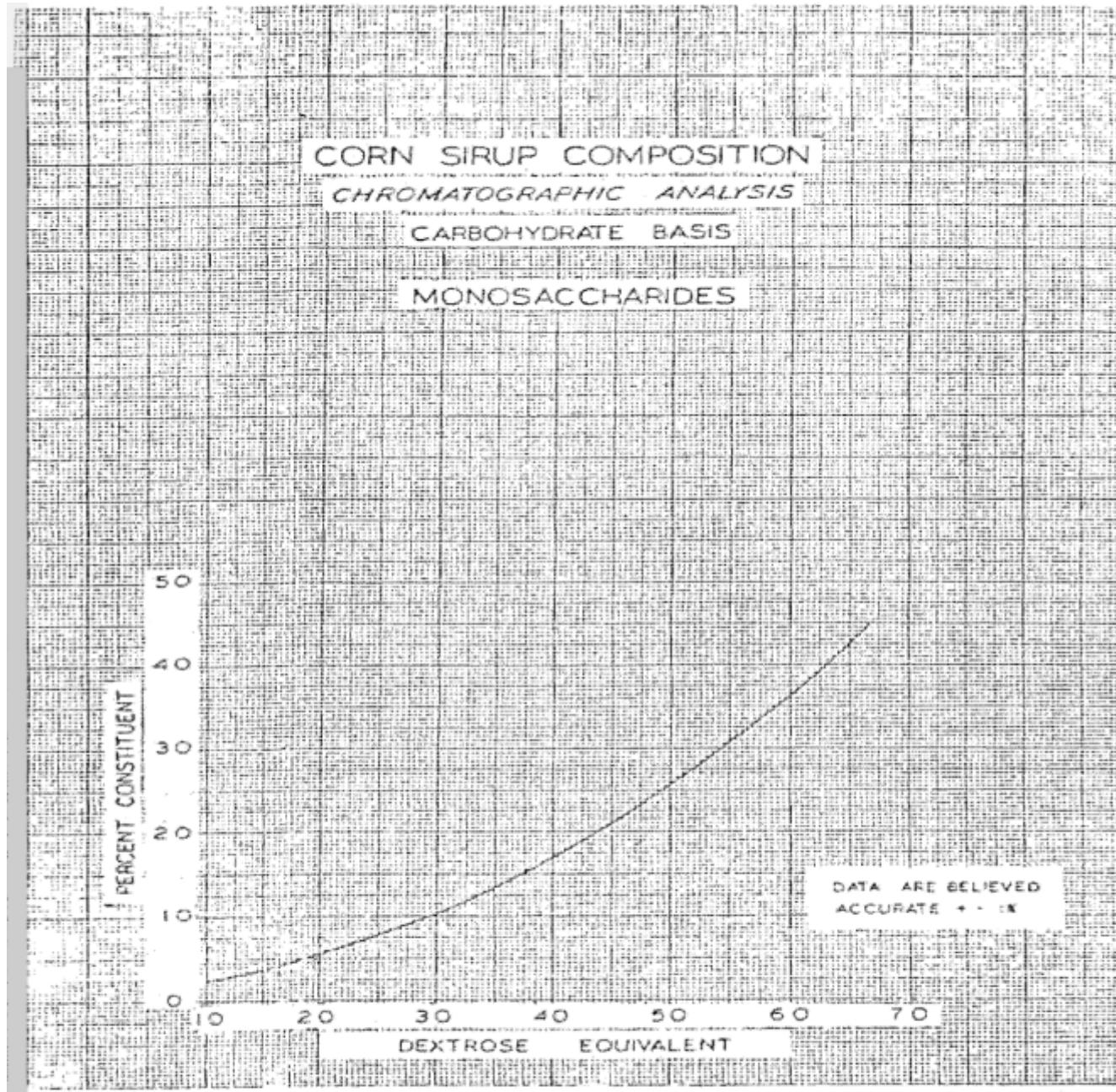
Composition by Chromatographic Analysis

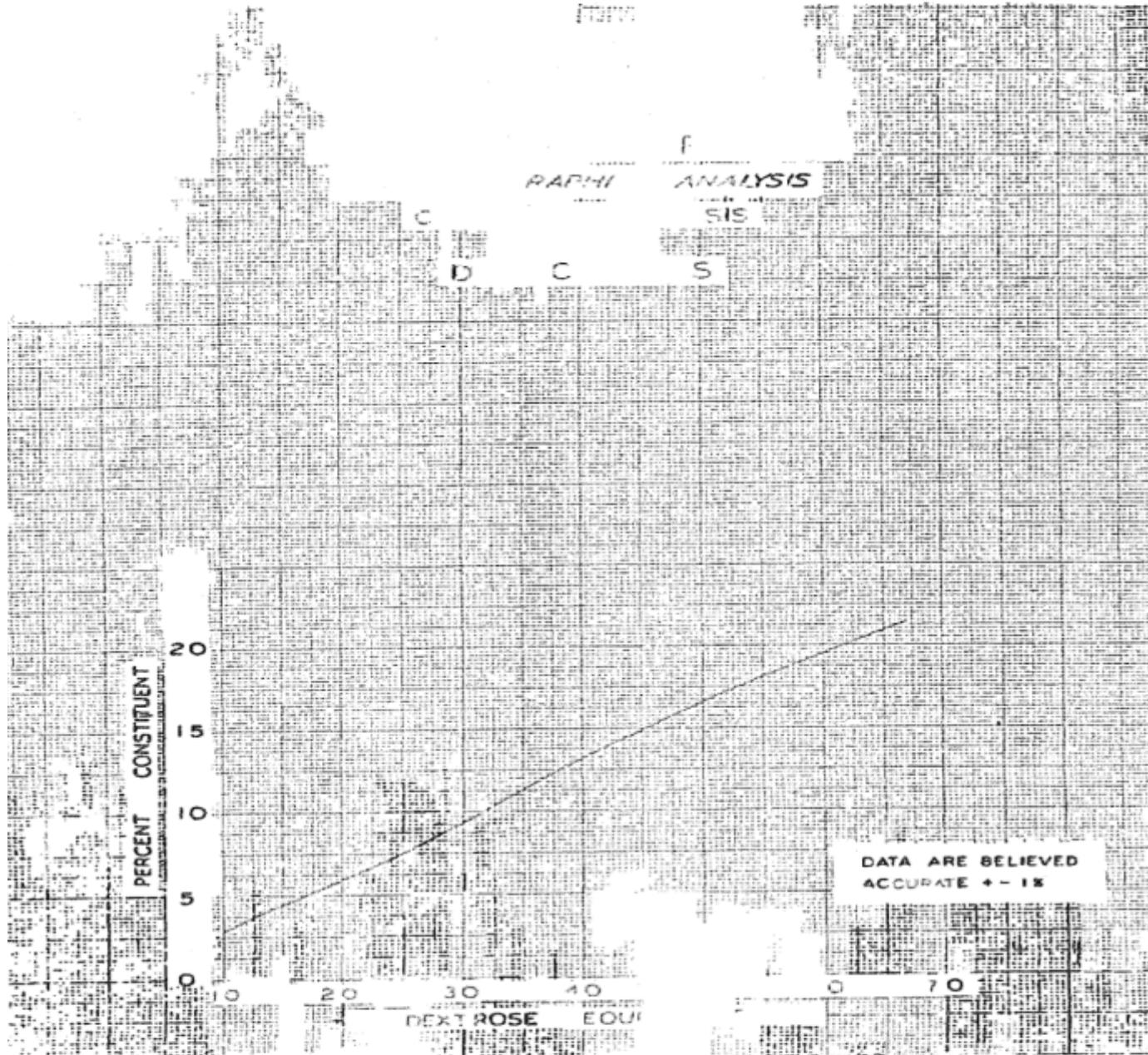
* CORN SYRUP COMPOSITION - CHROMATOGRAPHIC ANALYSIS

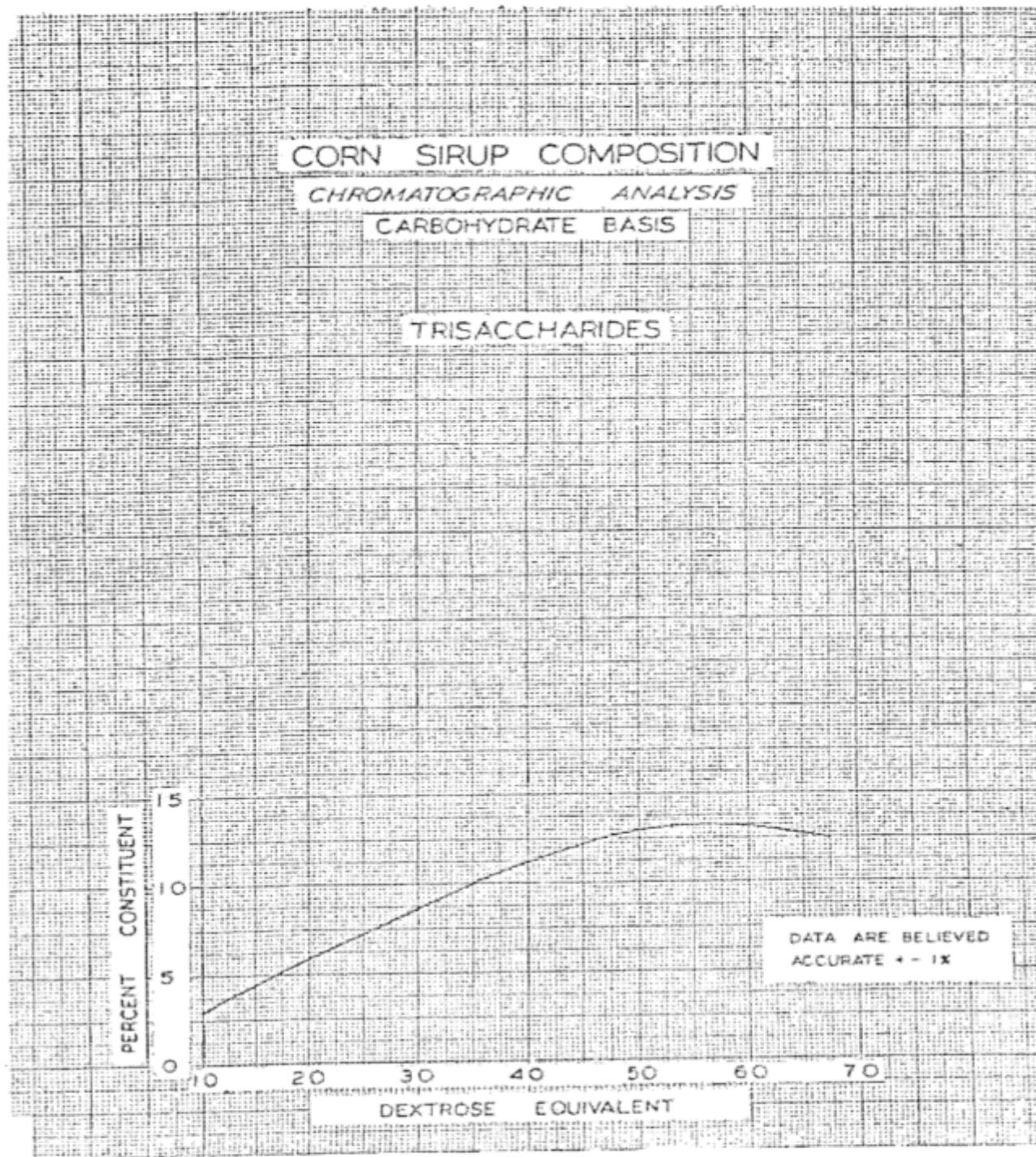
CARBOHYDRATE BASIS

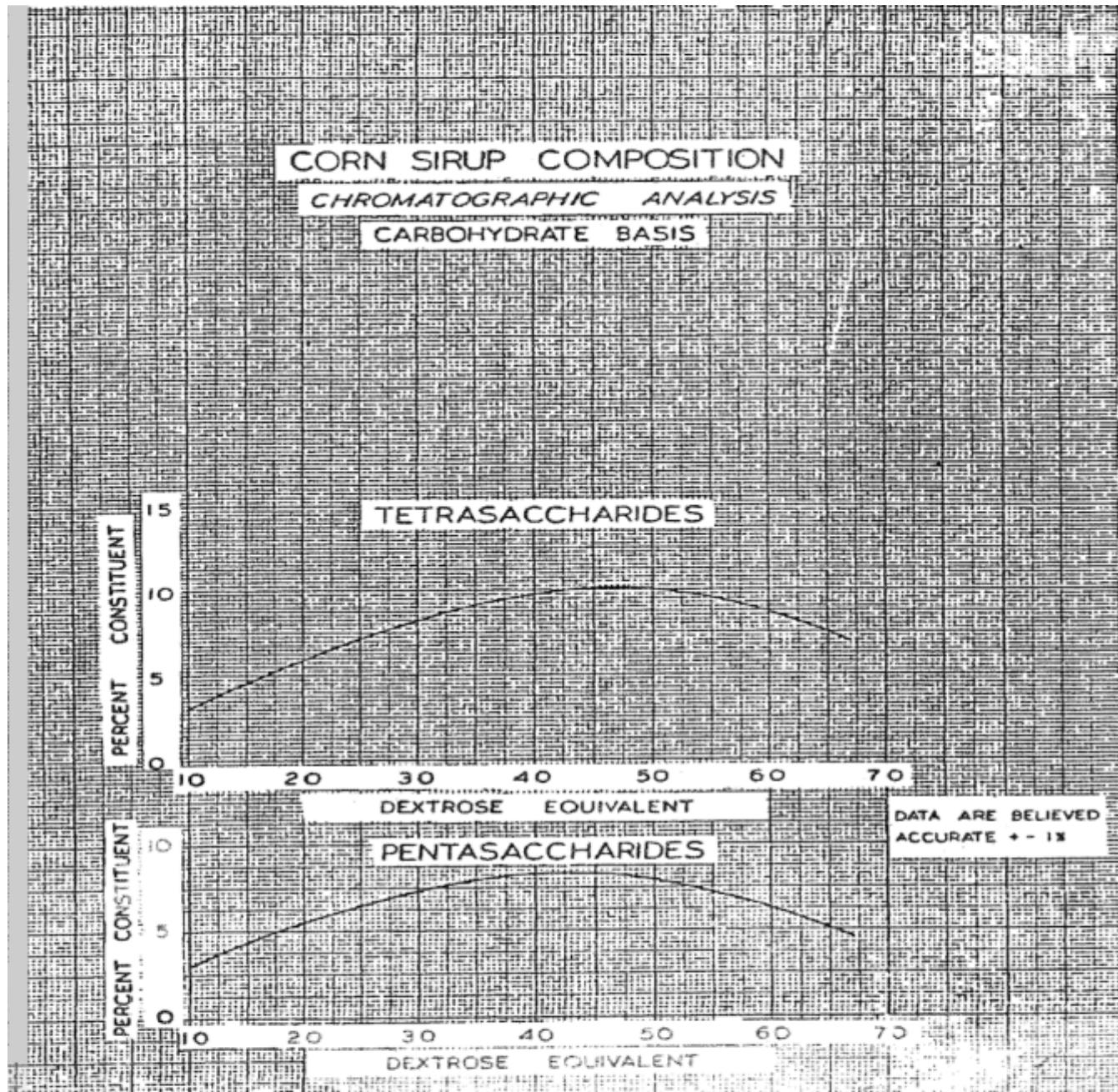
Dextrose Equivalent	Percent Saccharides							
	Mono	Di	Tri	Tetra	Penta	Hexa	Hepta	Higher
10	2.3	2.8	2.9	3.0	3.0	2.2	2.1	81.7
15	3.7	4.4	4.4	4.5	4.3	3.3	3.0	72.4
20	5.5	5.9	5.8	5.8	5.5	4.3	3.9	63.3
25	7.7	7.5	7.2	7.2	6.5	5.2	4.6	54.1
30	10.4	9.3	8.6	8.2	7.2	6.0	5.2	45.1
35	13.4	11.3	10.0	9.1	7.8	6.5	5.5	36.4
40	16.9	13.2	11.2	9.7	8.3	6.7	5.7	28.3
45	21.0	14.9	12.2	10.1	8.4	6.5	5.6	21.3
50	25.8	16.6	12.9	10.0	7.9	5.9	5.0	15.9
55	30.8	18.1	13.2	9.5	7.2	5.1	4.2	11.9
60	36.2	19.5	13.2	8.7	6.3	4.4	3.2	8.5
65	42.5	20.9	12.7	7.5	5.1	3.6	2.2	5.5
67	45.1	21.4	12.5	6.9	4.6	3.2	1.8	4.5

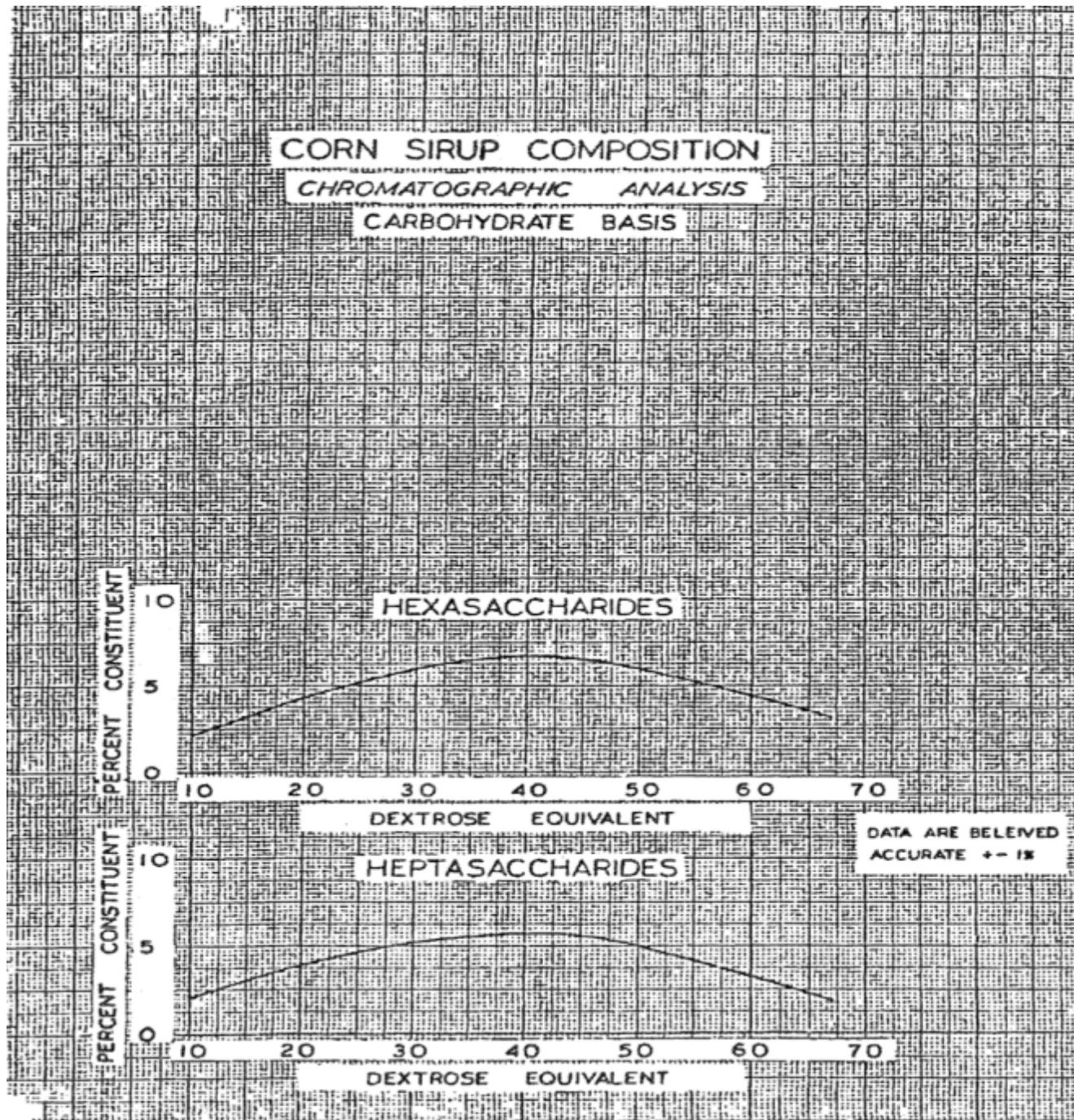
Data are believed accurate +/- 1%

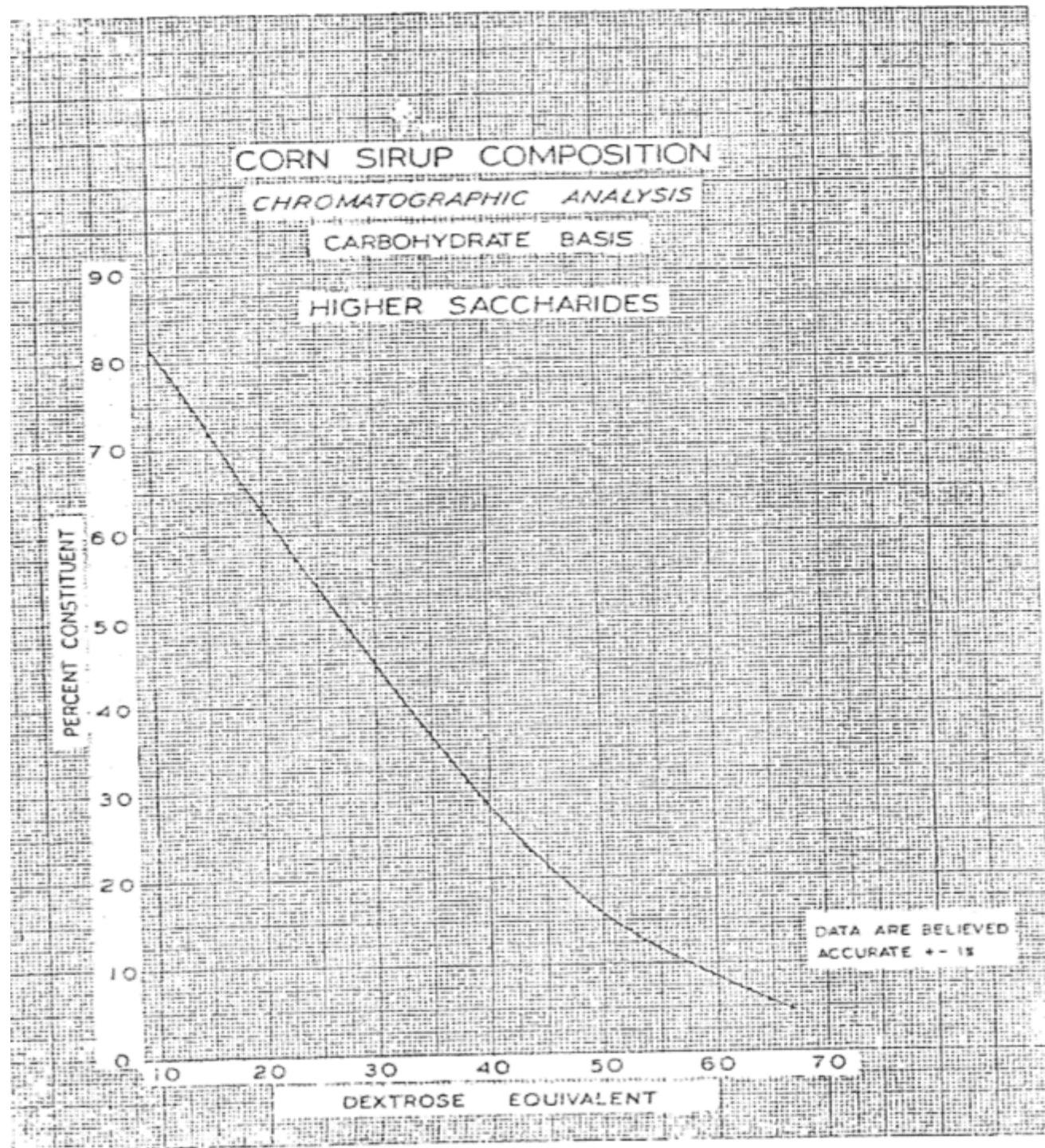




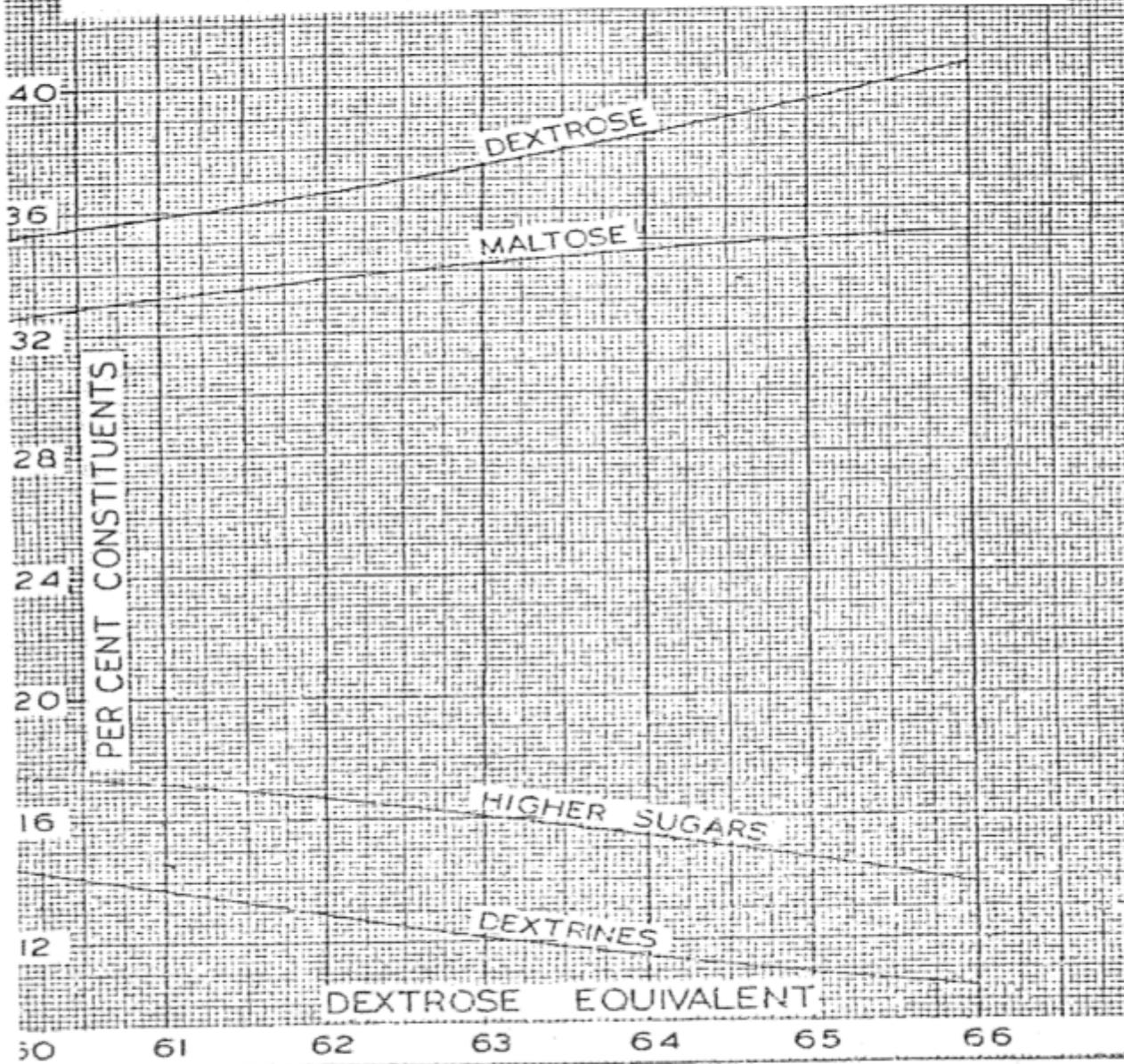








44
COMPOSITION OF ACID-ENZYME-CONVERTED
CORN SIRUP
(DRY SUBSTANCE BASIS)



Tables Relating Compositions of Corn Syrups and High Fructose Corn Syrups with Dry Substance, Refractive Index, and Commercial Baume'

The tables which follow may be used to determine the dry substance concentrations of corn syrups of "typical" compositions following determination of refractive index using the CRA Standard Analytical Method E-54. Tables are presented in the ranges of dry substance which are generally found in current commercial products. Tables for products found outside these ranges may be prepared using the computer program RI-DS available separately from the Corn Refiners Association.

References

1. Wartman, A.M., Hagberg, C., Eliason, M.A. 1976: Journal of Chemical and Engineering Data, 21, 459-468.
2. Kurtz, F.A., Eliason, M.A. 1979: Journal of Chemical and Engineering Data, 24, 44-45.
3. Wartman, A.M., Bridges, A.J., Eliason, M.A. 1980: Journal of Chemical and Engineering Data, 25, 277-282.
4. Wartman, A.M., Spawn, T.D., Eliason, M.A. 1984: Journal of Agricultural and Food Chemistry, 32, 971-974.
5. Maxwell, J.L., Kurtz, F.A., Strelka, B.J: 1984: Journal of Agricultural and Food Chemistry, 32, 974-979.
6. Fitt, L.E., Bernetti, R., Kurtz, F.A. 1987: Practical Aspects of Preparation and Validation of Tables of Dry Substances of Glucose and Fructose Syrups on the Basis of Density and Refractive Index Composition Models. Presented at the annual meeting , Association of Official Analytical Chemists, San Francisco, CA, September 14-17, 1987.

28 DE Corn Syrup

Fructose: 0% Sucrose: 0 %
 Dextrose: Maltose: 8.0%
 Maltotriose: 11.0% Higher Saccharides: 73.0%
 Ash: 0.30%, DS BASIS

<u>%DS</u>	<u>RI 20 °C</u>	<u>RI 45 °C</u>	<u>Be, Comm 140/60°F +1</u>	<u>SP Gr AIR/AIR 100/60 °F</u>	<u>Total Lbs/ Gal 100 °F</u>	<u>Dry Subst Lb/ Gal 100°F</u>
76.0	1.4888	1.4837		1.3929	11.61	
76.1	1.4891	1.4840		1.3936	11.62	
76.2	1.4894	1.4843		1.3943	11.62	
76.3	1.4896	1.4845		1.3949	11.63	
76.4	1.4899	1.4848		1.3956	11.64	
76.5	1.4902	1.4851	41.23	1.3963	11.64	8.91
76.6	1.4904	1.4853	41.29	1.3970	11.65	8.92
76.7	1.4907	1.4856	41.34	1.3976	11.65	8.94
76.8	1.4910	1.4859	41.39	1.3983	11.66	8.95
76.9	1.4913	1.4862	41.44	1.3990	11.66	8.97
77.0	1.4915	1.4864	41.49	1.3997	11.67	8.99
77.1	1.4918	1.4867	41.54	1.4003	11.67	9.00
77.2	1.4921	1.4870	41.59		11.68	9.02
77.3	1.4924	1.4872	41.64		11.69	9.03
77.4	1.4926	1.4875	41.69		11.69	9.05
77.5	1.4929	1.4878	41.74	1.4030	11.70	9.07
77.6	1.4932	1.4881	41.80	1.4037	11.70	9.08
77.7		1.4883	41.85	1.4044	11.71	9.10
77.8		1.4886	41.90	1.4051	11.71	9.11
77.9		1.4889	41.95	1.4057	11.72	9.13
78.0	1.4943	1.4892		1.4064	11.73	9.15
78.1	1.4946	1.4894		1.4071	11.73	9.16
78.2	1.4948	1.4897		1.4078	11.74	9.18
78.3	1.4951	1.4900		1.4085	11.74	9.19
78.4	1.4954	1.4903		1.4091	11.75	9.21
78.5		1.4905	42.25	1.4098	11.75	9.23
78.6		1.4908	42.30	1.4105	11.76	9.24
78.7			42.35	1.4112	11.77	9.26
78.8			42.40	1.4119	11.77	9.28
78.9			42.45	1.4126	11.78	9.29
79.0	1.4971	1.4919	42.51	1.4132	11.78	9.31
79.1	1.4973	1.4922	42.56	1.4139	11.79	9.32

79.2	1.4976	1.4925	42.61	1.4146	11.79	9.34
79.3	1.4979	1.4928	42.66	1.4153	11.80	9.36
79.4	1.4982	1.4930	42.71	1.4160	11.81	
79.5			42.76			
79.6			42.81			
79.7			42.86			
79.8			42.91			
79.9			42.96			
80.0			43.01			

36DE Corn Syrup

Fructose: 0.0% Sucrose: 0.0%

Dextrose: 14.0% Maltose: 11.0%

Maltotriose: 10.0% Higher Saccharides: 65.0%

Ash: 0.30%, DS BASIS

%DS	RI 20 °C	RI 45 °C	Be, Comm	Sp Gr Air/Air	Total Lbs/Gal 100 °F	Dry Subs Lbs/Gal 100 °F
			140/60 °F + 1	100/60 °F	Gal 100 °F	
78.4	1.4938	1.4887	42.01	1.4066	11.73	9.19
78.5	1.4940	1.4889	42.06	1.4073	11.73	9.21
78.6	1.4943	1.4892	42.11	1.4079	11.74	9.23
78.7	1.4946	1.4895	42.16	1.4086	11.74	9.24
78.8	1.4949	1.4897	42.22	1.4093	11.75	9.26
78.9	1.4951	1.4900	42.27	1.4100	11.76	9.27
79.0	1.4954	1.4903	42.32	1.4107	11.76	9.29
79.1	1.4957	1.4906	42.37	1.4113	11.77	9.31
79.2	1.4960	1.4908	42.42	1.4120	11.77	9.32
79.3	1.4962	1.4911	42.47	1.4127	11.78	9.34
79.4	1.4965	1.4914	42.52	1.4134	11.78	9.36
79.5	1.4968	1.4917	42.57	1.4141	11.79	9.37
79.6	1.4971	1.4919	42.62	1.4147	11.80	9.39
79.7	1.4974	1.4922	42.67	1.4154	11.80	9.41
79.8	1.4976	1.4925	42.72	1.4161	11.81	9.42
79.9	1.4979	1.4928	42.77	1.4168	11.81	9.44
80.0	1.4982	1.4930	42.82	1.4175	11.82	9.45
80.1	1.4985	1.4933	42.87	1.4182	11.82	9.47
80.2	1.4987	1.4936	42.92	1.4188	11.83	9.49
80.3	1.4990	1.4939	42.97	1.4195	11.83	9.50
80.4	1.4993	1.4941	43.02	1.4202	11.84	9.52
80.5	1.4996	1.4944	43.07	1.4209	11.85	9.54
80.6	1.4998	1.4947	43.12	1.4216	11.85	9.55
80.7	1.5001	1.4950	43.17	1.4223	11.86	9.57
80.8	1.5004	1.4952	43.22	1.4230	11.86	9.59
80.9	1.5007	1.4955	43.27	1.4237	11.87	9.60
81.0	1.5010	1.4958	43.32	1.4243	11.88	9.62
81.1	1.5012	1.4961	43.37	1.4250	11.88	9.64
81.2	1.5015	1.4964	43.42	1.4257	11.89	9.65
81.3	1.5018	1.4966	43.47	1.4264	11.89	9.67
81.4	1.5021	1.4969	43.52	1.4271	11.90	9.68
81.5	1.5024	1.4972	43.57	1.4278	11.90	9.70
81.6	1.5026	1.4975	43.62	1.4285	11.91	9.72
81.7	1.5029	1.4978	43.67	1.4292	11.92	9.73

81.8	1.5032	1.4980	43.72	1.4299	11.92	9.75
81.9	1.5035	1.4983	43.77	1.4305	11.93	9.77
82.0	1.5038	1.4986	43.82	1.4312	11.93	9.78
82.1	1.5040	1.4989	43.87	1.4319	11.94	9.80
82.2	1.5043	1.4992	43.92	1.4326	11.94	9.82
82.3	1.5046	1.4994	43.97	1.4333	11.95	9.83
82.4	1.5049	1.4997	44.02	1.4340	11.96	9.85

34 DE High Maltose Corn Syrup

Fructose: 0.0% Sucrose: 0.0%

Dextrose: 9.0% Maltose: 34.0%

Maltotriose: 24.0% Higher Saccharides: 33.0%

Ash: 0.30%, DS BASIS

<u>%DS</u>	<u>RI 20 °C</u>	<u>RI 45 °C</u>	BE, Comm <u>140/60 °F + 1</u>	SP G AIR/AIR <u>100/60 °F</u>	TOTAL LBS/ <u>GAL 100 °F</u>	DRY SUB LBS/ <u>GAL 100 °F</u>
78.6	1.4933	1.4882	41.99	1.4062	11.72	9.21
78.7	1.4936	1.4884	42.04	1.4068	11.73	9.23
78.8	1.4938	1.4887	42.09	1.4075	11.73	9.25
78.9	1.4941	1.4890	42.14	1.4082	11.74	9.26
79.0	1.4944	1.4893	42.19	1.4089	11.75	9.28
79.1	1.4947	1.4895	42.24	1.4095	11.75	9.30
79.2	1.4949	1.4898	42.29	1.4102	11.76	9.31
79.3	1.4952	1.4901	42.34	1.4109	11.76	9.33
79.4	1.4955	1.4903	42.39	1.4116	11.77	9.34
79.5	1.4958	1.4906	42.44	1.4123	11.77	9.36
79.6	1.4960	1.4909	42.49	1.4129	11.78	9.38
79.7	1.4963	1.4912	42.54	1.4136	11.79	9.39
79.8	1.4966	1.4914	42.59	1.4143	11.79	9.41
79.9	1.4968	1.4917	42.64	1.4150	11.80	9.43
80.0	1.4971	1.4920	42.69	1.4156	11.80	9.44
80.1	1.4974	1.4923	42.74	1.4163	11.81	9.46
80.2	1.4977	1.4925	42.79	1.4170	11.81	9.47
80.3	1.4979	1.4928	42.84	1.4177	11.82	9.49
80.4	1.4982	1.4931	42.89	1.4184	11.83	9.51
80.5	1.4985	1.4934	42.94	1.4190	11.83	9.52
80.6	1.4988	1.4936	42.99	1.4197	11.84	9.54
80.7	1.4991	1.4939	43.04	1.4204	11.84	9.56
80.8	1.4993	1.4942	43.09	1.4211	11.85	9.57
80.9	1.4996	1.4944	43.14	1.4218	11.85	9.59
81.0	1.4999	1.4947	43.19	1.4225	11.86	9.61
81.1	1.5002	1.4950	43.24	1.4231	11.86	9.62
81.2	1.5004	1.4953	43.29	1.4238	11.87	9.64
81.3	1.5007	1.4956	43.34	1.4245	11.88	9.66
81.4	1.5010	1.4958	43.39	1.4252	11.88	9.67
81.5	1.5013	1.4961	43.44	1.4259	11.89	9.69
81.6	1.5015	1.4964	43.49	1.4266	11.89	9.71
81.7	1.5018	1.4967	43.54	1.4272	11.90	9.72
81.8	1.5021	1.4969	43.59	1.4279	11.90	9.74
81.9	1.5024	1.4972	43.64	1.4286	11.91	9.75

82.0	1.5027	1.4975	43.69	1.4293	11.92	9.77
82.1	1.5029	1.4978	43.74	1.4300	11.92	9.79
82.2	1.5032	1.4980	43.79	1.4307	11.93	9.80
82.3	1.5035	1.4983	43.84	1.4313	11.93	9.82
82.4	1.5038	1.4986	43.89	1.4320	11.94	9.84
82.5	1.5041	1.4989	43.94	1.4327	11.94	9.85
82.6	1.5043	1.4992	43.99	1.4334	11.95	9.87

43 DE High Maltose Corn Syrup

Fructose: 0.0% Sucrose: 0.0%
 Dextrose: 9.0% Maltose: 43.0%
 Maltotriose: 18.0% Higher Saccharides: 30.0%
 Ash: 0.30%, DS BASIS

%DS	RI 20 °C	RI 45 °C	Be, Comm	Sp Gr Air/Air	Total Lbs/Gal	Dry Subs
			<u>140/60°F +1</u>	<u>100/60 °F</u>	<u>100 °F</u>	<u>Lbs/Gal 100 °F</u>
78.9	1.4934	1.4883	42.00	1.4063	11.72	9.25
79.0	1.4936	1.4885	42.05	1.4070	11.73	9.27
79.1	1.4939	1.4888	42.10	1.4077	11.74	9.28
79.2	1.4942	1.4891	42.15	1.4084	11.74	9.30
79.3	1.4945	1.4893	42.20	1.4090	11.75	9.32
79.4	1.4947	1.4896	42.25	1.4097	11.75	9.33
79.5	1.4950	1.4899	42.30	1.4104	11.76	9.35
79.6	1.4953	1.4901	42.35	1.4111	11.76	9.36
79.7	1.4955	1.4904	42.41	1.4118	11.77	9.38
79.8	1.4958	1.4907	42.46	1.4124	11.78	9.40
79.9	1.4961	1.4910	42.51	1.4131	11.78	9.41
80.0	1.4964	1.4912	42.56	1.4138	11.79	9.43
80.1	1.4966	1.4915	42.61	1.4145	11.79	9.45
80.2	1.4969	1.4918	42.66	1.4152	11.80	9.46
80.3	1.4972	1.4920	42.71	1.4158	11.80	9.48
80.4	1.4975	1.4923	42.76	1.4165	11.81	9.50
80.5	1.4977	1.4926	42.81	1.4172	11.82	9.51
80.6	1.4980	1.4929	42.86	1.4179	11.82	9.53
80.7	1.4983	1.4931	42.91	1.4186	11.83	9.54
80.8	1.4986	1.4934	42.96	1.4193	11.83	9.56
80.9	1.4988	1.4937	43.01	1.4199	11.84	9.58
81.0	1.4991	1.4940	43.06	1.4206	11.84	9.59
81.1	1.4994	1.4942	43.11	1.4213	11.85	9.61
81.2	1.4997	1.4945	43.16	1.4220	11.86	9.63
81.3	1.4999	1.4948	43.21	1.4227	11.86	9.64
81.4	1.5002	1.4950	43.26	1.4234	11.87	9.66
81.5	1.5005	1.4953	43.31	1.4240	11.87	9.68
81.6	1.5008	1.4956	43.36	1.4247	11.88	9.69
81.7	1.5010	1.4959	43.41	1.4254	11.88	9.71
81.8	1.5013	1.4961	43.46	1.4261	11.89	9.73
81.9	1.5016	1.4964	43.51	1.4268	11.90	9.74
82.0	1.5019	1.4967	43.56	1.4275	11.90	9.76
82.1	1.5021	1.4970	43.61	1.4282	11.91	9.78
82.2	1.5024	1.4972	43.66	1.4289	11.91	9.79
82.3	1.5027	1.4975	43.71	1.4295	11.92	9.81

82.4	1.5030	1.4978	43.76	1.4302	11.92	9.83
82.5	1.5033	1.4981	43.81	1.4309	11.93	9.84
82.6	1.5035	1.4984	43.86	1.4316	11.94	9.86
82.7	1.5038	1.4986	43.91	1.4323	11.94	9.88
82.8	1.5041	1.4989	43.96	1.4330	11.95	9.89
82.9	1.5044	1.4992	44.01	1.4337	11.95	9.91

43 DE Corn Syrup

Fructose: 0.0% Sucrose: 0

Dextrose: 19.0% Maltose: 14.0%

Maltotriose: 12.0% Higher Saccharides: 55.0%

Ash: 0.30%, DS BASIS

<u>%DS</u>	<u>RI 20 °C</u>	<u>RI 45 °C</u>	<u>Be, Comm 140/60 °F + 1</u>	<u>Sp Gr Air/Air 100/60 °F</u>	<u>Total Lbs/Gal 100 °F</u>	<u>Dry Subs Lbs/Gal 100 °F</u>
78.7	1.4933	1.4882	42.01	1.4065	11.73	9.23
78.8	1.4936	1.4885	42.06	1.4072	11.73	9.24
78.9	1.4938	1.4887	42.11	1.4079	11.74	9.26
79.0	1.4941	1.4890	42.16	1.4086	11.74	9.28
79.1	1.4944	1.4893	42.21	1.4092	11.75	9.29
79.2	1.4947	1.4895	42.26	1.4099	11.75	9.31
79.3	1.4949	1.4898	42.31	1.4106	11.76	9.33
79.4	1.4952	1.4901	42.36	1.4113	11.77	9.34
79.5	1.4955	1.4904	42.41	1.4119	11.77	9.36
79.6	1.4958	1.4906	42.46	1.4126	11.78	9.37
79.7	1.4960	1.4909	42.51	1.4133	11.78	9.39
79.8	1.4963	1.4912	42.56	1.4140	11.79	9.41
79.9	1.4966	1.4914	42.61	1.4147	11.79	9.42
80.0	1.4969	1.4917	42.66	1.4153	11.80	9.44
80.1	1.4971	1.4920	42.71	1.4160	11.81	9.46
80.2	1.4974	1.4923	42.76	1.4167	11.81	9.47
80.3	1.4977	1.4925	42.82	1.4174	11.82	9.49
80.4	1.4979	1.4928	42.87	1.4181	11.82	9.51
80.5	1.4982	1.4931	42.92	1.4187	11.83	9.52
80.6	1.4985	1.4934	42.97	1.4194	11.83	9.54
80.7	1.4988	1.4936	43.02	1.4201	11.84	9.55
80.8	1.4991	1.4939	43.07	1.4208	11.85	9.57
80.9	1.4993	1.4942	43.12	1.4215	11.85	9.59
81.0	1.4996	1.4945	43.17	1.4222	11.86	9.60
81.1	1.4999	1.4947	43.22	1.4228	11.86	9.62
81.2	1.5002	1.4950	43.27	1.4235	11.87	9.64
81.3	1.5004	1.4953	43.32	1.4242	11.87	9.65
81.4	1.5007	1.4956	43.37	1.4249	11.88	9.67
81.5	1.5010	1.4958	43.42	1.4256	11.89	9.69
81.6	1.5013	1.4961	43.47	1.4263	11.89	9.70
81.7	1.5015	1.4964	43.52	1.4269	11.90	9.72
81.8	1.5018	1.4967	43.57	1.4276	11.90	9.74
81.9	1.5021	1.4969	43.62	1.4283	11.91	9.75
82.0	1.5024	1.4972	43.67	1.4290	11.91	9.77
82.1	1.5027	1.4975	43.71	1.4297	11.92	9.79

82.2	1.5029	1.4978	43.76	1.4304	11.93	9.80
82.3	1.5032	1.4981	43.81	1.4311	11.93	9.82
82.4	1.5035	1.4983	43.86	1.4318	11.94	9.84
82.5	1.5038	1.4986	43.91	1.4324	11.94	9.85
82.6	1.5041	1.4989	43.96	1.4331	11.95	9.87
82.7	1.5043	1.4992	44.01	1.4338	11.95	9.89

43 DE Ion Exchanged Corn Syrup

Fructose: 0.0% Sucrose: 0.0%

Dextrose: 19.0% Maltose: 14.0%

Maltotriose: 12.0% Higher Saccharides: 55.0%

Ash: 0.03%, DS BASIS

<u>%DS</u>	<u>RI 20 °C</u>	<u>RI 45 °C</u>	Be, Comm <u>140/60 °F + 1</u>	Sp Gr Air/Air <u>100/60 °F</u>	Total Lbs/Gal <u>100 °F</u>	Dry Subst <u>Lbs/Gal 100 °F</u>
78.8	1.4935	1.4884	41.99	1.4063	11.72	9.24
78.9	1.4938	1.4887	42.04	1.4070	11.73	9.26
79.0	1.4941	1.4889	42.09	1.4076	11.74	9.27
79.1	1.4943	1.4892	42.14	1.4083	11.74	9.29
79.2	1.4946	1.4895	42.19	1.4090	11.75	9.30
79.3	1.4949	1.4898	42.24	1.4097	11.75	9.32
79.4	1.4951	1.4900	42.29	1.4103	11.76	9.34
79.5	1.4954	1.4903	42.34	1.4110	11.76	9.35
79.6	1.4957	1.4906	42.39	1.4117	11.77	9.37
79.7	1.4960	1.4908	42.45	1.4124	11.78	9.38
79.8	1.4962	1.4911	42.50	1.4131	11.78	9.40
79.9	1.4965	1.4914	42.55	1.4137	11.79	9.42
80.0	1.4968	1.4917	42.60	1.4144	11.79	9.43
80.1	1.4971	1.4919	42.65	1.4151	11.80	9.45
80.2	1.4973	1.4922	42.70	1.4158	11.80	9.47
80.3	1.4976	1.4925	42.75	1.4164	11.81	9.48
80.4	1.4979	1.4927	42.80	1.4171	11.81	9.50
80.5	1.4982	1.4930	42.85	1.4178	11.82	9.52
80.6	1.4984	1.4933	42.90	1.4185	11.83	9.53
80.7	1.4987	1.4936	42.95	1.4192	11.83	9.55
80.8	1.4990	1.4938	43.00	1.4198	11.84	9.56
80.9	1.4993	1.4941	43.05	1.4205	11.84	9.58
81.0	1.4995	1.4944	43.10	1.4212	11.85	9.60
81.1	1.4998	1.4947	43.15	1.4219	11.85	9.61
81.2	1.5001	1.4949	43.20	1.4226	11.86	9.63
81.3	1.5004	1.4952	43.25	1.4233	11.87	9.65
81.4	1.5006	1.4955	43.30	1.4239	11.87	9.66
81.5	1.5009	1.4958	43.35	1.4246	11.88	9.68
81.6	1.5012	1.4960	43.40	1.4253	11.88	9.70
81.7	1.5015	1.4963	43.45	1.4260	11.89	9.71
81.8	1.5018	1.4966	43.50	1.4267	11.89	9.73
81.9	1.5020	1.4969	43.55	1.4274	11.90	9.75
82.0	1.5023	1.4972	43.60	1.4281	11.91	9.76
82.1	1.5026	1.4974	43.65	1.4287	11.91	9.78
82.2	1.5029	1.4977	43.69	1.4294	11.92	9.80

82.3	1.5031	1.4980	43.74	1.4301	11.92	9.81
82.4	1.5034	1.4983	43.79	1.4308	11.93	9.83
82.5	1.5037	1.4985	43.84	1.4315	11.93	9.85
82.6	1.5040	1.4988	43.89	1.4322	11.94	9.86
82.7	1.5043	1.4991	43.94	1.4329	11.95	9.88
82.8	1.5045	1.4994	43.99	1.4336	11.95	9.90

53 DE Corn Syrup

Fructose: 0.0% Sucrose: 0.0%
 Dextrose: 28.0% Maltose: 18.0%
 Maltotriose: 13.0% Higher Saccharides: 41.0%
 Ash: 0.30%, DS BASIS

<u>%DS</u>	<u>RI 20 °C</u>	<u>RI 45 °C</u>	Be, Comm <u>140/60 °F + 1</u>	Sp Gr Air/Air <u>100/60 °F</u>	Total Lbs/Gal <u>100 °F</u>	Dry Subst Lbs/Gal <u>100 °F</u>
80.5	1.4962	1.4911	42.64	1.4150	11.80	9.50
80.6	1.4964	1.4913	42.69	1.4157	11.80	9.51
80.7	1.4967	1.4916	42.74	1.4164	11.81	9.53
80.8	1.4970	1.4919	42.79	1.4170	11.81	9.55
80.9	1.4973	1.4921	42.84	1.4177	11.82	9.56
81.0	1.4975	1.4924	42.89	1.4184	11.83	9.58
81.1	1.4978	1.4927	42.94	1.4191	11.83	9.59
81.2	1.4981	1.4930	42.99	1.4197	11.84	9.61
81.3	1.4984	1.4932	43.04	1.4204	11.84	9.63
81.4	1.4986	1.4935	43.09	1.4211	11.85	9.64
81.5	1.4989	1.4938	43.14	1.4218	11.85	9.66
81.6	1.4992	1.4940	43.19	1.4225	11.86	9.68
81.7	1.4994	1.4943	43.24	1.4231	11.87	9.69
81.8	1.4997	1.4946	43.29	1.4238	11.87	9.71
81.9	1.5000	1.4949	43.34	1.4245	11.88	9.73
82.0	1.5003	1.4951	43.39	1.4252	11.88	9.74
82.1	1.5005	1.4954	43.44	1.4259	11.89	9.76
82.2	1.5008	1.4957	43.49	1.4265	11.89	9.78
82.3	1.5011	1.4959	43.54	1.4272	11.90	9.79
82.4	1.5014	1.4962	43.59	1.4279	11.90	9.81
82.5	1.5016	1.4965	43.64	1.4286	11.91	9.83
82.6	1.5019	1.4968	43.69	1.4293	11.92	9.84
82.7	1.5022	1.4970	43.74	1.4300	11.92	9.86
82.8	1.5025	1.4973	43.79	1.4306	11.93	9.88
82.9	1.5027	1.4976	43.84	1.4313	11.93	9.89
83.0	1.5030	1.4979	43.89	1.4320	11.94	9.91
83.1	1.5033	1.4981	43.93	1.4327	11.94	9.93
83.2	1.5036	1.4984	43.98	1.4334	11.95	9.94
83.3	1.5038	1.4987	44.03	1.4341	11.96	9.96
83.4	1.5041	1.4990	44.08	1.4348	11.96	9.98
83.5	1.5044	1.4992	44.13	1.4354	11.97	9.99
83.6	1.5047	1.4995	44.18	1.4361	11.97	10.01
83.7	1.5050	1.4998	44.23	1.4368	11.98	10.03

83.8	1.5052	1.5001	44.28	1.4375	11.98	10.04
83.9	1.5055	1.5003	44.33	1.4382	11.99	10.06
84.0	1.5058	1.5006	44.38	1.4389	12.00	10.08
84.1	1.5061	1.5009	44.43	1.4396	12.00	10.09
84.2	1.5063	1.5012	44.48	1.4403	12.01	10.11
84.3	1.5066	1.5015	44.53	1.4409	12.01	10.13
84.4	1.5069	1.5017	44.58	1.4416	12.02	10.14
84.5	1.5072	1.5020	44.63	1.4423	12.02	10.16

63 DE Corn Syrup

Fructose: 0.0% Sucrose: 0.0%
 Dextrose: 36.0% Maltose: 31.0%
 Maltotriose: 13.0% Higher Saccharides: 20.0%
 Ash: 0.30%, DS BASIS

%DS	RI 20 °C	RI 45 °C	Be, Comm	Sp Gr	Total Lbs/Gal	Dry Subst
			140/60 °F + 1	Air/Air100/60 °F	100 °F	Lbs/Gal 100 °F
81.0	1.4955	1.4904	42.53	1.4133	11.78	9.54
81.1	1.4958	1.4907	42.58	1.4140	11.79	9.56
81.2	1.4961	1.4910	42.63	1.4147	11.79	9.58
81.3	1.4963	1.4912	42.68	1.4154	11.80	9.59
81.4	1.4966	1.4915	42.72	1.4160	11.81	9.61
81.5	1.4969	1.4918	42.77	1.4167	11.81	9.63
81.6	1.4972	1.4920	42.82	1.4174	11.82	9.64
81.7	1.4974	1.4923	42.87	1.4181	11.82	9.66
81.8	1.4977	1.4926	42.92	1.4187	11.83	9.68
81.9	1.4980	1.4928	42.97	1.4194	11.83	9.69
82.0	1.4982	1.4931	43.02	1.4201	11.84	9.71
82.1	1.4985	1.4934	43.07	1.4208	11.85	9.72
82.2	1.4988	1.4937	43.12	1.4214	11.85	9.74
82.3	1.4990	1.4939	43.17	1.4221	11.86	9.76
82.4	1.4993	1.4942	43.22	1.4228	11.86	9.77
82.5	1.4996	1.4945	43.27	1.4235	11.87	9.79
82.6	1.4998	1.4947	43.32	1.4241	11.87	9.81
82.7	1.5001	1.4950	43.37	1.4248	11.88	9.82
82.8	1.5004	1.4953	43.42	1.4255	11.88	9.84
82.9	1.5007	1.4955	43.47	1.4262	11.89	9.86
83.0	1.5009	1.4958	43.52	1.4269	11.90	9.87
83.1	1.5012	1.4961	43.57	1.4275	11.90	9.89
83.2	1.5015	1.4963	43.62	1.4282	11.91	9.91
83.3	1.5017	1.4966	43.67	1.4289	11.91	9.92
83.4	1.5020	1.4969	43.71	1.4296	11.92	9.94
83.5	1.5023	1.4972	43.76	1.4303	11.92	9.96
83.6	1.5026	1.4974	43.81	1.4309	11.93	9.97
83.7	1.5028	1.4977	43.86	1.4316	11.94	9.99
83.8	1.5031	1.4980	43.91	1.4323	11.94	10.01
83.9	1.5034	1.4982	43.96	1.4330	11.95	10.02
84.0	1.5037	1.4985	44.01	1.4337	11.95	10.04
84.1	1.5039	1.4988	44.06	1.4344	11.96	10.06
84.2	1.5042	1.4991	44.11	1.4350	11.96	10.07
84.3	1.5045	1.4993	44.16	4.4357	11.97	10.09

84.4	1.5048	1.4996	44.21	1.4364	11.98	10.11
84.5	1.5050	1.4999	44.26	1.4371	11.98	10.12
84.6	1.5053	1.5002	44.31	1.4378	11.99	10.14
84.7	1.5056	1.5004	44.35	1.4385	11.99	10.16
84.8	1.5058	1.5007	44.40	1.4391	12.00	10.17
84.9	1.5061	1.5010	44.45	1.4398	12.00	10.19
85.0	1.5064	1.5012	44.50	1.4405	12.01	10.21

63 DE Ion Exchanged Corn Syrup

Fructose: 0.0% Sucrose: 0.0%
 Dextrose: 36.0% Maltose: 31.0%
 Maltotriose: 13.0% Higher Saccharides: 20.0%
 Ash: 0.03%, DS BASIS

<u>%DS</u>	<u>RI 20 °C</u>	<u>RI 45 °C</u>	<u>Be, Comm 140/60 °F + 1</u>	<u>Sp Gr Air/Air 100/60 °F</u>	<u>Total Lbs/Gal 100 °F</u>	<u>Dry Subst Lbs/Gal 100 °F</u>
81.3	1.4963	1.4912	42.60	1.4144	11.79	9.59
81.4	1.4966	1.4914	42.65	1.4151	11.80	9.60
81.5	1.4968	1.4917	42.70	1.4158	11.80	9.62
81.6	1.4971	1.4920	42.75	1.4164	11.81	9.64
81.7	1.4974	1.4922	42.80	1.4171	11.81	9.65
81.8	1.4976	1.4925	42.85	1.4178	11.82	9.67
81.9	1.4979	1.4928	42.90	1.4184	11.83	9.69
82.0	1.4982	1.4930	42.95	1.4191	11.83	9.70
82.1	1.4984	1.4933	43.00	1.4198	11.84	9.72
82.2	1.4987	1.4936	43.05	1.4205	11.84	9.73
82.3	1.4990	1.4939	43.10	1.4211	11.85	9.75
82.4	1.4992	1.4941	43.15	1.4218	11.85	9.77
82.5	1.4995	1.4944	43.20	1.4225	11.86	9.78
82.6	1.4998	1.4947	43.25	1.4232	11.87	9.80
82.7	1.5000	1.4949	43.30	1.4238	11.87	9.82
82.8	1.5003	1.4952	43.35	1.4245	11.88	9.83
82.9	1.5006	1.4955	43.40	1.4252	11.88	9.85
83.0	1.5009	1.4957	43.45	1.4259	11.89	9.87
83.1	1.5011	1.4960	43.49	1.4266	11.89	9.88
83.2	1.5014	1.4963	43.54	1.4272	11.90	9.90
83.3	1.5017	1.4965	43.59	1.4279	11.90	9.92
83.4	1.5019	1.4968	43.64	1.4286	11.91	9.93
83.5	1.5022	1.4971	43.69	1.4293	11.92	9.95
83.6	1.5025	1.4974	43.74	1.4300	11.92	9.97
83.7	1.5028	1.4976	43.79	1.4306	11.93	9.98
83.8	1.5030	1.4979	43.84	1.4313	11.93	10.00
83.9	1.5033	1.4982	43.89	1.4320	11.94	10.02
84.0	1.5036	1.4984	43.94	1.4327	11.94	10.03
84.1	1.5039	1.4987	43.99	1.4334	11.95	10.05
84.2	1.5041	1.4990	44.04	1.4340	11.96	10.07
84.3	1.5044	1.4993	44.09	1.4347	11.96	10.08
84.4	1.5047	1.4995	44.14	1.4354	11.97	10.10
84.5	1.5050	1.4998	44.18	1.4361	11.97	10.12
84.6	1.5052	1.5001	44.23	1.4368	11.98	10.13

84.7	1.5055	1.5004	44.28	1.4375	11.98	10.15
84.8	1.5058	1.5006	44.33	1.4381	11.99	10.17
84.9	1.5061	1.5009	44.38	1.4388	12.00	10.18
85.0	1.5063	1.5012	44.43	1.4395	12.00	10.20
85.1	1.5066	1.5014	44.48	1.4402	12.01	10.22
85.2	1.5069	1.5017	44.53	1.4409	12.01	10.24
85.3	1.5072	1.5020	44.58	1.4416	12.02	10.25

66 DE Corn Syrup

Fructose: 0.0% Sucrose: 0.0%
 Dextrose: 40.0% Maltose: 35.0%
 Maltotriose: 8.0% Higher Saccharides: 17.0%
 Ash: 0.30%, DS BASIS

<u>%DS</u>	<u>RI 20 °C</u>	<u>RI 45 °C</u>	<u>Be, Comm 140/60 °F + 1</u>	<u>Sp Gr Air/Air 100/60 °F</u>	<u>Total Lbs/Gal 100 °F</u>	<u>Dry Subst Lbs/Gal 100 °F</u>
81.0	1.4949	1.4898	42.36	1.4111	11.76	9.53
81.1	1.4951	1.4900	42.41	1.4118	11.77	9.55
81.2	1.4954	1.4903	42.46	1.4124	11.78	9.56
81.3	1.4957	1.4906	42.51	1.4131	11.78	9.58
81.4	1.4959	1.4908	42.56	1.4138	11.79	9.59
81.5	1.4962	1.4911	42.61	1.4145	11.79	9.61
81.6	1.4965	1.4914	42.66	1.4151	11.80	9.63
81.7	1.4967	1.4916	42.71	1.4158	11.80	9.64
81.8	1.4970	1.4919	42.76	1.4165	11.81	9.66
81.9	1.4973	1.4922	42.81	1.4172	11.82	9.68
82.0	1.4975	1.4924	42.86	1.4178	11.82	9.69
82.1	1.4978	1.4927	42.91	1.4185	11.83	9.71
82.2	1.4981	1.4930	42.96	1.4192	11.83	9.73
82.3	1.4983	1.4932	43.01	1.4199	11.84	9.74
82.4	1.4986	1.4935	43.06	1.4205	11.84	9.76
82.5	1.4989	1.4938	43.11	1.4212	11.85	9.78
82.6	1.4991	1.4940	43.16	1.4219	11.85	9.79
82.7	1.4994	1.4943	43.21	1.4226	11.86	9.81
82.8	1.4997	1.4946	43.26	1.4233	11.87	9.83
82.9	1.4999	1.4948	43.31	1.4239	11.87	9.84
83.0	1.5002	1.4951	43.36	1.4246	11.88	9.86
83.1	1.5005	1.4954	43.41	1.4253	11.88	9.87
83.2	1.5008	1.4956	43.46	1.4260	11.89	9.89
83.3	1.5010	1.4959	43.50	1.4267	11.89	9.91
83.4	1.5013	1.4962	43.55	1.4273	11.90	9.92
83.5	1.5016	1.4964	43.60	1.4280	11.91	9.94
83.6	1.5018	1.4967	43.65	1.4287	11.91	9.96
83.7	1.5021	1.4970	43.70	1.4294	11.92	9.97
83.8	1.5024	1.4972	43.75	1.4301	11.92	9.99
83.9	1.5026	1.4975	43.80	1.4308	11.93	10.01
84.0	1.5029	1.4978	43.85	1.4314	11.93	10.02
84.1	1.5032	1.4981	43.90	1.4321	11.94	10.04
84.2	1.5035	1.4983	43.95	1.4328	11.95	10.06
84.3	1.5037	1.4986	44.00	1.4335	11.95	10.07

84.4	1.5040	1.4989	44.05	1.4342	11.96	10.09
84.5	1.5043	1.4991	44.10	1.4349	11.96	10.11
84.6	1.5046	1.4994	44.15	1.4355	11.97	10.13
84.7	1.5048	1.4997	44.20	1.4362	11.97	10.14
84.8	1.5051	1.5000	44.25	1.4369	11.98	10.16
84.9	1.5054	1.5002	44.30	1.4376	11.99	10.18
85.0	1.5056	1.5005	44.35	1.4383	11.99	10.19

95 DE Corn Syrup

Fructose: 0.0% Sucrose: 0.0%
 Dextrose: 95.0% Maltose: 3.0%
 Maltotriose: 0.5% Higher Saccharides: 1.5%
 Ash: 0.30%, DS BASIS

<u>%DS</u>	<u>RI 20 °C</u>	<u>RI 45 °C</u>	<u>Be, Comm 140/60 °F + 1</u>	<u>Sp Gr Air/Air 100/60 °F</u>	<u>TOTAL Lbs/Gal 100 °F</u>	<u>DRY SUB LBS/GAL 100 °F</u>
69.0	1.4598	1.4550	35.46	1.3237	11.04	7.61
69.1	1.4600	1.4552	35.51	1.3243	11.04	7.63
69.2	1.4602	1.4554	35.56	1.3249	11.05	7.64
69.3	1.4605	1.4556	35.61	1.3255	11.05	7.66
69.4	1.4607	1.4559	35.66	1.3261	11.06	7.67
69.5	1.4609	1.4561	35.71	1.3267	11.06	7.69
69.6	1.4612	1.4563	35.76	1.3273	11.07	7.70
69.7	1.4614	1.4566	35.81	1.3279	11.07	7.72
69.8	1.4616	1.4568	35.86	1.3285	11.08	7.73
69.9	1.4619	1.4570	35.91	1.3291	11.08	7.75
70.0	1.4621	1.4573	35.96	1.3297	11.09	7.76
70.1	1.4623	1.4575	36.01	1.3303	11.09	7.77
70.2	1.4626	1.4577	36.06	1.3309	11.10	7.79
70.3	1.4628	1.4580	36.11	1.3315	11.10	7.80
70.4	1.4630	1.4582	36.16	1.3321	11.11	7.82
70.5	1.4633	1.4584	36.21	1.3327	11.11	7.83
70.6	1.4635	1.4587	36.26	1.3333	11.12	7.85
70.7	1.4637	1.4589	36.31	1.3339	11.12	7.86
70.8	1.4640	1.4591	36.36	1.3345	11.13	7.88
70.9	1.4642	1.4594	36.41	1.3351	11.13	7.89
71.0	1.4644	1.4596	36.46	1.3357	11.14	7.91
71.1	1.4647	1.4598	36.51	1.3363	11.14	7.92
71.2	1.4649	1.4601	36.56	1.3369	11.15	7.94
71.3	1.4651	1.4603	36.61	1.3375	11.15	7.95
71.4	1.4654	1.4605	36.66	1.3381	11.16	7.97
71.5	1.4656	1.4608	36.71	1.3387	11.16	7.98
71.6	1.4658	1.4610	36.76	1.3393	11.17	7.99
71.7	1.4661	1.4612	36.81	1.3399	11.17	8.01
71.8	1.4663	1.4615	36.86	1.3405	11.18	8.02
71.9	1.4666	1.4617	36.91	1.3411	11.18	8.04
72.0	1.4668	1.4619	36.96	1.3417	11.19	8.05
72.1	1.4670	1.4622	37.00	1.3423	11.19	8.07
72.2	1.4673	1.4624	37.05	1.3429	11.20	8.08

72.3	1.4675	1.4626	37.10	1.3435	11.20	8.10
72.4	1.4677	1.4629	37.15	1.3441	11.21	8.11
72.5	1.4680	1.4631	37.20	1.3447	11.21	8.13
72.6	1.4682	1.4633	37.25	1.3453	11.22	8.14
72.7	1.4685	1.4636	37.30	1.3459	11.22	8.16
72.8	1.4687	1.4638	37.35	1.3466	11.23	8.17
72.9	1.4689	1.4640	37.40	1.3472	11.23	8.19
73.0	1.4692	1.4643	37.45	1.3478	11.24	8.20

95 DE Ion Exchanged Corn Syrup

Fructose: 0.0% Sucrose: 0.0%
 Dextrose: 95.0% Maltose: 3.0%
 Maltotriose: 0.5% Higher Saccharides: 1.5%
 Ash: 0.03%, DS BASIS

<u>%DS</u>	<u>RI 20 °C</u>	<u>RI 45 °C</u>	<u>Be, Comm 140/60 °F + 1</u>	<u>Sp Gr Air/Air 100/60 °F</u>	<u>Total Lbs/Gal 100 °F</u>	<u>Dry Subst Lbs/Gal 100 °F</u>
69.0	1.4597	1.4549	35.39	1.3229	11.03	7.61
69.1	1.4600	1.4551	35.44	1.3235	11.03	7.62
69.2	1.4602	1.4554	35.49	1.3241	11.04	7.64
69.3	1.4604	1.4556	35.54	1.3247	11.04	7.65
69.4	1.4606	1.4558	35.59	1.3253	11.05	7.67
69.5	1.4609	1.4561	35.64	1.3259	11.05	7.68
69.6	1.4611	1.4563	35.69	1.3265	11.06	7.70
69.7	1.4613	1.4565	35.74	1.3271	11.06	7.71
69.8	1.4616	1.4567	35.79	1.3277	11.07	7.73
69.9	1.4618	1.4570	35.84	1.3283	11.07	7.74
70.0	1.4620	1.4572	35.89	1.3288	11.08	7.76
70.1	1.4623	1.4574	35.94	1.3294	11.08	7.77
70.2	1.4625	1.4577	35.99	1.3300	11.09	7.78
70.3	1.4627	1.4579	36.04	1.3306	11.09	7.80
70.4	1.4630	1.4581	36.09	1.3312	11.10	7.81
70.5	1.4632	1.4584	36.14	1.3318	11.10	7.83
70.6	1.4634	1.4586	36.19	1.3324	11.11	7.84
70.7	1.4637	1.4588	36.24	1.3330	11.11	7.86
70.8	1.4639	1.4591	36.29	1.3336	11.12	7.87
70.9	1.4642	1.4593	36.34	1.3342	11.12	7.89
71.0	1.4644	1.4595	36.39	1.3348	11.13	7.90
71.1	1.4646	1.4598	36.44	1.3354	11.13	7.92
71.2	1.4649	1.4600	36.49	1.3360	11.14	7.93
71.3	1.4651	1.4602	36.54	1.3366	11.14	7.95
71.4	1.4653	1.4605	36.59	1.3372	11.15	7.96
71.5	1.4656	1.4607	36.64	1.3378	11.15	7.98
71.6	1.4658	1.4609	36.69	1.3384	11.16	7.99
71.7	1.4660	1.4612	36.74	1.3390	11.16	8.00
71.8	1.4663	1.4614	36.79	1.3397	11.17	8.02
71.9	1.4665	1.4616	36.84	1.3403	11.17	8.03
72.0	1.4667	1.4619	36.89	1.3409	11.18	8.05
72.1	1.4670	1.4621	36.94	1.3415	11.18	8.06
72.2	1.4672	1.4623	36.98	1.3421	11.19	8.08

72.3	1.4674	1.4626	37.03	1.3427	11.19	8.09
72.4	1.4677	1.4628	37.08	1.3433	11.20	8.11
72.5	1.4679	1.4631	37.13	1.3439	11.20	8.12
72.6	1.4682	1.4633	37.18	1.3445	11.21	8.14
72.7	1.4684	1.4635	37.23	1.3451	11.21	8.15
72.8	1.4686	1.4638	37.28	1.3457	11.22	8.17
72.9	1.4689	1.4640	37.33	1.3463	11.22	8.18
73.0	1.4691	1.4642	37.38	1.3469	11.23	8.20

High Fructose Corn Syrup 42

Fructose: 42.5% Sucrose: 0.0%
 Dextrose: 52.5% Maltose: 3.0%
 Maltotriose: 0.7% Higher Saccharides: 1.3%
 Ash: 0.30%, DS BASIS

<u>%DS</u>	<u>RI 20 °C</u>	<u>RI 45 °C</u>	<u>SP G Air/Air 100/60 °F</u>	<u>Total Lbs/Gal 100 °F</u>	<u>Dry Subst Lbs/Gal 100 °F</u>
69.0	1.4597	1.4543	1.3252	11.05	7.62
69.1	1.4599	1.4545	1.3258	11.05	7.64
69.2	1.4601	1.4547	1.3264	11.06	7.65
69.3	1.4604	1.4549	1.3270	11.06	7.67
69.4	1.4606	1.4552	1.3276	11.07	7.68
69.5	1.4608	1.4554	1.3282	11.07	7.70
69.6	1.4611	1.4556	1.3288	11.08	7.71
69.7	1.4613	1.4559	1.3294	11.08	7.73
69.8	1.4615	1.4561	1.3300	11.09	7.74
69.9	1.4618	1.4563	1.3306	11.09	7.75
70.0	1.4620	1.4565	1.3312	11.10	7.77
70.1	1.4622	1.4568	1.3318	11.10	7.78
70.2	1.4625	1.4570	1.3324	11.11	7.80
70.3	1.4627	1.4572	1.3330	11.11	7.81
70.4	1.4629	1.4575	1.3336	11.12	7.83
70.5	1.4632	1.4577	1.3342	11.12	7.84
70.6	1.4634	1.4579	1.3348	11.13	7.86
70.7	1.4636	1.4582	1.3354	11.13	7.87
70.8	1.4639	1.4584	1.3360	11.14	7.89
70.9	1.4641	1.4586	1.3366	11.14	7.90
71.0	1.4643	1.4589	1.3372	11.15	7.92
71.1	1.4646	1.4591	1.3378	11.15	7.93
71.2	1.4648	1.4593	1.3384	11.16	7.94
71.3	1.4650	1.4596	1.3390	11.16	7.96
71.4	1.4653	1.4598	1.3396	11.17	7.97
71.5	1.4655	1.4600	1.3402	11.17	7.99
71.6	1.4657	1.4602	1.3408	11.18	8.00
71.7	1.4660	1.4605	1.3414	11.18	8.02
71.8	1.4662	1.4607	1.3420	11.19	8.03
71.9	1.4665	1.4609	1.3426	11.19	8.05
72.0	1.4667	1.4612	1.3432	11.20	8.06
72.1	1.4669	1.4614	1.3438	11.20	8.08
72.2	1.4672	1.4616	1.3445	11.21	8.09
72.3	1.4674	1.4619	1.3451	11.21	8.11

72.4	1.4676	1.4621	1.3457	11.22	8.12
72.5	1.4679	1.4623	1.3463	11.22	8.14
72.6	1.4681	1.4626	1.3469	11.23	8.15
72.7	1.4683	1.4628	1.3475	11.23	8.17
72.8	1.4686	1.4631	1.3481	11.24	8.18
72.9	1.4688	1.4633	1.3487	11.24	8.20
73.0	1.4691	1.4635	1.3493	11.25	8.21

High Fructose Corn Syrup 55

Fructose: 55.4% Sucrose: 0.0%
 Dextrose: 40.3% Maltose: 3.0%
 Maltotriose: 0.4% Higher Saccharides: 0.9%
 Ash: 0.05%, DS BASIS

<u>%DS</u>	<u>RI 20 °C</u>	<u>RI 45 °C</u>	<u>Sp Gr Air/Air 100/60 °F</u>	<u>Total Lbs/Gal 100 °F</u>	<u>Dry Subst Lbs/Gal 100 °F</u>
75.0	1.4738	1.4680	1.3622	11.36	8.52
75.1	1.4740	1.4682	1.3628	11.36	8.53
75.2	1.4743	1.4685	1.3634	11.37	8.55
75.3	1.4745	1.4687	1.3640	11.37	8.56
75.4	1.4747	1.4689	1.3646	11.38	8.58
75.5	1.4750	1.4692	1.3653	11.38	8.59
75.6	1.4752	1.4694	1.3659	11.39	8.61
75.7	1.4755	1.4697	1.3665	11.39	8.62
75.8	1.4757	1.4699	1.3671	11.40	8.64
75.9	1.4759	1.4701	1.3678	11.40	8.66
76.0	1.4762	1.4704	1.3684	11.41	8.67
76.1	1.4764	1.4706	1.3690	11.41	8.69
76.2	1.4767	1.4708	1.3696	11.42	8.70
76.3	1.4769	1.4711	1.3702	11.42	8.72
76.4	1.4772	1.4713	1.3709	11.43	8.73
76.5	1.4774	1.4716	1.3715	11.43	8.75
76.6	1.4776	1.4718	1.3721	11.44	8.76
76.7	1.4779	1.4720	1.3727	11.44	8.78
76.8	1.4781	1.4723	1.3734	11.45	8.79
76.9	1.4784	1.4725	1.3740	11.46	8.81
77.0	1.4786	1.4728	1.3746	11.46	8.82
77.1	1.4789	1.4730	1.3752	11.47	8.84
77.2	1.4791	1.4733	1.3759	11.47	8.86
77.3	1.4794	1.4735	1.3765	11.48	8.87
77.4	1.4796	1.4737	1.3771	11.48	8.89
77.5	1.4798	1.4740	1.3777	11.49	8.90
77.6	1.4801	1.4742	1.3784	11.49	8.92
77.7	1.4803	1.4745	1.3790	11.50	8.93
77.8	1.4806	1.4747	1.3796	11.50	8.95
77.9	1.4808	1.4749	1.3803	11.51	8.96
78.0	1.4811	1.4752	1.3809	11.51	8.98
78.1	1.4813	1.4754	1.3815	11.52	9.00
78.2	1.4816	1.4757	1.3821	11.52	9.01
78.3	1.4818	1.4759	1.3828	11.53	9.03

78.4	1.4820	1.4762	1.3834	11.53	9.04
78.5	1.4823	1.4764	1.3840	11.54	9.06
78.6	1.4825	1.4766	1.3847	11.54	9.07
78.7	1.4828	1.4769	1.3853	11.55	9.09
78.8	1.4830	1.4771	1.3859	11.55	9.11
78.9	1.4833	1.4774	1.3866	11.56	9.12
79.0	1.4835	1.4776	1.3872	11.57	9.14

Temperature/Ash Correction Factors

FACTORS FOR APPROXIMATE CALCULATION OF REFRACTIVE INDEX AT TEMPERATURES FROM 10 TO 70 °C*

<u>T °C</u>	<u>Water</u>	<u>28 to 95 DE Syrups</u>	<u>HFCS</u>	<u>Maltodextrin</u>
10	0.000716	0.002260	0.002590	0.002300
12	0.000605	0.001808	0.002072	0.001840
14	0.000477	0.001356	0.001554	0.001380
16	0.000333	0.000904	0.001036	0.000920
18	0.000174	0.000452	0.000518	0.000460
20	0.000000	0.000000	0.000000	0.000000
22	-0.000187	-0.000452	-0.000518	-0.000460
24	-0.000389	-0.000904	-0.001036	-0.000920
26	-0.000603	-0.001356	-0.001554	-0.001380
28	-0.000829	-0.001808	-0.002072	-0.001840
30	-0.001068	-0.002260	-0.002590	-0.002300
32	-0.001318	-0.002712	-0.003108	-0.002760
34	-0.001579	-0.003164	-0.003625	-0.003220
36	-0.001850	-0.003616	-0.004144	-0.003680
38	-0.002133	-0.004068	-0.004662	-0.004140
40	-0.002425	-0.004520	-0.005180	-0.004600
42	-0.002727	-0.004972	-0.005698	-0.005060
44	-0.003039	-0.005424	-0.006216	-0.005520
46	-0.003360	-0.005876	-0.006734	-0.005980
48	-0.003690	-0.006328	-0.007251	-0.006440
50	-0.004029	-0.006780	-0.007770	-0.006900
52	-0.004377	-0.007232	-0.008288	-0.007360
54	-0.004734	-0.007684	-0.008806	-0.007820
56	-0.005099	-0.008136	-0.009324	-0.008280
58	-0.005472	-0.008588	-0.009842	-0.008740
60	-0.005853	-0.009040	-0.010360	-0.009200
62	-0.006331	-0.009492	-0.010878	-0.009660
64	-0.006760	-0.009944	-0.011396	-0.010120
66	-0.007168	-0.010396	-0.011914	-0.010580
68	-0.007586	-0.010848	-0.012432	-0.011040
70	-0.008035	-0.011300	-0.012949	-0.011500

*The approximate refractive index change with temperature can be represented as the sum of the water effect and the solids effect as:

$$n_D^t = n_D^{20} + F_w(1-s) + F_s(s)$$

where

s = percent dry substance/100

F_w = water factor from table

F_s = solids factor from table, appropriate to the product type

Exact refractive index at any temperature can be calculated from Equation 1, but this is a tedious procedure. This table is presented as a convenient alternative.

Refractive Index Ash and D.E. Corrections

Dry Subst. %	Change in n_D for an increase of:		Dry subst. %	Change in n_D for an increase of:	
	<u>1% Ash</u>	<u>1 D.E.</u>		<u>1% Ash</u>	<u>1 D.E.</u>
1	0.000000	-0.000000	41	0.000058	-0.000064
2	0.000000	-0.000001	42	0.000061	-0.000066
3	0.000000	-0.000002	43	0.000064	-0.000068
4	0.000000	-0.000003	44	0.000068	-0.000071
5	0.000000	-0.000004	45	0.000071	-0.000073
6	0.000001	-0.000005	46	0.000074	-0.000076
7	0.000001	-0.000006	47	0.000078	-0.000079
8	0.000002	-0.000007	48	0.000082	-0.000081
9	0.000002	-0.000009	49	0.000085	-0.000084
10	0.000003	-0.000010	50	0.000089	-0.000087
11	0.000003	-0.000011	51	0.000093	-0.000090
12	0.000004	-0.000012	52	0.000097	-0.000093
13	0.000005	-0.000013	53	0.000101	-0.000096
14	0.000006	-0.000015	54	0.000105	-0.000099
15	0.000007	-0.000016	55	0.000110	-0.000102
16	0.000008	-0.000017	56	0.000114	-0.000105
17	0.000009	-0.000019	57	0.000119	-0.000108
18	0.000010	-0.000020	58	0.000123	-0.000112
19	0.000011	-0.000022	59	0.000128	-0.000115
20	0.000013	-0.000023	60	0.000133	-0.000118
21	0.000014	-0.000025	61	0.000138	-0.000122
22	0.000016	-0.000026	62	0.000143	-0.000125
23	0.000017	-0.000028	63	0.000148	-0.000129
24	0.000019	-0.000029	64	0.000153	-0.000132
25	0.000020	-0.000031	65	0.000158	-0.000136
26	0.000022	-0.000033	66	0.000164	-0.000140
27	0.000024	-0.000034	67	0.000169	-0.000144
28	0.000026	-0.000036	68	0.000175	-0.000147

29	0.000028	-0.000038	69	0.000181	-0.000151
30	0.000030	-0.000040	70	0.000187	-0.000155
31	0.000032	-0.000042	71	0.000193	-0.000159
32	0.000034	-0.000044	72	0.000199	-0.000163
33	0.000037	-0.000046	73	0.000206	-0.000168
34	0.000039	-0.000048	74	0.000212	-0.000172
35	0.000042	-0.000050	75	0.000219	-0.000176
36	0.000044	-0.000052	76	0.000225	-0.000181
37	0.000047	-0.000054	77	0.000232	-0.000185
38	0.000049	-0.000057	78	0.000239	-0.000190
39	0.000052	-0.000059	79	0.000246	-0.000194
40	0.000055	-0.000061	80	0.000253	-0.000199
			81	0.000261	-0.000204
			82	0.000268	-0.000208
			83	0.000276	-0.000213
			84	0.000283	-0.000218
			85	0.000291	-0.000223

Refractive Index Commercial Baume * For Corn Sugar Syrups (Expanded)

	Dextrose	Equivalent - Ash		
	82.0	89.0	82.0	89.0
	0.41	0.61	0.41	0.61
Comm'l. Be.	<u>45 °C. (113 °F.)</u>		<u>20 °C. (68 °F.)</u>	
40.0	1.4762	1.4760	1.4810	1.4808
40.1	1.4767	1.4765	1.4815	1.4813
40.2	1.4772	1.4770	1.4820	1.4818
40.3	1.4777	1.4775	1.4826	1.4823
40.4	1.4782	1.4780	1.4831	1.4828
40.5	1.4787	1.4785	1.4836	1.4833
40.6	1.4793	1.4791	1.4841	1.4839
40.7	1.4798	1.4796	1.4846	1.4844
40.8	1.4803	1.4801	1.4852	1.4849
40.9	1.4808	1.4806	1.4857	1.4854
41.0	1.4813	1.4811	1.4862	1.4859
41.1	1.4818	1.4816	1.4867	1.4864
41.2	1.4823	1.4821	1.4872	1.4869
41.3	1.4829	1.4827	1.4877	1.4875
41.4	1.4834	1.4832	1.4882	1.4880
41.5	1.4839	1.4837	1.4887	1.4885
41.6	1.4844	1.4842	1.4893	1.4890

41.7	1.4849	1.4847	1.4898	1.4895
41.8	1.4855	1.4853	1.4903	1.4901
41.9	1.4860	1.4858	1.4908	1.4906
42.0	1.4865	1.4863	1.4913	1.4911
42.1	1.4870	1.4868	1.4918	1.4916
42.2	1.4876	1.4874	1.4924	1.4922
42.3	1.4881	1.4879	1.4929	1.4927
42.4	1.4887	1.4884	1.4935	1.4933
42.5	1.4892	1.4889	1.4940	1.4938
42.6	1.4897	1.4895	1.4945	1.4943
42.7	1.4903	1.4900	1.4951	1.4949
42.8	1.4908	1.4905	1.4956	1.4954
42.9	1.4914	1.4911	1.4962	1.4960
43.0	1.4919	1.4916	1.4967	1.4965
43.1	1.4924	1.4921	1.4972	1.4970
43.2	1.4930	1.4927	1.4978	1.4976
43.3	1.4935	1.4932	1.4983	1.4981
43.4	1.4941	1.4938	1.4989	1.4987
43.5	1.4946	1.4943	1.4994	1.4992
43.6	1.4951	1.4949	1.5000	1.4998
43.7	1.4957	1.4954	1.5005	1.5003
43.8	1.4962	1.4960	1.5011	1.5009
43.9	1.4968	1.4965	1.5016	1.5014
44.0	1.4973	1.4971	1.5022	1.5020
44.1	1.4979	1.4977	1.5027	1.5025
44.2	1.4984	1.4982	1.5033	1.5031
44.3	1.4990	1.4988	1.5038	1.5036
44.4	1.4995	1.4993	1.5044	1.5042
44.5	1.5001	1.4999	1.5049	1.5047
44.6	1.5007	1.5005	1.5055	1.5053
44.7	1.5012	1.5010	1.5060	1.5058
44.8	1.5018	1.5016	1.5066	1.5064
44.9	1.5023	1.5021	1.5071	1.5069
45.0	1.5029	1.5027	1.5077	1.5075
45.1	1.5035	1.5033	1.5083	1.5081
45.2	1.5040	1.5038	1.5089	1.5086
45.3	1.5046	1.5044	1.5094	1.5092
45.4	1.5051	1.5049	1.5100	1.5098
45.5	1.5057	1.5055	1.5106	1.5103
45.6	1.5063	1.5061	1.5112	1.5109
45.7	1.5068	1.5066	1.5118	1.5115
45.8	1.5074	1.5072	1.5123	1.5121
45.9	1.5079	1.5077	1.5129	1.5126

46.0	1.5085	1.5083	1.5135	1.5132
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* J. E. Cleland, J. W. Evans, E. E. Fauser and W. r. Fetzer Anal. E. Ind. and Eng. Chem. Vol. 16, Page 161, March 15, 1944

Colligative Properties of Corn Syrups and Corn Sugars

Thermal Conductivity of 18 and 43 Baume' Corn Syrups

Provisional Data

18 Be. 140/60 + 1 C. S. U., 33.61% D. S., 42 D. E. unmixed

<u>Temp. °F.</u>	<u>Therm. Cond. (BTU/ft²/°F./hr., ft.)</u>
32	.267
60	.280
100	.296
140	.308
180	.319

43 Be Acid-Enzyme Converted and Acid Converted Corn Syrup

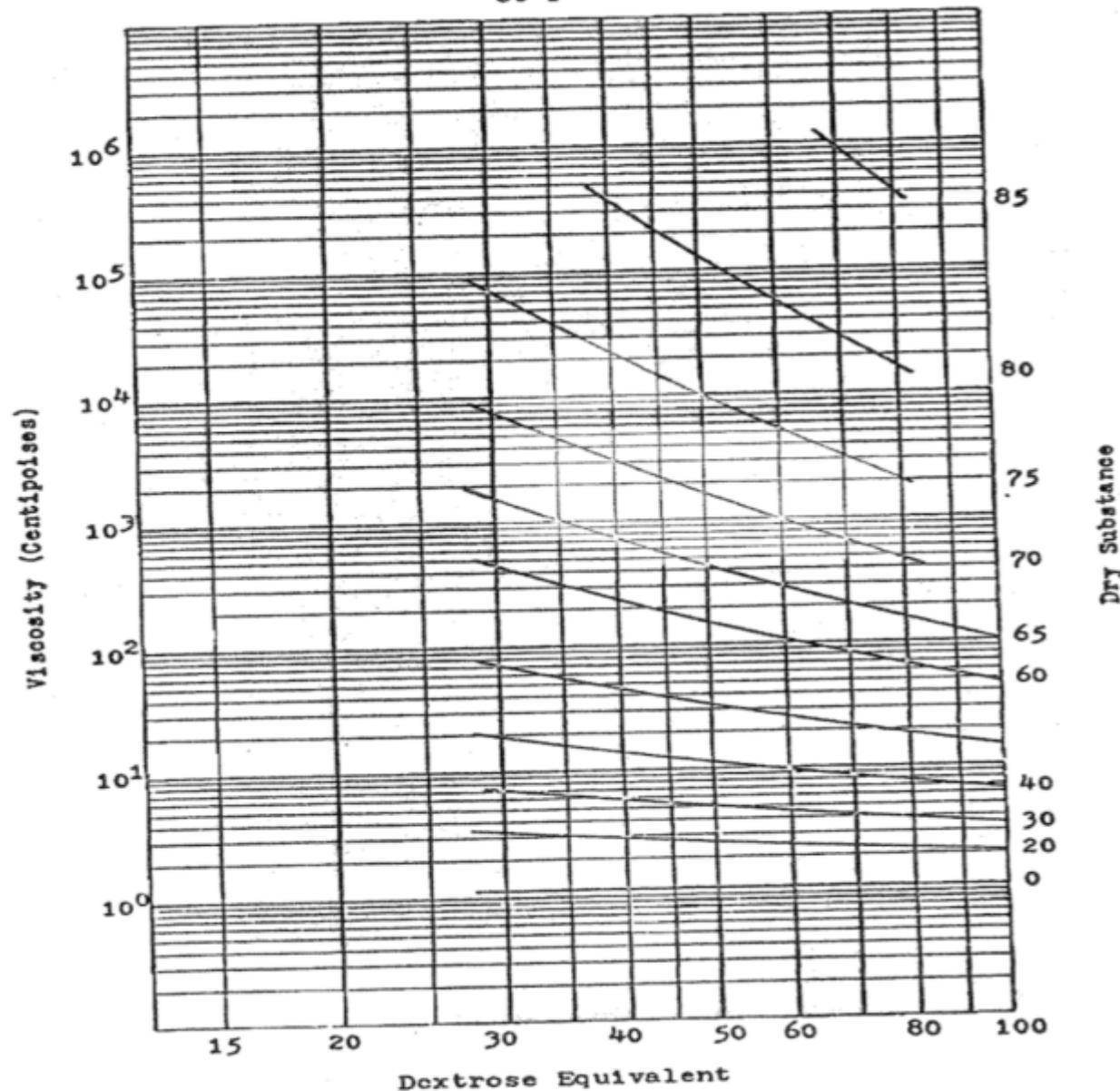
<u>Temp. °F.</u>	<u>43 Be Acid-Enzyme C. S. U.</u>	<u>43 Be Acid Conv. C. S. U.</u>
32	.182	.185
40	.185	.188
60	.191	.194
80	.197	.200
100	.202	.205
120	.207	.210
140	.211	.214
160	.215	.218
180	.218	.221

Calculations based on Riedel, Chem. Ing. Tecknik. 21: 340-1 (1949) for sucrose and dextrose.

(1) D. W. Hansen, A. E. Staley Mfg. Co. (1951)

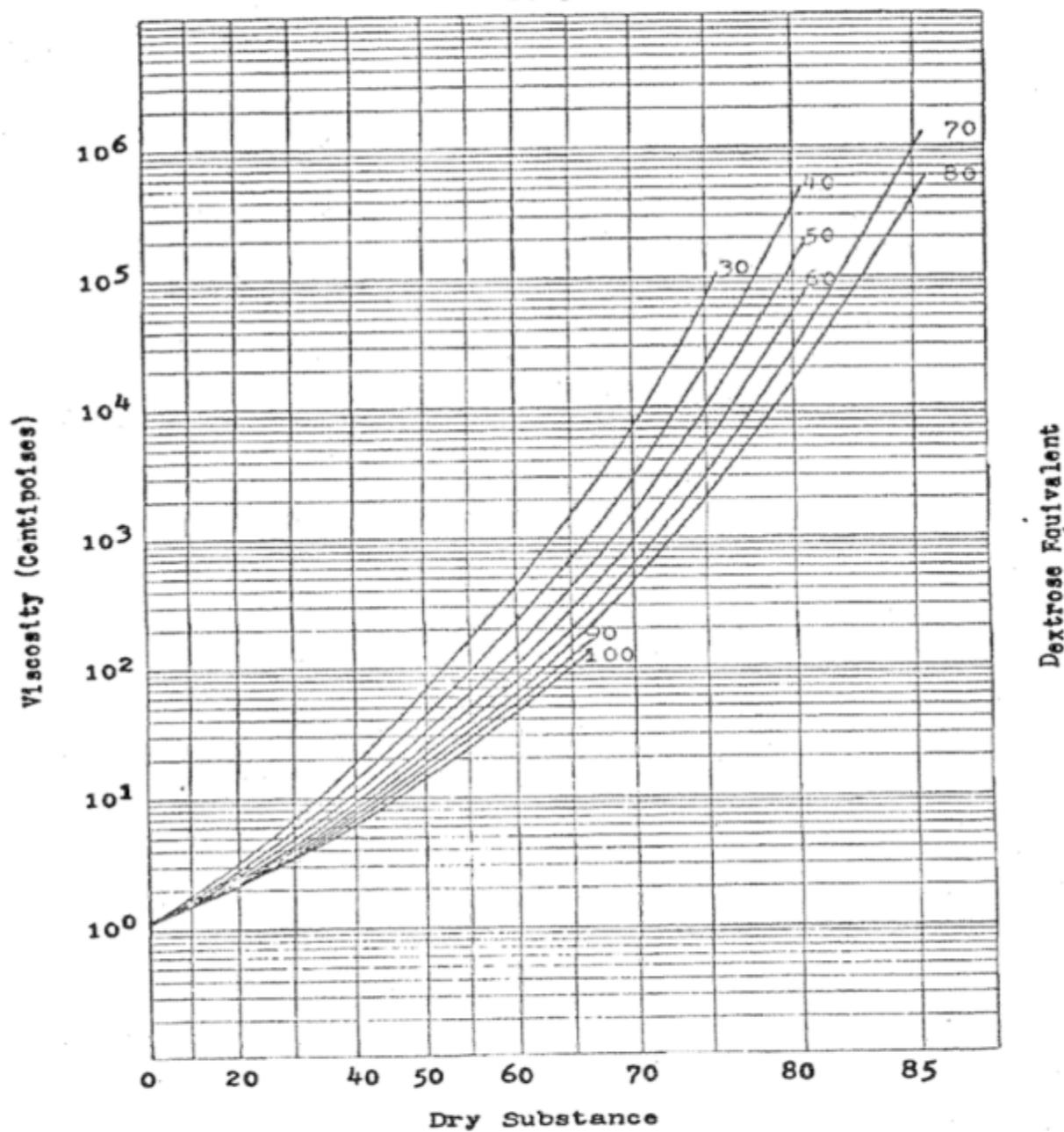
CORN STARCH HYDROLYZATE - VISCOSITY

60°F



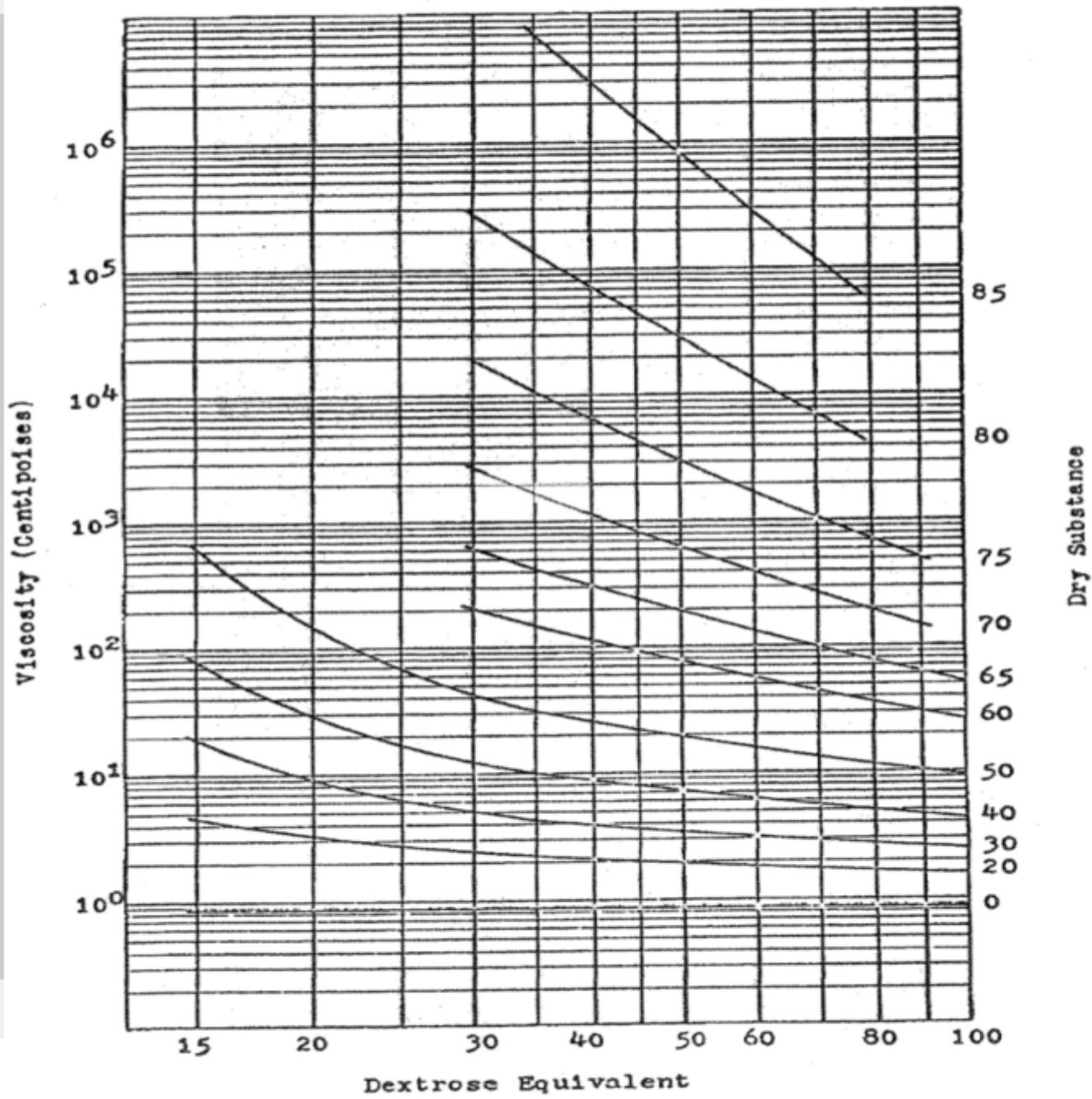
CORN STARCH HYDROLYZATE - VISCOSITY

60°F



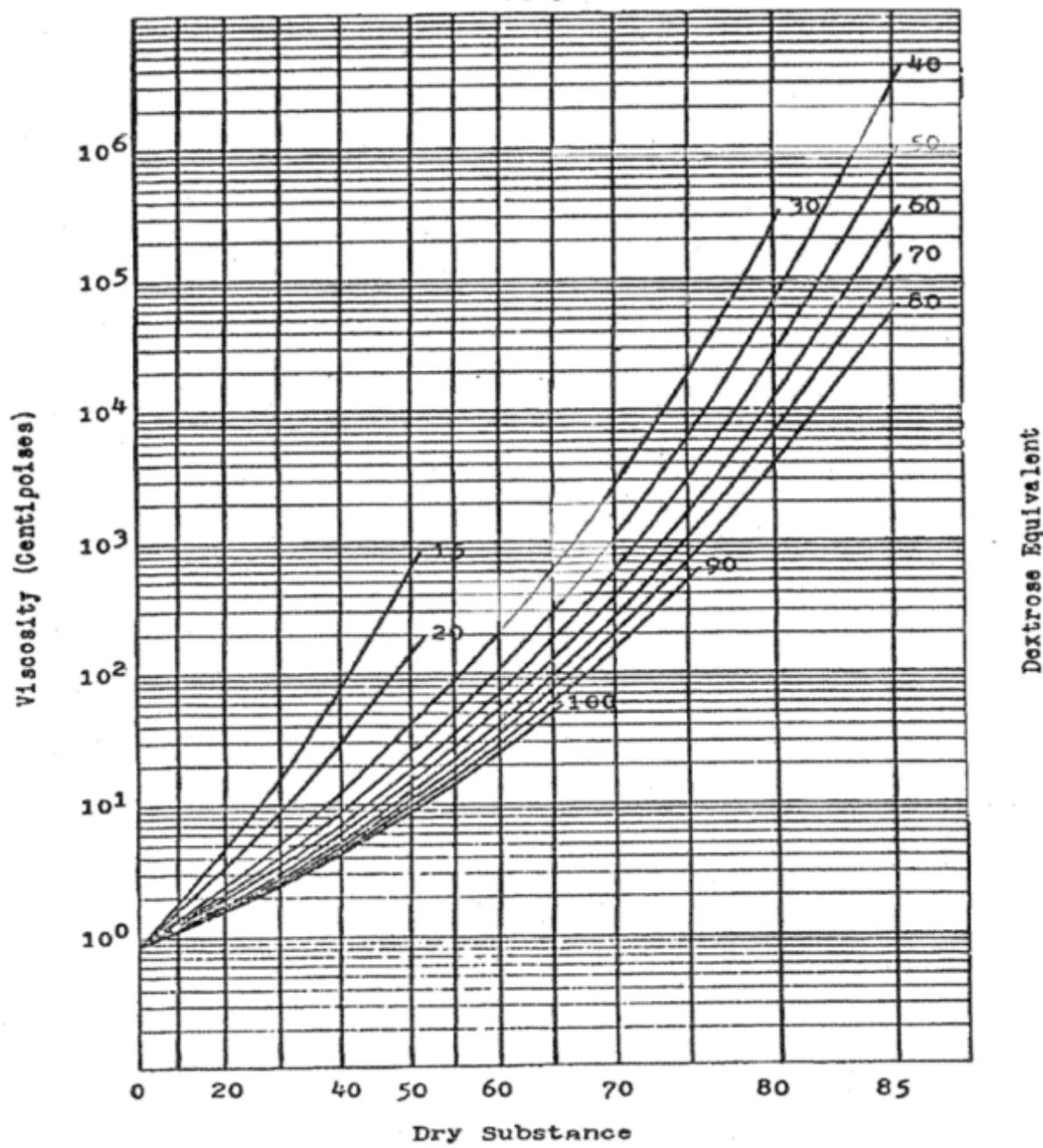
CORN STARCH HYDROLYZATE - VISCOSITY

80°F



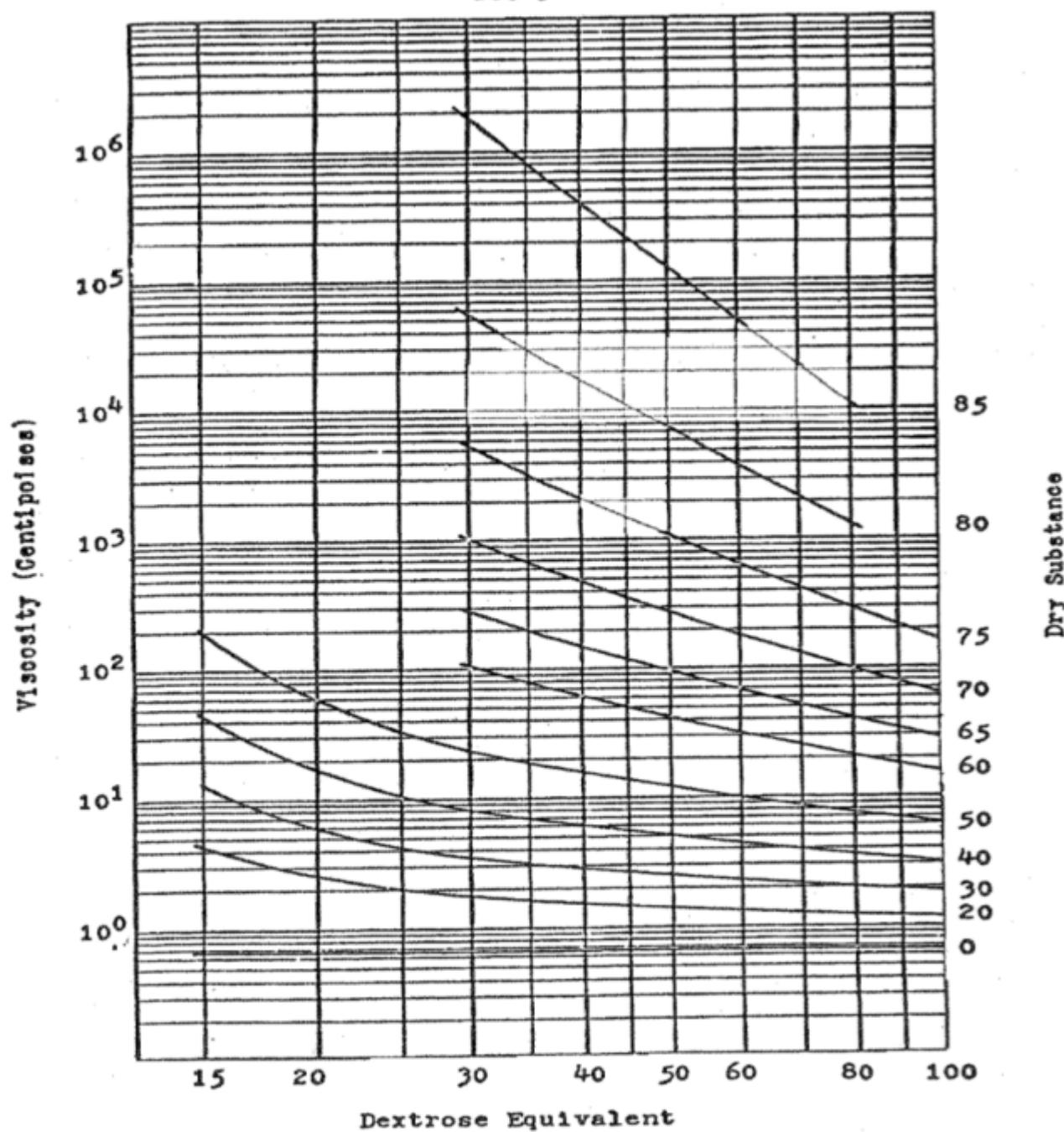
CORN STARCH HYDROLYZATE - VISCOSITY

80°F



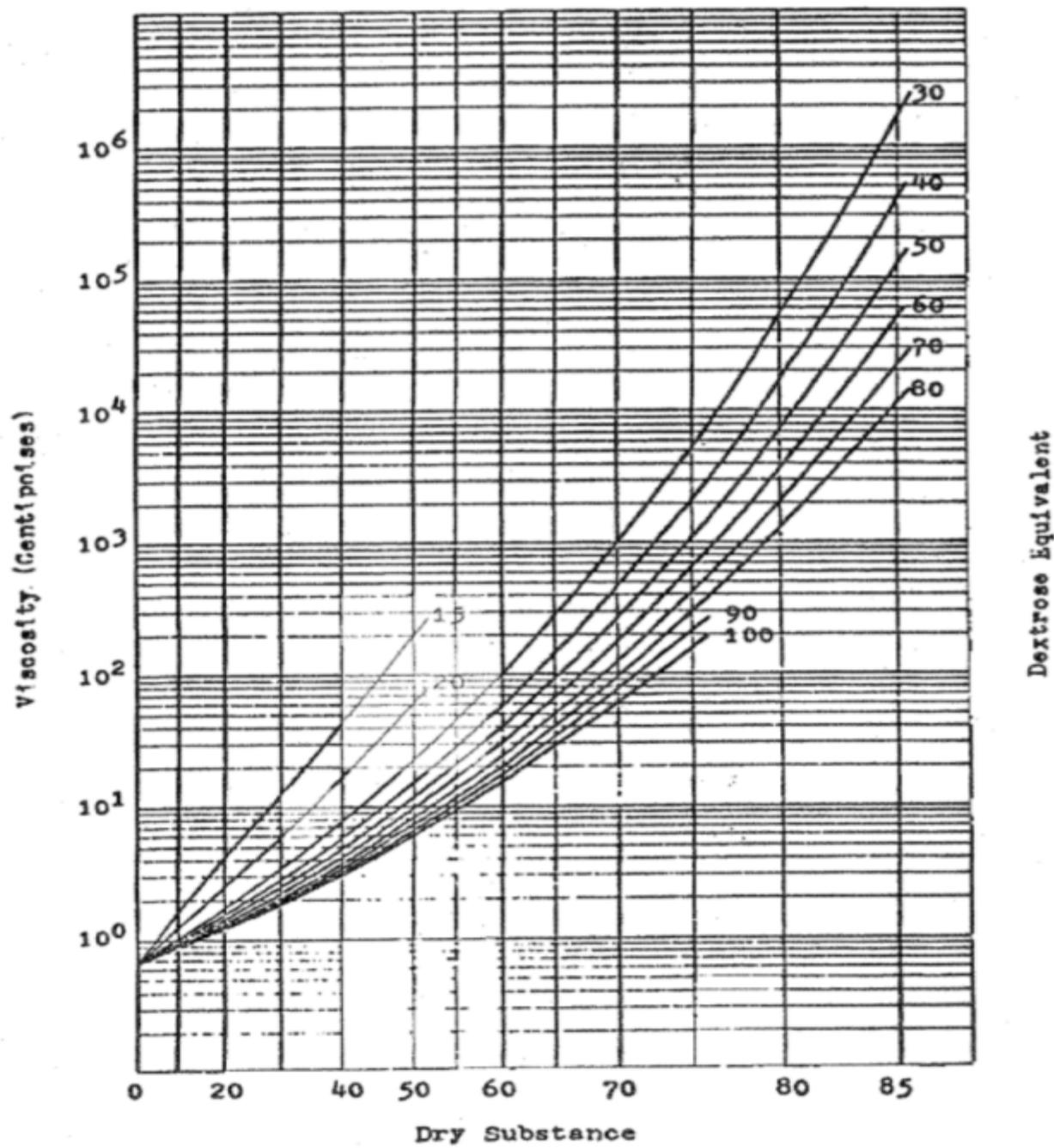
CORN STARCH HYDROLYZATE - VISCOSITY

100°F



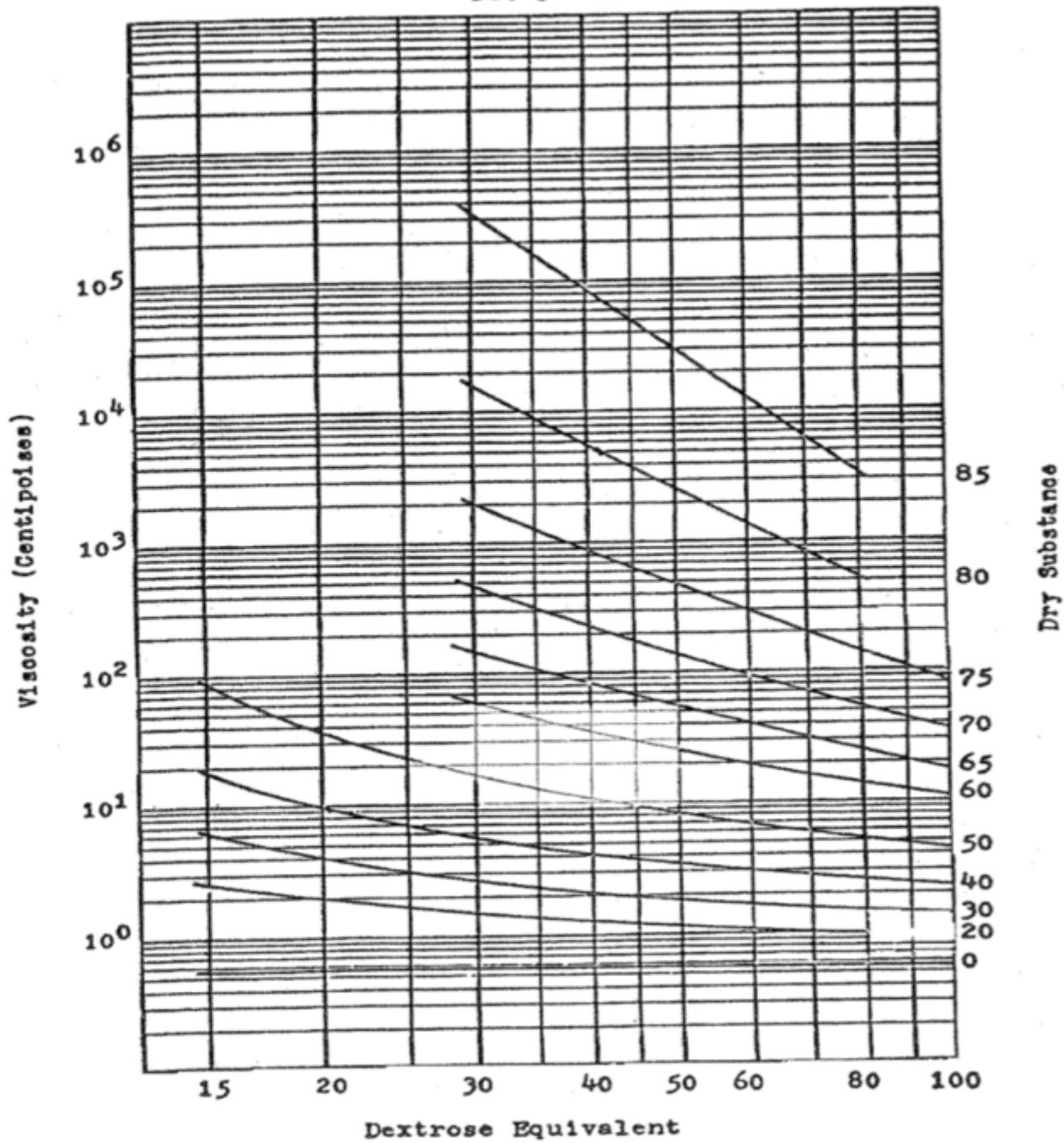
CORN STARCH HYDROLYZATE - VISCOSITY

100°F



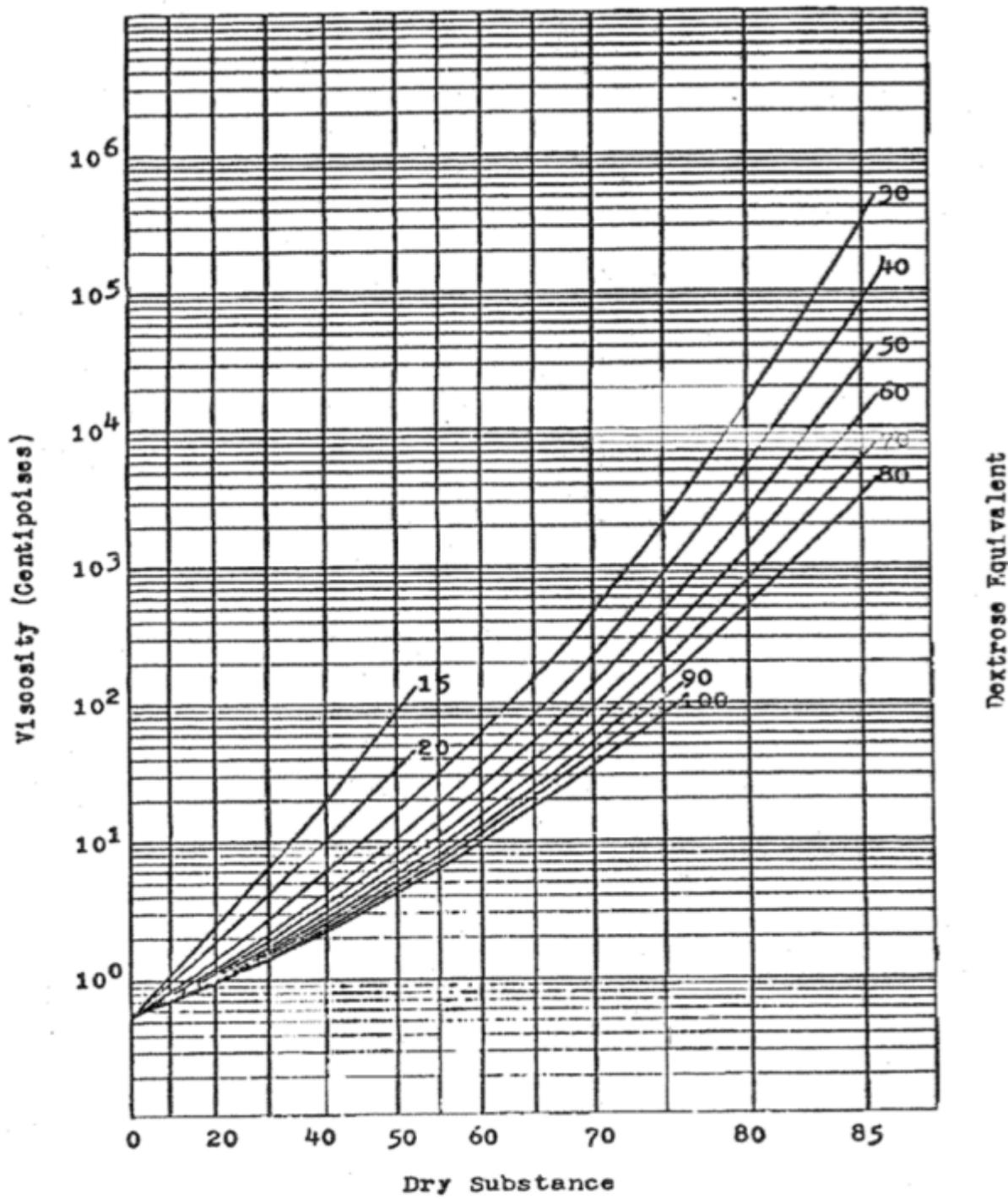
CORN STARCH HYDROLYZATE - VISCOSITY

120°F



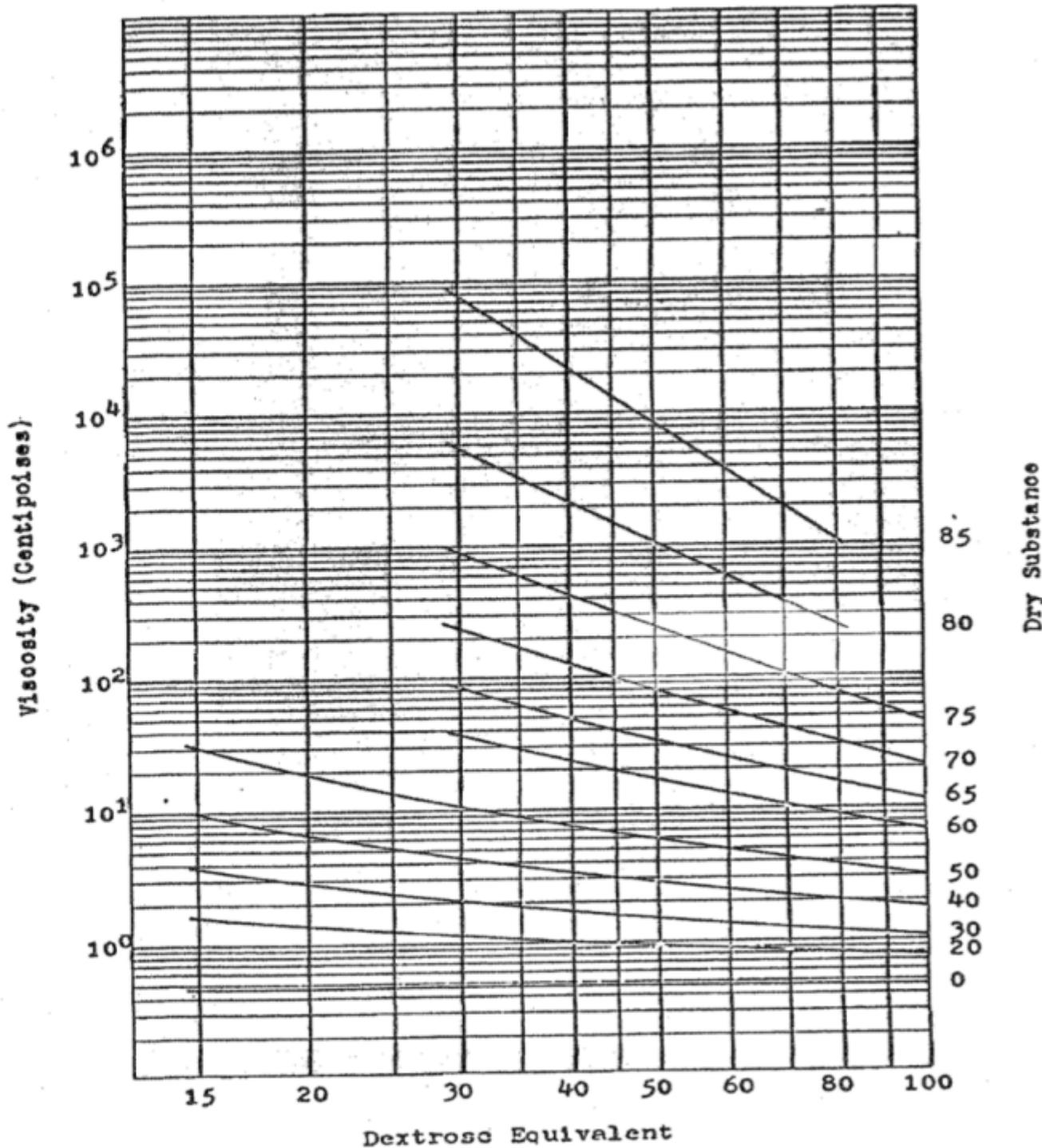
CORN STARCH HYDROLYZATE - VISCOSITY

120°F



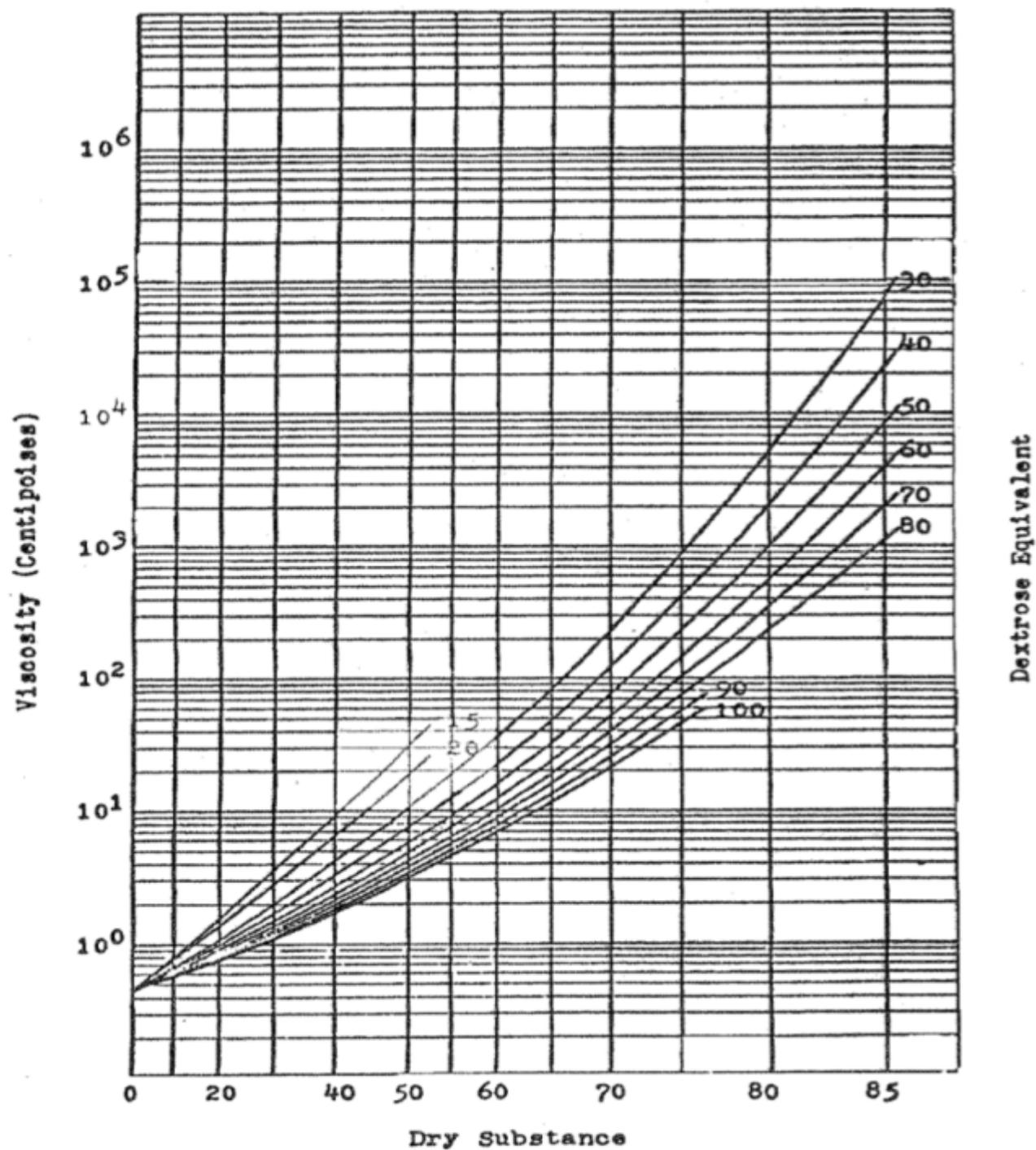
CORN STARCH HYDROLYZATE - VISCOSITY

140°F



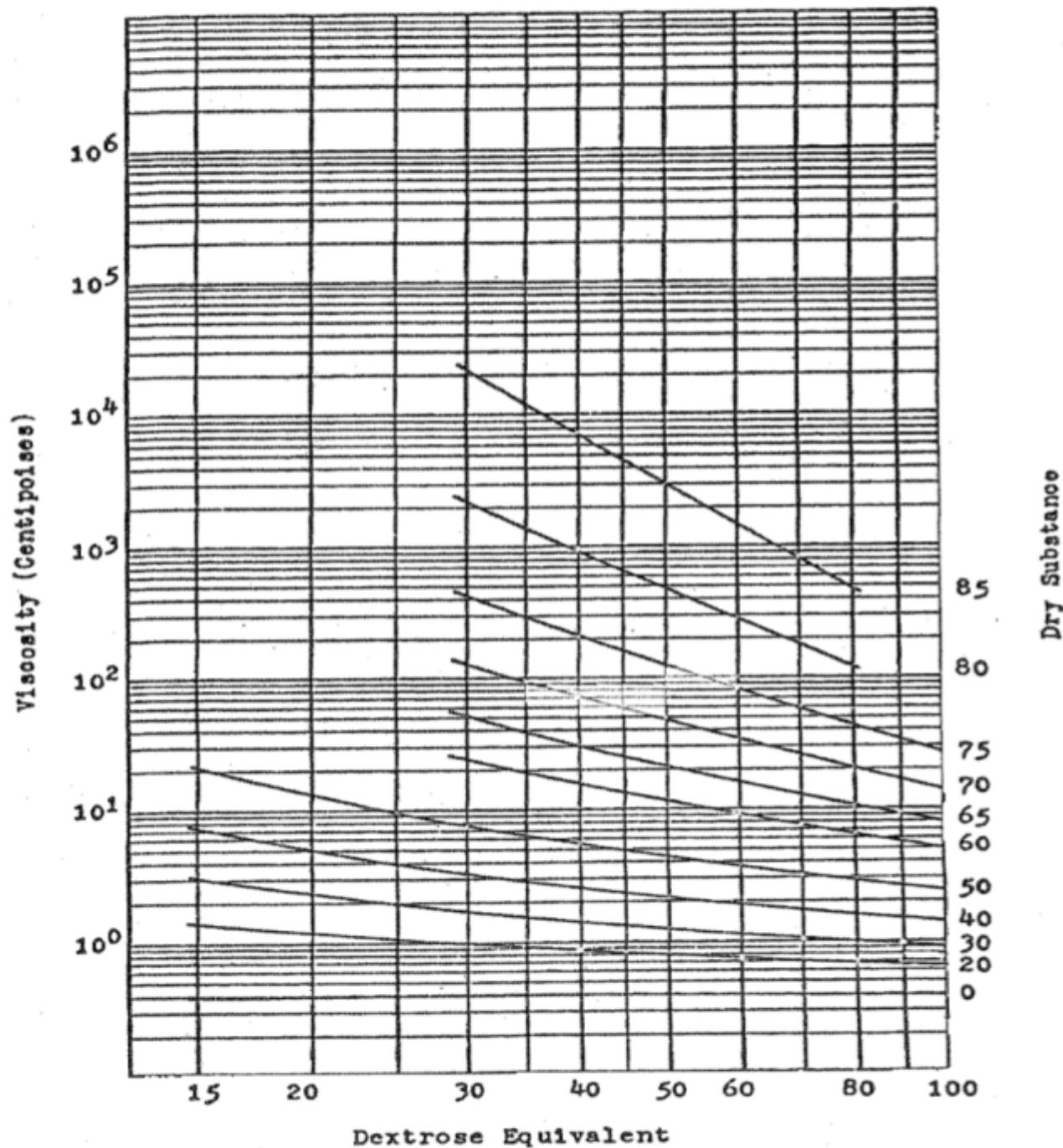
CORN STARCH HYDROLYZATE - VISCOSITY

140°F



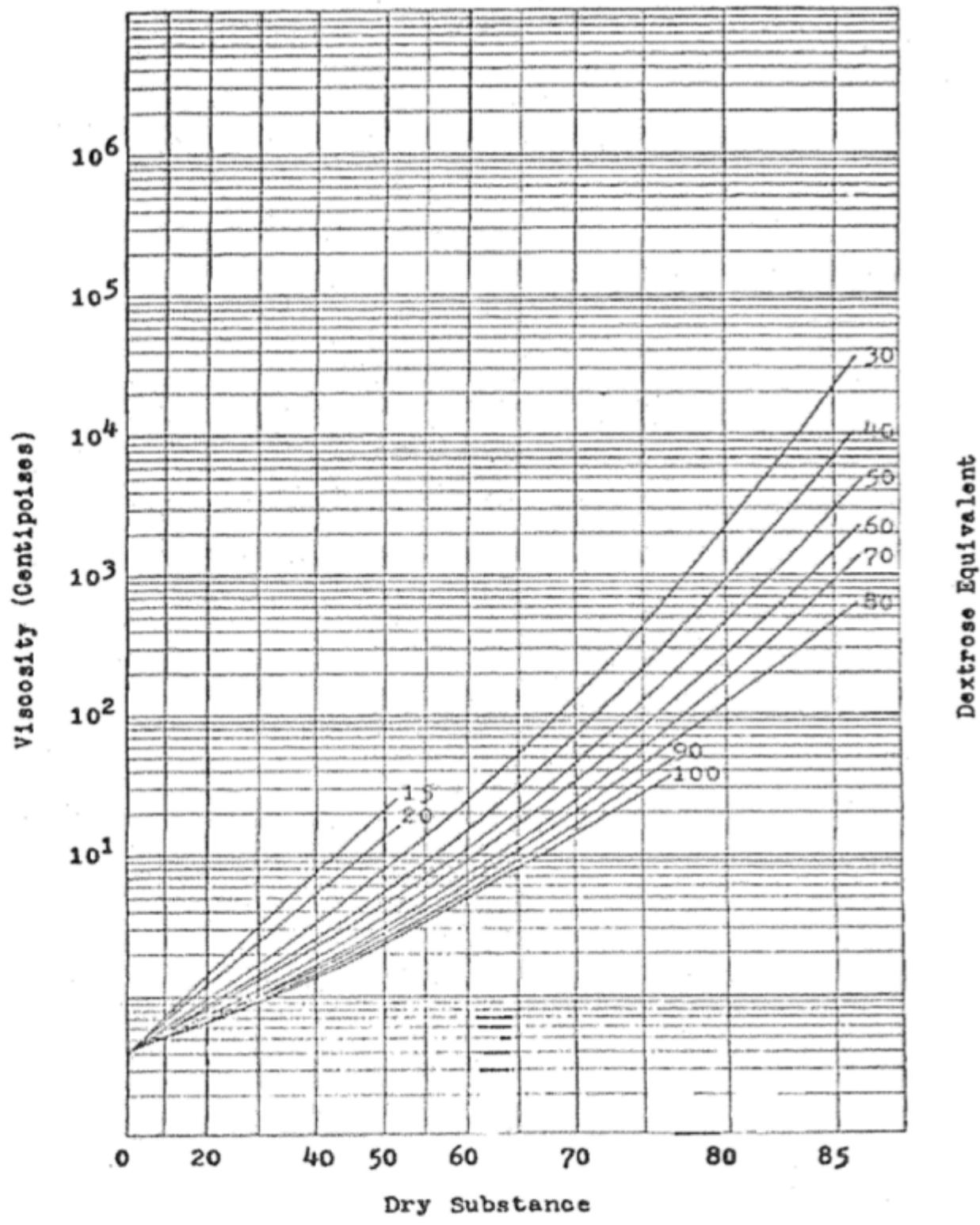
CORN STARCH HYDROLYZATE - VISCOSITY

160°F



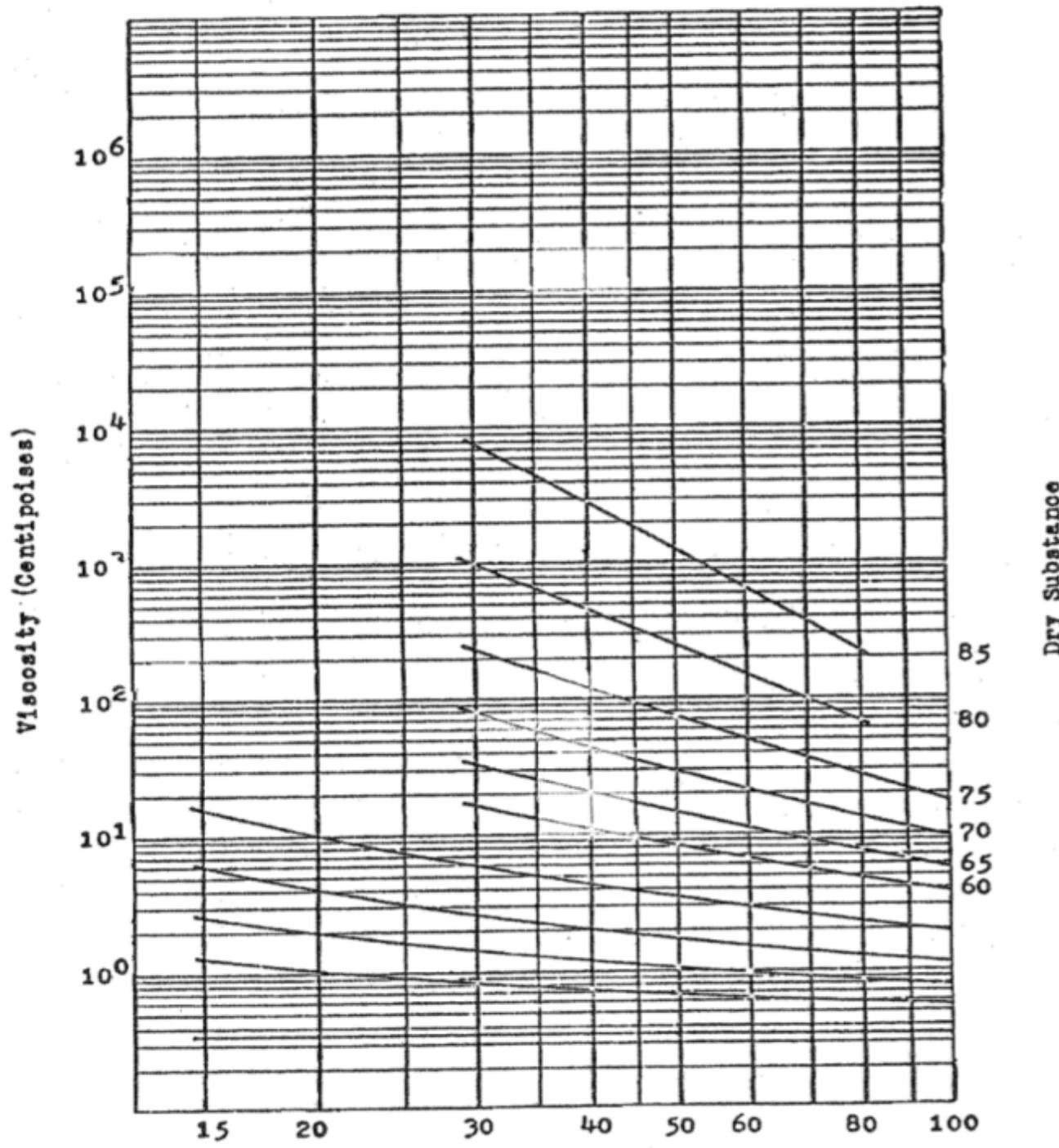
CORN STARCH HYDROLYZATE - VISCOSITY

160°F



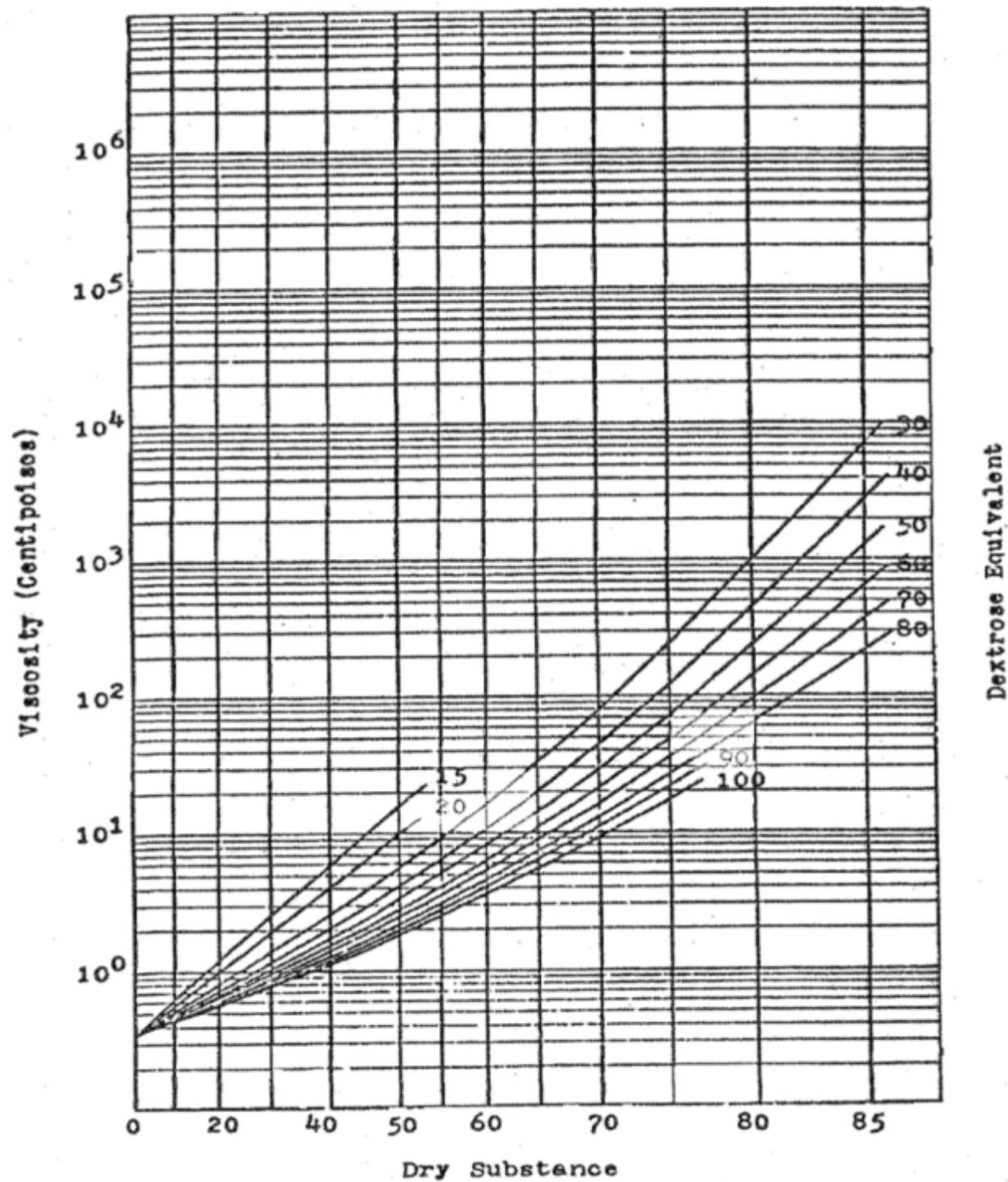
CORN STARCH HYDROLYZATE - VISCOSITY

180°F



CORN STARCH HYDROLYZATE - VISCOSITY

180°F



Vapor Pressure of Corn Syrups

The vapor pressures of three stock syrups, 30.06, 40.03 and 60.2 D.E., were determined by differential measurements against the secondary standard H₂SO₄ solution., the differences expressed in mm Hg at 0 °C. Measurements were made from 0 °C to approximately 90 °C. From the experimental data the values of the vapor pressure at even temperatures were obtained from (1) graphs of log vapor pressure against the reciprocal of absolute temperature and (2) vapor pressure against temperature in degrees °C.

Vapor Pressure mm Hg (0 °C)

<u>Temperature °C</u>	<u>30.6 D.E. (42 BE)</u>	<u>40.3 D.E. (42 Be)</u>	<u>60.2 D.E. (43 Be)</u>
0	4.7	3.0	3.1
10	8.3	7.4	6.8
20	14.4	13.3	12.2
30	27.0	24.9	22.6
40	47.1	43.5	39.1
50	77.9	71.6	65.1
60	126	116	106
70	197	181	165
90	440	402	372

(1) E. R. Smith and John L. Toregesen, Phys. Chem. Sec. Nat'l. Bur. Std's Report No. 53 Sept. 1950.

Osmotic Pressure of Corn Syrup at 25 C (1)

<u>Product</u>	<u>Dextrose Equivalent</u>	<u>g Corn Syrup per 1000 g Water</u>	<u>Osmotic Pressure(Atm)</u>
Low conversion corn syrup	31.7	114.996 62.614 156.604 211.513 3368.72(a)	5.25 2.82 7.24 9.70 154.93(a)
Regular conversion corn syrup	40.6	66.824	3.80

		121.141	7.10
		168.718	9.80
		183.580	10.60
		4065.85 (a)	235.79 (a)
Intermediate conversion corn syrup	53.2	53.585	3.93
		107.011	7.94
		124.039	9.27
		161.999	12.24
		4302.23 (a)	325.21 (a)
High conversion corn syrup	64.9	72.051	6.40
		111.620	10.02
		145.226	13.04
		166.878	14.96
		4437.74 (a)	403.18 (a)
Extra high conversion corn syrup	71.0	62.792	6.05
		91.754	9.04
		127.753	12.56
		164.040	16.30
		4605.38 (a)	457.71 (a)
High maltose corn syrup	41.9	101.263	5.80
		136.183	7.86
		156.675	9.05
		235.131	14.05
		4050.51 (a)	234.90 (a)

(a) Extrapolated values

(1) A. A. Mahdi, Wisconsin Alumni Research Foundation, 2/25/63

Viscosity of Corn Syrup and Dextrose Mixtures

	<u>Solution (in poises) (2)</u>	<u>d₂₅₂₅</u>	<u>η²⁵</u>
1	Original syrup plus dextrose	1.470	165000
2	Original syrup plus dextrose	1.447	14000
3	Original syrup	1.436	5000
4	Original syrup plus water	1.420	764
5	Original syrup plus water	1.379	36.6
6	Original syrup plus water	1.331	3.7

(2) I. C. T. V, 23 (1929)

Specific Heat of Corn Syrups (1)

Commercial Baume	Percent dry Substance by Wt.	Temperature °F.				
		40	80	120	160	200
-1.0	0.0	1.004	0.998	0.998	1.001	1.005
0.0	1.8	0.995	.989	.989	0.992	0.997
5.0	10.5	.939	.940	.944	.948	.955
10.0	19.2	.883	.890	.897	.904	.912
15.0	28.1	.828	.840	.850	.860	.871
20.0	37.0	.774	.790	.803	.815	.827
25.0	45.9	.720	.740	.756	.770	.783
30.0	55.0	.666	.688	.705	.722	.737
32.0	58.7	.645	.667	.685	.703	.717
34.0	62.4	.623	.646	.665	.682	.697
36.0	66.1	.602	.624	.643	.660	.676
38.0	69.9	.580	.602	.622	.639	.654
40.0	73.7	.559	.581	.599	.617	.632
41.0	75.6	.548	.569	.588	.605	.620
42.0	77.5	.537	.558	.576	.593	.608
43.0	79.5	.527	.547	.564	.581	.595
44.0	81.4	.517	.536	.553	.568	.582
45.0	83.4	.506	.524	.540	.555	.569
46.0	85.3	.496	.513	.526	.543	.555
Temperature °F.						
42 D.E.Corn Syrup						

<u>Commercial Baume</u>	<u>Percent dry Substance by Wt.</u>	<u>40</u>	<u>80</u>	<u>120</u>	<u>160</u>	<u>200</u>
		<u>BTU/lb °F</u>	BTU/lb °F	BTU/lb °F	BTU/lb °F	BTU/lb °F
0.0	1.8	.994	.989	.990	.992	.997
5.0	10.5	.939	.940	.944	.949	.955
10.0	19.4	.883	.890	.898	.905	.913
15.0	28.2	.828	.840	.851	.861	.871
20.0	37.2	.774	.790	.804	.816	.826
25.0	46.3	.720	.739	.756	.771	.785
30.0	55.5	.666	.688	.707	.724	.739
32.0	59.2	.644	.667	.687	.705	.720
34.0	62.9	.622	.646	.666	.684	.700
36.0	66.7	.601	.625	.645	.663	.679
38.0	70.5	.580	.604	.624	.642	.658
40.0	74.4	.560	.582	.602	.620	.636
41.0	76.3	.550	.572	.591	.608	.624
42.0	78.3	.539	.561	.579	.597	.612
43.0	80.3	.530	.550	.568	.585	.600
44.0	82.3	.519	.539	.557	.573	.587
45.0	84.3	.509	.528	.545	.561	.575
46.0	86.3	.499	.516	.533	.548	.562

55 D.E.Corn Syrup Temperature °F.

<u>Commercial Baume</u>	<u>Percent dry Substance by Wt.</u>	<u>40</u>	<u>80</u>	<u>120</u>	<u>160</u>	<u>200</u>
		<u>BTU/lb °F</u>	<u>BTU/lb °F</u>	<u>BTU/lb</u>	<u>BTU/lb °F</u>	<u>BTU/lb °F</u>
0.0	1.8	.994	.989	.990	.992	.997
5.0	10.6	.936	.940	.944	.949	.956
10.0	19.5	.882	.890	.898	.906	.915
15.0	28.4	.827	.840	.852	.862	.873
20.0	37.5	.772	.790	.804	.818	.831
25.0	46.7	.717	.739	.756	.772	.787
30.0	56.0	.664	.688	.708	.726	.742
32.0	59.7	.643	.668	.688	.707	.723
34.0	63.5	.622	.647	.668	.687	.703
36.0	67.4	.601	.626	.647	.666	.683
38.0	71.2	.581	.605	.626	.645	.662
40.0	75.2	.561	.584	.605	.624	.640
41.0	77.1	.551	.574	.594	.613	.629
42.0	79.1	.541	.564	.584	.602	.618

43.0	81.1	.531	.553	.572	.590	.606
44.0	83.2	.522	.542	.561	.579	.594
45.0	85.2	.512	.532	.550	.567	.582
46.0	87.3	.503	.522	.539	.555	.569

65 D.E.

Commercial Baume	Percent dry Substance by Wt.	Temperature °F				
		40	80	120	160	200
		BTU/lb °F	BTU/lb °F	BTU/lb °F	BTU/lb °F	BTU/lb °F
0.0	1.8	.994	.989	.990	.992	.997
5.0	10.6	.938	.939	.944	.949	.957
10.0	19.6	.882	.890	.898	.907	.916
15.0	28.6	.827	.840	.852	.862	.875
20.0	37.8	.772	.790	.805	.819	.833
25.0	47.0	.717	.739	.757	.773	.789
30.0	56.4	.664	.688	.709	.728	.744
32.0	60.2	.642	.667	.689	.709	.725
34.0	64.0	.621	.647	.669	.689	.706
36.0	67.9	.601	.627	.649	.668	.686
38.0	71.8	.581	.606	.629	.648	.665
40.0	75.8	.561	.586	.608	.628	.644
41.0	77.8	.552	.576	.597	.616	.633
42.0	79.8	.542	.566	.587	.606	.623
43.0	81.8	.533	.556	.576	.595	.611
44.0	83.9	.524	.546	.566	.583	.599
45.0	85.9	.515	.536	.555	.572	.587
46.0	88.0	.506	.526	.544	.561	.576

(1) J. L. Torgesen, Nat'l. Bur. of Std's. Phys. Chem. Sec. Quarterly Report Research Project Dec. 1950.

Specific Heat of Corn Sugar Syrups (1)

80 D. E.Corn (Sugar)

<u>Syrup</u> Commercial <u>Baume</u>	Percent dry Substance by Wt.	Temperature °F				
		40	80	120	160	200
0.0	1.8	0.994	0.989	0.990	0.992	0.997
5.0	10.7	.938	.939	.944	.950	.958
10.0	19.7	.881	.889	.898	.908	.918
15.0	28.8	.826	.840	.852	.864	.877
20.0	38.0	.771	.790	.806	.821	.835
25.0	47.4	.717	.739	.759	.776	.792
30.0	56.9	.663	.689	.711	.730	.748
32.0	60.8	.641	.668	.691	.711	.729
34.0	64.7	.621	.648	.671	.691	.710
36.0	68.7	.600	.628	.652	.672	.691
38.0	72.6	.582	.609	.632	.652	.671
40.0	76.7	.563	.590	.613	.632	.650
41.0	78.7	.555	.580	.603	.623	.640
42.0	80.8	.546	.571	.592	.612	.630
43.0	82.9	.537	.561	.582	.601	.619
44.0	85.0	.528	.551	.572	.591	.608
45.0	87.1	.520	.543	.562	.581	.597
46.0	89.2	.512	.534	.552	.570	.587

90 D.E. Corn (Sugar) Syrup

<u>Syrup</u> Commercial <u>Baume</u>	Percent dry Substance by Wt.	Temperature °F				
		40	80	120	160	200
-1.0	0.0	1.004	.998	.998	1.001	1.005
0.0	1.8	0.994	.989	.990	.993	.998
5.0	10.8	.938	.939	.944	.950	.958
10.0	19.8	.881	.889	.898	.908	.919
15.0	29.0	.825	.840	.853	.866	.879
20.0	38.3	.770	.790	.807	.822	.837
25.0	47.7	.716	.739	.759	.777	.794
30.0	57.3	.662	.689	.712	.732	.750
32.0	61.2	.641	.669	.693	.713	.731
34.0	65.2	.620	.649	.674	.694	.713
36.0	69.2	.600	.630	.655	.675	.694

38.0	73.2	.582	.611	.635	.657	.675
40.0	77.3	.564	.593	.617	.638	.655
41.0	79.4	.556	.583	.607	.628	.646
42.0	81.5	.547	.574	.598	.618	.636
43.0	83.6	.539	.565	.588	.607	.625
44.0	85.7	.532	.556	.578	.597	.615
45.0	87.8	.525	.548	.568	.587	.604
46.0	89.9	.517	.539	.558	.577	.594

(1) J. L. Torgesen, Nat'l. Bur. of Std's. Phys. Chem. Sec. Quarterly Report Research Project Dec. 1950.

Commercial Baume' – Corn Syrup Solids Conversion Tables (Ash corrected)

82.0 D. E., 0.41% Ash Corn Sugar Syrup Table *

Comm'l Baume at <u>140/60 F. plus 1</u>	Observed Baume at	Specific Gravity at	Wt. per Gal. in	Wt. per Cu. Ft. in	% Dry Substance by Wt. (3)	Lbs. Dry Substance per Gallon
	<u>100/60 °F(1)</u>	<u>100/60 °F(2)</u>	Lbs. at 100 F. <u>In Air</u>	Lbs. at 100 F. <u>In Air</u>		
0.0	0.296	0.9989	8.319	62.231	98.20	1.80
1.0	1.290	1.0079	8.394	62.791	96.42	3.58
2.0	2.284	1.0149	8.452	63.228	94.64	5.36
3.0	3.278	1.0221	8.512	63.676	92.85	7.15
4.0	4.272	1.0294	8.573	64.131	91.06	8.94
5.0	5.266	1.0367	8.634	64.586	89.27	10.73
6.0	6.262	1.0441	8.696	65.047	87.47	12.53
7.0	7.254	1.0516	8.758	65.514	85.67	14.33
8.0	8.248	1.0592	8.821	65.988	83.87	16.13
9.0	9.242	1.0670	8.886	66.473	82.06	17.94
10.0	10.236	1.0749	8.952	66.966	80.25	19.75
11.0	11.230	1.0829	9.019	67.464	78.44	21.56
12.0	12.222	1.0909	9.085	67.963	76.62	23.38
13.0	13.214	1.0992	9.154	68.480	74.80	25.20
14.0	14.206	1.1077	9.225	69.009	72.98	27.02
15.0	15.198	1.1161	9.295	69.532	71.15	28.85
16.0	16.190	1.1247	9.367	70.069	69.31	30.69
17.0	17.180	1.1333	9.438	70.604	67.47	32.53
18.0	18.170	1.1421	9.512	71.152	65.62	34.38
19.0	19.160	1.1512	9.588	71.719	63.77	36.23
20.0	20.150	1.1603	9.663	72.286	61.92	38.08
21.0	21.140	1.1696	9.741	72.866	60.06	39.94
22.0	22.130	1.1791	9.820	73.457	58.19	41.81
23.0	23.120	1.1887	9.900	74.056	56.32	43.68
24.0	24.110	1.1984	9.981	74.660	54.44	45.56
25.0	25.100	1.2083	10.063	75.276	52.56	47.44
26.0	26.090	1.2184	10.147	75.906	50.66	49.34
27.0	27.078	1.2285	10.231	76.535	48.76	51.24
28.0	28.066	1.2389	10.318	77.183	46.85	53.15
29.0	29.054	1.2495	10.406	77.843	44.93	55.07
30.0	30.042	1.2603	10.496	78.516	43.01	56.99
31.0	31.030	1.2712	10.587	79.195	41.07	58.93
32.0	32.016	1.2824	10.680	79.893	39.13	60.87
						6.501

33.0	33.002	1.2936	10.773	80.591	37.18	62.82	6.768
34.0	33.988	1.3052	10.870	81.313	35.21	64.79	7.043
35.0	34.974	1.3169	10.967	82.042	33.24	66.76	7.322
36.0	35.960	1.3287	11.066	82.777	31.25	68.75	7.608
37.0	36.944	1.3408	11.167	83.531	29.25	70.75	7.900
38.0	37.928	1.3532	11.270	84.304	27.25	72.75	8.199
39.0	38.912	1.3658	11.375	85.089	25.22	74.78	8.506
40.0	39.896	1.3786	11.481	85.886	23.18	76.82	8.820
41.0	40.880	1.3916	11.590	86.696	21.14	78.86	9.140
42.0	41.862	1.4049	11.700	87.524	19.08	80.92	9.468
43.0	42.844	1.4184	11.813	88.366	17.00	83.00	9.805
44.0	43.826	1.4322	11.928	89.225	14.90	85.10	10.150
45.0	44.808	1.4463	12.045	90.104	12.79	87.21	10.505
46.0	45.790	1.4605	12.163	90.989	10.67	89.33	10.866
47.0	46.772	1.4752	12.286	91.904	8.53	91.47	11.238

* E. E. Fauser, J. E. Cleland, J. W. Evans, and W. R. Fetzer. Ind. Eng. Chem. Anal. Ed. Vol. 15, pg. 193, 1943
(1) Corrections from table XIII. (2) Corr. From table V. (3) From table XVI. Weight per Gal. = Sp.gr. X 8.32823.
Wt. Cu. Ft. = Wt. per Gal. X 7.48052

87.0 D. E., 0.61% Ash Corn Sugar Syrup Table *

Comm'l Baume at 140/60 F. <u>plus 1</u>	Observed Baume at 100/60 °F(1)	Specific Gravity at 100/60 °F. (2)	Wt. per Gal. in Lbs. at 100 °F. In Air	Wt. per Cu. Ft. in			
				Lbs. at 100 °F. In Air	% Moisture	% Dry Substance by Wt. (3)	Lbs. Dry Substance per Gallon
0.0	0.296	0.9989	8.319	62.231	98.20	1.80	0.150
1.0	1.290	1.0079	8.394	62.791	96.41	3.59	0.301
2.0	2.284	1.0149	8.452	63.228	94.62	5.38	0.455
3.0	3.278	1.0221	8.512	63.676	92.83	7.17	0.610
4.0	4.272	1.0294	8.573	64.131	92.04	8.96	0.768
5.0	5.266	1.0367	8.634	64.586	89.24	10.76	0.929
6.0	6.262	1.0441	8.696	65.047	87.44	12.56	1.092
7.0	7.254	1.0516	8.758	65.514	85.64	14.36	1.258
8.0	8.248	1.0592	8.821	65.988	83.83	16.17	1.426
9.0	9.242	1.0670	8.886	66.473	82.02	17.98	1.598
10.0	10.236	1.0749	8.952	66.966	80.21	19.79	1.772
11.0	11.230	1.0829	9.019	67.464	78.39	21.61	1.949
12.0	12.222	1.0909	9.085	67.963	76.56	23.44	2.130
13.0	13.214	1.0992	9.154	68.480	74.74	25.26	2.312

14.0	14.206	1.1077	9.225	69.009	72.91	27.09	2.499
15.0	15.198	1.1161	9.295	69.532	71.07	28.93	2.689
16.0	16.190	1.1247	9.367	70.069	69.23	30.77	2.882
17.0	17.180	1.1333	9.438	70.604	67.38	32.62	3.079
18.0	18.170	1.1421	9.512	71.152	65.53	34.47	3.279
19.0	19.160	1.1512	9.588	71.719	63.67	36.33	3.483
20.0	20.150	1.1603	9.663	72.286	61.81	38.19	3.690
21.0	21.140	1.1696	9.741	72.866	59.95	40.05	3.901
22.0	22.130	1.1791	9.820	73.457	58.07	41.93	4.117
23.0	23.120	1.1887	9.900	74.056	56.19	43.81	4.337
24.0	24.110	1.1984	9.981	74.660	54.30	45.70	4.561
25.0	25.100	1.2083	10.063	75.276	52.40	47.60	4.790
26.0	26.090	1.2184	10.147	75.906	50.50	49.50	5.023
27.0	27.078	1.2285	10.231	76.535	48.60	51.40	5.259
28.0	28.066	1.2389	10.318	77.183	46.68	53.32	5.501
29.0	29.054	1.2495	10.406	77.843	44.75	55.25	5.749
30.0	30.042	1.2603	10.496	78.516	42.82	57.18	6.002
31.0	31.030	1.2712	10.587	79.195	40.87	59.13	6.260
32.0	32.016	1.2824	10.680	79.893	38.92	61.08	6.523
33.0	33.002	1.2936	10.773	80.591	36.96	63.04	6.792
34.0	33.988	1.3052	10.870	81.313	34.98	65.02	7.068
35.0	34.974	1.3169	10.967	82.042	32.99	67.01	7.349
36.0	35.960	1.3287	11.066	82.777	30.99	69.01	7.636
37.0	36.944	1.3408	11.167	83.531	28.99	71.01	7.929
38.0	37.928	1.3532	11.270	84.304	26.97	73.03	8.230
39.0	38.912	1.3658	11.375	85.089	24.93	75.07	8.539
40.0	39.896	1.3786	11.481	85.886	22.88	77.12	8.885
41.0	40.880	1.3916	11.590	86.696	20.82	79.18	9.177
42.0	41.862	1.4049	11.700	87.524	18.75	81.25	9.506
43.0	42.844	1.4184	11.813	88.366	16.65	83.35	9.846
44.0	43.826	1.4322	11.928	89.225	14.54	85.46	10.193
45.0	44.808	1.4463	12.045	90.104	12.42	87.58	10.549
46.0	45.790	1.4605	12.163	90.989	10.29	89.71	10.912
47.0	46.772	1.4752	12.286	91.904	8.13	91.87	11.287

* E. E. Fauser, J. E. Cleland, J. W. Evans, and W. R. Fetzer. Ind. Eng. Chem. Anal. Ed. Vol. 15, pg. 193, 1943
 (1) Corrections from table XIII. (2) Corr. From table V. (3) From table XVI. Weight per Gal. = Sp.gr. X 8.32823.
 Wt. Cu. Ft. = Wt. per Gal. X 7.48052

89.0 D. E., 0.61% Ash Corn Syrup Table *

Comm'l Baume at 140/60 F. <u>plus 1</u>	Observed Baume at 100/60 °F. (1)	Specific Gravity at 100/60 °F. (2)	Wt. per Gal. in Lbs. at 100 °F. <u>In Air</u>	Wt. per Cu. Ft. in Lbs. at 100 °F. <u>In Air</u>	% Dry Substance by Wt. (3)	Lbs. Dry Substance per Gallon
0.0	0.296	0.9989	8.319	62.231	98.20	0.150
1.0	1.290	1.0079	8.394	62.791	96.41	0.301
2.0	2.284	1.0149	8.452	63.228	94.62	0.455
3.0	3.278	1.0221	8.512	63.676	92.83	0.610
4.0	4.272	1.0294	8.573	64.131	91.04	0.768
5.0	5.266	1.0367	8.634	64.586	89.24	0.929
6.0	6.262	1.0441	8.696	65.047	87.43	1.093
7.0	7.254	1.0516	8.758	65.514	85.63	1.259
8.0	8.248	1.0592	8.821	65.988	83.82	1.427
9.0	9.242	1.0670	8.886	66.473	82.00	1.600
10.0	10.236	1.0749	8.952	66.966	80.19	1.773
11.0	11.230	1.0829	9.019	67.464	78.37	1.951
12.0	12.222	1.0909	9.085	67.963	76.54	2.131
13.0	13.214	1.0992	9.154	68.480	74.71	2.315
14.0	14.206	1.1077	9.225	69.009	72.88	2.502
15.0	15.198	1.1161	9.295	69.532	71.04	2.692
16.0	16.190	1.1247	9.367	70.069	69.20	2.885
17.0	17.180	1.1333	9.438	70.604	67.35	3.082
18.0	18.170	1.1421	9.512	71.152	65.49	3.282
19.0	19.160	1.1512	9.588	71.719	63.63	3.487
20.0	20.150	1.1603	9.663	72.286	61.77	3.694
21.0	21.140	1.1696	9.741	72.866	59.90	3.906
22.0	22.130	1.1791	9.820	73.457	58.02	4.122
23.0	23.120	1.1887	9.900	74.056	56.14	4.342
24.0	24.110	1.1984	9.981	74.660	54.25	4.566
25.0	25.100	1.2083	10.063	75.276	52.35	4.795
26.0	26.090	1.2184	10.147	75.906	50.44	5.029
27.0	27.078	1.2285	10.231	76.535	48.53	5.266
28.0	28.066	1.2389	10.318	77.183	46.61	5.509
29.0	29.054	1.2495	10.406	77.843	44.68	5.757
30.0	30.042	1.2603	10.496	78.516	42.74	6.010
31.0	31.030	1.2712	10.587	79.195	40.79	6.268
32.0	32.016	1.2824	10.680	79.893	38.84	6.532
33.0	33.002	1.2936	10.773	80.591	36.87	6.801
34.0	33.988	1.3052	10.870	81.313	34.89	7.077
35.0	34.974	1.3169	10.967	82.042	32.90	7.359
36.0	35.960	1.3287	11.066	82.777	30.89	7.648

37.0	36.944	1.3408	11.167	83.531	28.88	71.12	7.942
38.0	37.928	1.3532	11.270	84.304	26.86	73.14	8.243
39.0	38.912	1.3658	11.375	85.089	24.82	75.18	8.551
40.0	39.896	1.3786	11.481	85.886	22.76	77.24	8.868
41.0	40.880	1.3916	11.590	86.696	20.70	79.30	9.191
42.0	41.862	1.4049	11.700	87.524	18.62	81.38	9.522
43.0	42.844	1.4184	11.813	88.366	16.52	83.48	9.861
44.0	43.826	1.4322	11.928	89.225	14.40	85.60	10.210
45.0	44.808	1.4463	12.045	90.104	12.28	87.72	10.566
46.0	45.790	1.4605	12.163	90.989	10.14	89.86	10.930
47.0	46.772	1.4752	12.286	91.904	7.97	92.03	11.307

* E. E. Fauser, J. E. Cleland, J. W. Evans, and W. R. Fetzer. Ind. Eng. Chem. Anal. Ed. Vol. 15, pg. 193, 1943

(1) Corrections from table XIII. (2) Corr. From table V. (3) From table XVI. Weight per Gal. = Sp.gr. X 8.32823. Wt. Cu. Ft. = Wt. per Gal. X 7.48052

90.7 D. E., 1.22% Ash Corn Syrup Table *

Comm'l Baume at 140/60 °F. plus 1	Observed Baume at 100/60 °F. (1)	Specific Gravity at 100/60 °F. (2)	Wt. per Gal. in Lbs. at 100 °F. In Air	Wt. per Cu. Ft. in Lbs. at 100 °F. In Air	% Dry Substance by Wt. (3)	Lbs. Dry Substance per Gallon	
0.0	0.296	0.9989	8.319	62.231	98.20	1.80	0.150
1.0	1.290	1.0079	8.394	62.791	96.41	3.59	0.301
2.0	2.284	1.0149	8.452	63.228	94.63	5.37	0.454
3.0	3.278	1.0221	8.512	63.676	92.83	7.17	0.610
4.0	4.272	1.0294	8.573	64.131	91.04	8.96	0.768
5.0	5.266	1.0367	8.634	64.586	89.24	10.76	0.929
6.0	6.262	1.0441	8.696	65.047	87.44	12.56	1.092
7.0	7.254	1.0516	8.758	65.514	85.63	14.37	1.259
8.0	8.248	1.0592	8.821	65.988	83.83	16.17	1.426
9.0	9.242	1.0670	8.886	66.473	82.01	17.99	1.599
10.0	10.236	1.0749	8.952	66.966	80.20	19.80	1.772
11.0	11.230	1.0829	9.019	67.464	78.38	21.62	1.950
12.0	12.222	1.0909	9.085	67.963	76.55	23.45	2.131
13.0	13.214	1.0992	9.154	68.480	74.73	25.27	2.313
14.0	14.206	1.1077	9.225	69.009	72.89	27.11	2.501
15.0	15.198	1.1161	9.295	69.532	71.06	28.94	2.690
16.0	16.190	1.1247	9.367	70.069	69.22	30.78	2.883

17.0	17.180	1.1333	9.438	70.604	67.37	32.63	3.080
18.0	18.170	1.1421	9.512	71.152	65.52	34.48	32.80
19.0	19.160	1.1512	9.588	71.719	63.66	36.34	3.484
20.0	20.150	1.1603	9.663	72.286	61.80	38.20	3.691
21.0	21.140	1.1696	9.741	72.866	59.94	40.06	3.902
22.0	22.130	1.1791	9.820	73.457	58.06	41.94	4.118
23.0	23.120	1.1887	9.900	74.056	56.18	43.82	4.338
24.0	24.110	1.1984	9.981	74.660	54.29	45.71	4.562
25.0	25.100	1.2083	10.063	75.276	52.40	47.60	4.790
26.0	26.090	1.2184	10.147	75.906	50.50	49.50	5.023
27.0	27.078	1.2285	10.231	76.535	48.59	51.41	5.260
28.0	28.066	1.2389	10.318	77.183	46.67	53.33	5.502
29.0	29.054	1.2495	10.406	77.843	44.75	55.25	5.749
30.0	30.042	1.2603	10.496	78.516	42.81	57.19	6.003
31.0	31.030	1.2712	10.587	79.195	40.87	59.13	6.260
32.0	32.016	1.2824	10.680	79.893	38.91	61.09	6.524
33.0	33.002	1.2936	10.773	80.591	36.95	63.05	6.793
34.0	33.988	1.3052	10.870	81.313	34.98	65.02	7.068
35.0	34.974	1.3169	10.967	82.042	33.00	67.00	7.348
36.0	35.960	1.3287	11.066	82.777	31.00	69.00	7.635
37.0	36.944	1.3408	11.167	83.531	28.99	71.01	7.929
38.0	37.928	1.3532	11.270	84.304	26.97	73.03	8.230
39.0	38.912	1.3658	11.375	85.089	24.94	75.06	8.538
40.0	39.896	1.3786	11.481	85.886	22.90	77.10	8.852
41.0	40.880	1.3916	11.590	86.696	20.83	79.17	9.175
42.0	41.862	1.4049	11.700	87.524	18.75	81.25	9.506
43.0	42.844	1.4184	11.813	88.366	16.67	83.33	9.844
44.0	43.826	1.4322	11.928	89.225	14.56	85.44	10.191
45.0	44.808	1.4463	12.045	90.104	12.44	87.56	10.547
46.0	45.790	1.4605	12.163	90.989	10.31	89.69	10.909
47.0	46.772	1.4752	12.286	91.904	8.16	91.84	11.283

* E. E. Fauser, J. E. Cleland, J. W. Evans, and W. R. Fetzer. Ind. Eng. Chem. Anal. Ed. Vol. 15, pg. 193, 1943

(1) Corrections from table XIII. (2) Corr. From table V. (3) From table XVI. Weight per Gal. = Sp.gr. X 8.32823. Wt. Cu. Ft. = Wt. per Gal. X 7.48052

91.2 D. E., 0.61% Ash Corn Syrup Table *

Comm'l Baume at 140/60 °F. <u>plus 1</u>	Observed Baume at 100/60 °F. (1)	Specific Gravity at 100/60 °F. (2)	Wt. per Gal. in Lbs. at 100 °F. <u>In Air</u>	Wt. per Cu. Ft. in Lbs. at 100 °F. <u>In Air</u>	% Dry Substance by Wt. (3)	Lbs. Dry Substance per Gallon
0.0	0.296	0.9989	8.319	62.231	98.20	0.150
1.0	1.290	1.0079	8.394	62.791	96.41	0.301
2.0	2.284	1.0149	8.452	63.228	94.62	0.455
3.0	3.278	1.0221	8.512	63.676	92.82	0.611
4.0	4.272	1.0294	8.573	64.131	91.03	0.769
5.0	5.266	1.0367	8.634	64.586	89.23	0.930
6.0	6.262	1.0441	8.696	65.047	87.42	1.094
7.0	7.254	1.0516	8.758	65.514	85.61	1.260
8.0	8.248	1.0592	8.821	65.988	83.80	1.429
9.0	9.242	1.0670	8.886	66.473	81.98	1.601
10.0	10.236	1.0749	8.952	66.966	80.17	1.775
11.0	11.230	1.0829	9.019	67.464	78.35	1.953
12.0	12.222	1.0909	9.085	67.963	76.52	2.133
13.0	13.214	1.0992	9.154	68.480	74.69	2.317
14.0	14.206	1.1077	9.225	69.009	72.85	2.505
15.0	15.198	1.1161	9.295	69.532	71.01	2.695
16.0	16.190	1.1247	9.367	70.069	69.16	2.889
17.0	17.180	1.1333	9.438	70.604	67.31	3.085
18.0	18.170	1.1421	9.512	71.152	65.45	3.286
19.0	19.160	1.1512	9.588	71.719	63.59	3.491
20.0	20.150	1.1603	9.663	72.286	61.72	3.699
21.0	21.140	1.1696	9.741	72.866	59.85	3.911
22.0	22.130	1.1791	9.820	73.457	57.97	4.127
23.0	23.120	1.1887	9.900	74.056	56.08	4.348
24.0	24.110	1.1984	9.981	74.660	54.19	4.572
25.0	25.100	1.2083	10.063	75.276	52.29	4.801
26.0	26.090	1.2184	10.147	75.906	50.38	5.035
27.0	27.078	1.2285	10.231	76.535	48.46	5.273
28.0	28.066	1.2389	10.318	77.183	46.53	5.517
29.0	29.054	1.2495	10.406	77.843	44.60	5.765
30.0	30.042	1.2603	10.496	78.516	42.66	6.018
31.0	31.030	1.2712	10.587	79.195	40.70	6.278
32.0	32.016	1.2824	10.680	79.893	38.75	6.542
33.0	33.002	1.2936	10.773	80.591	36.78	6.811
34.0	33.988	1.3052	10.870	81.313	34.79	7.088
35.0	34.974	1.3169	10.967	82.042	32.79	7.371
36.0	35.960	1.3287	11.066	82.777	30.78	7.660

37.0	36.944	1.3408	11.167	83.531	28.76	71.24	7.955
38.0	37.928	1.3532	11.270	84.304	26.74	73.26	8.256
39.0	38.912	1.3658	11.375	85.089	24.69	75.31	8.566
40.0	39.896	1.3786	11.481	85.886	22.63	77.37	8.883
41.0	40.880	1.3916	11.590	86.696	20.56	79.44	9.207
42.0	41.862	1.4049	11.700	87.524	18.48	81.52	9.538
43.0	42.844	1.4184	11.813	88.366	16.37	83.63	9.879
44.0	43.826	1.4322	11.928	89.225	14.25	85.75	10.228
45.0	44.808	1.4463	12.045	90.104	12.12	87.88	10.585
46.0	45.790	1.4605	12.163	90.989	9.97	90.03	10.951
47.0	46.772	1.4752	12.286	91.904	7.79	92.21	11.329

* E. E. Fauser, J. E. Cleland, J. W. Evans, and W. R. Fetzer. Ind. Eng. Chem. Anal. Ed. Vol. 15, pg. 193, 1943

(1) Corrections from table XIII. (2) Corr. From table V. (3) From table XVI. Weight per Gal. = Sp.gr. X 8.32823. Wt. Cu. Ft. = Wt. per Gal. X 7.48052

DEXTROSE (glucose)

The Adsorption Spectra of Sugars in the Near Infa-red (2)

Band locations for materials used in evaporated forms.

1-arabinose	2.16	2.36
d-Galactose	2.17	2.34
d-Glucose	2.15	2.35
β -Glucose	2.13	2.36
d-Levulose	2.19	2.37
Maltose (hydrate)	2.14	2.40
d-Mannose	2.12	2.35
1-Rhamnose (hydrate)	2.15	2.35
Sucrose	2.17	2.38
d-Xylose	2.18	2.37

(2) E. S. Barr and C. H. Chrisman, Jr. J. Chem. Physics, 8, 51 - 55 (1940)

Corresponding Boiling Points of Dextrose Solutions and Water (1)

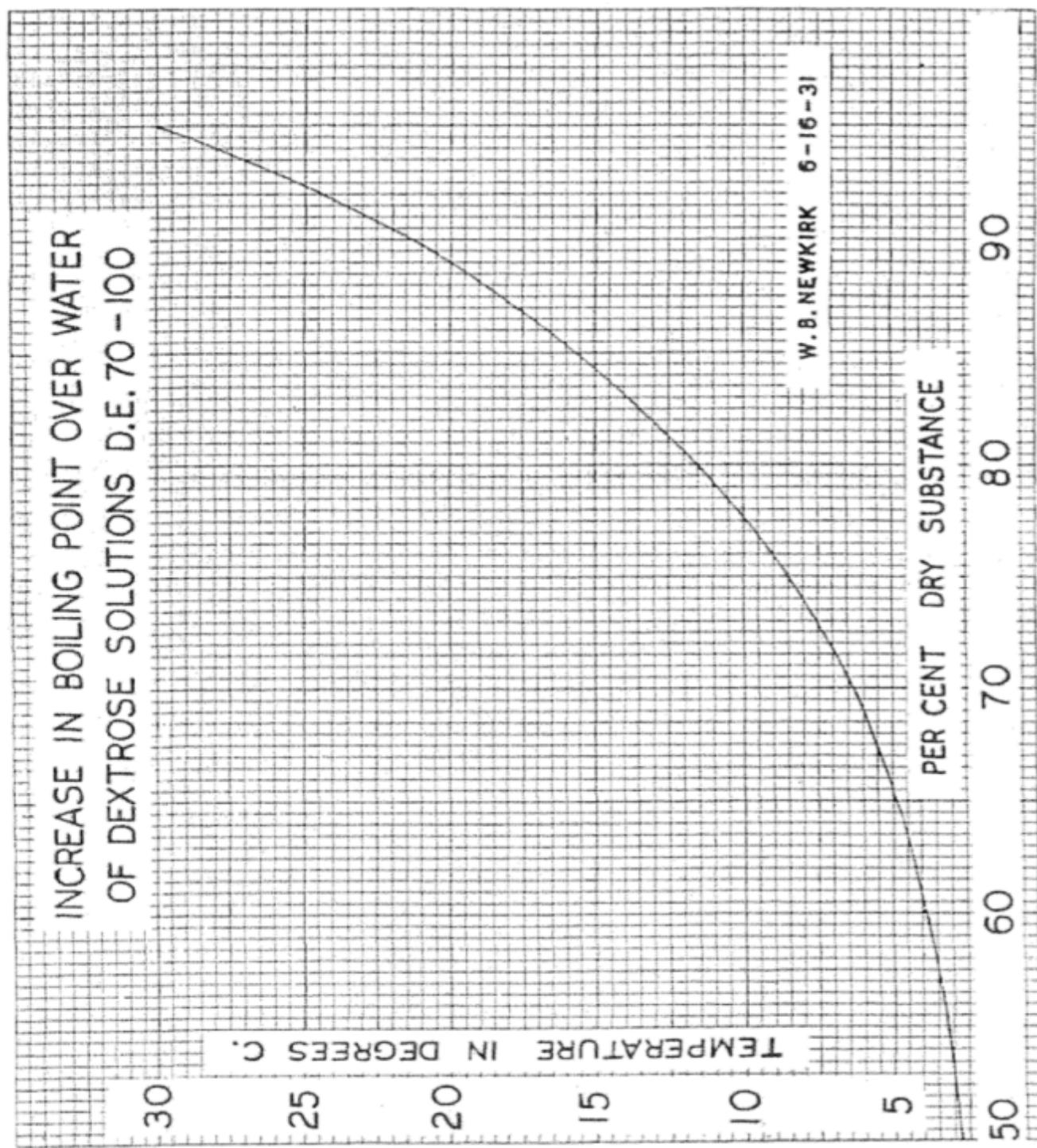
<u>10.34% solution</u>	<u>Water</u>	<u>21.36% solution</u>	<u>Water</u>	<u>32.50% solution</u>	<u>Water</u>	<u>40.31% solution</u>	<u>Water</u>
<u>°C</u>	<u>°C</u>	<u>°C</u>	<u>°C</u>	<u>°C</u>	<u>°C</u>	<u>°C</u>	<u>°C</u>
100.054	99.724	100.567	99.788	101.286	99.869	101.686	99.686
100.063	99.732	100.563	99.783	101.293	99.876	101.685	99.684
94.183	93.863	94.267	93.514	95.533	94.163	95.258	93.330
94.200	93.881	94.273	93.520	87.802	86.490	87.725	85.879
86.414	86.109	86.927	86.207	81.624	80.358	80.303	78.523
84.433	86.128	86.940	86.220	92.864	91.513	93.033	91.122
75.946	75.652	76.675	75.992	101.389	99.965	101.483	99.472
75.977	75.684	76.704	76.021	101.653	100.229	101.701	99.686
100.261	99.929	64.876	64.232	101.653	100.233	101.698	99.688
100.261	99.928	64.940	64.292	106.877	105.417	106.970	104.898
105.559	105.218	78.142	77.455	111.307	109.798	111.431	109.306
105.562	105.220	87.363	86.638	115.220	113.683	115.416	113.248
109.860	109.507	94.550	93.793	118.782	117.212	119.115	116.895
109.862	109.511	100.616	99.832	122.419	120.805	122.526	120.264
113.867	113.508	100.791	100.007	101.522	100.098	116.730	114.542
113.873	113.512	105.994	105.186			110.091	107.987
117.356	116.988	110.293	109.463			101.731	99.722
117.364	116.994	114.495	113.649				
120.838	120.461	117.897	117.030				
120.844	120.462	121.007	120.118				
118.216	117.843						
118.224	117.850	117.891	117.023				
114.205	113.843	114.405	113.556				
114.214	113.851	110.298	109.469				
110.450	110.095	105.852	105.044				
110.458	110.104	100.689	99.907				
106.190	105.844						
106.200	105.855						
100.266	99.934						
100.230	99.896						
100.235	99.902						
94.021	93.699						
94.034	93.712						
86.212	85.905						
86.228	85.922						
76.098	75.799						

76.124	75.825
62.585	62.297
62.641	62.344
77.031	76.732
86.288	85.982
94.084	93.763
100.080	99.747

Boiling Point Continued

50.54% <u>solution</u>	<u>Water</u>	59.69% <u>solution</u>	<u>Water</u>	63.23% <u>solution</u>	<u>Water</u>
<u>°C</u>	<u>°C</u>	<u>°C</u>	<u>°C</u>	<u>°C</u>	<u>°C</u>
103.237	100.063	104.806	100.059	105.386	99.867
103.246	100.072	104.813	100.066	101.163	95.745
99.271	96.170	98.302	93.711	96.579	91.272
103.323	100.140	90.880	86.462	91.387	86.222
99.134	96.044	80.696	76.489	84.844	79.809
94.684	91.673	69.077	65.092	76.686	71.771
89.448	86.522	90.914	86.488	105.293	99.742
82.844	80.011	104.634	99.882	110.639	104.931
75.432	72.705	111.295	106.362	115.148	109.315
103.161	99.985	117.229	112.147	119.269	113.303
103.162	99.990	122.262	117.038	122.863	116.788
108.270	105.011	125.670	120.369	126.482	120.304
112.778	109.442	116.143	111.123	105.324	99.795
116.880	113.457	104.542	99.828		
120.461	116.972				
123.864	120.324				
103.191	100.031				

(1) By John L. Torgesen, Vincent E. Bower, and Edgar R. Smith, J. of Res. Nat'l. Bur. of Stds., Vol. 45, No. 6(1950)



Boiling Points of Dextrose Solutions in Terms of the Boiling Points of Water (1)

$$t_s = a + bt_w + ct_w^2$$

Concentration of dextrose %	a	b	c	Average deviation °C	Maximum deviation °C
10.34	0.3376	0.997929	0.2011X10 ⁻⁴	± 0.002	±0.003
21.36	.5516	.999929	.2377	±.002	±.004
32.50	.9815	1.000342	.4030	±.003	±.006
40.31	1.2027	1.004451	.3626	±.004	±.007
50.54	1.9000	1.007563	.5515	±.007	±.012
59.69	3.2872	1.003618	1.0954	±.009	±.026
63.23	4.7004	.988355	2.0042	±.013	±.023

Boiling Points of Dextrose Solutions at Standard Reference Pressures (1)

<u>Concentration</u>	Boiling point of <u>Water °C</u>		Boiling point of <u>solutions °C</u>				
	10%	20%	30%	40%	50%	60%	
<u>Pressure in mm Hg</u>							
187.57	65	65.277	65.600	66.047	66.624	67.555	69.045
233.72	70	70.280	70.615	71.073	71.670	72.625	74.137
289.13	75	75.284	75.631	76.101	76.718	77.697	79.235
355.22	80	80.289	80.648	81.130	81.767	82.772	84.338
433.56	85	85.295	85.666	86.161	86.818	87.849	89.446
525.86	90	90.302	90.685	91.194	91.871	92.929	94.560
633.99	95	95.310	95.705	96.229	96.926	98.011	99.680
760.00	100	100.319	100.726	101.265	101.983	103.096	104.804
906.06	105	105.329	105.748	106.303	107.042	108.183	109.935
1,074.58	110	110.340	110.771	111.343	112.102	113.273	115.070
1,268.03	115	115.352	115.793	116.385	117.163	118.365	120.212
1,489.14	120	120.365	120.819	121.428	122.225	123.460	125.359

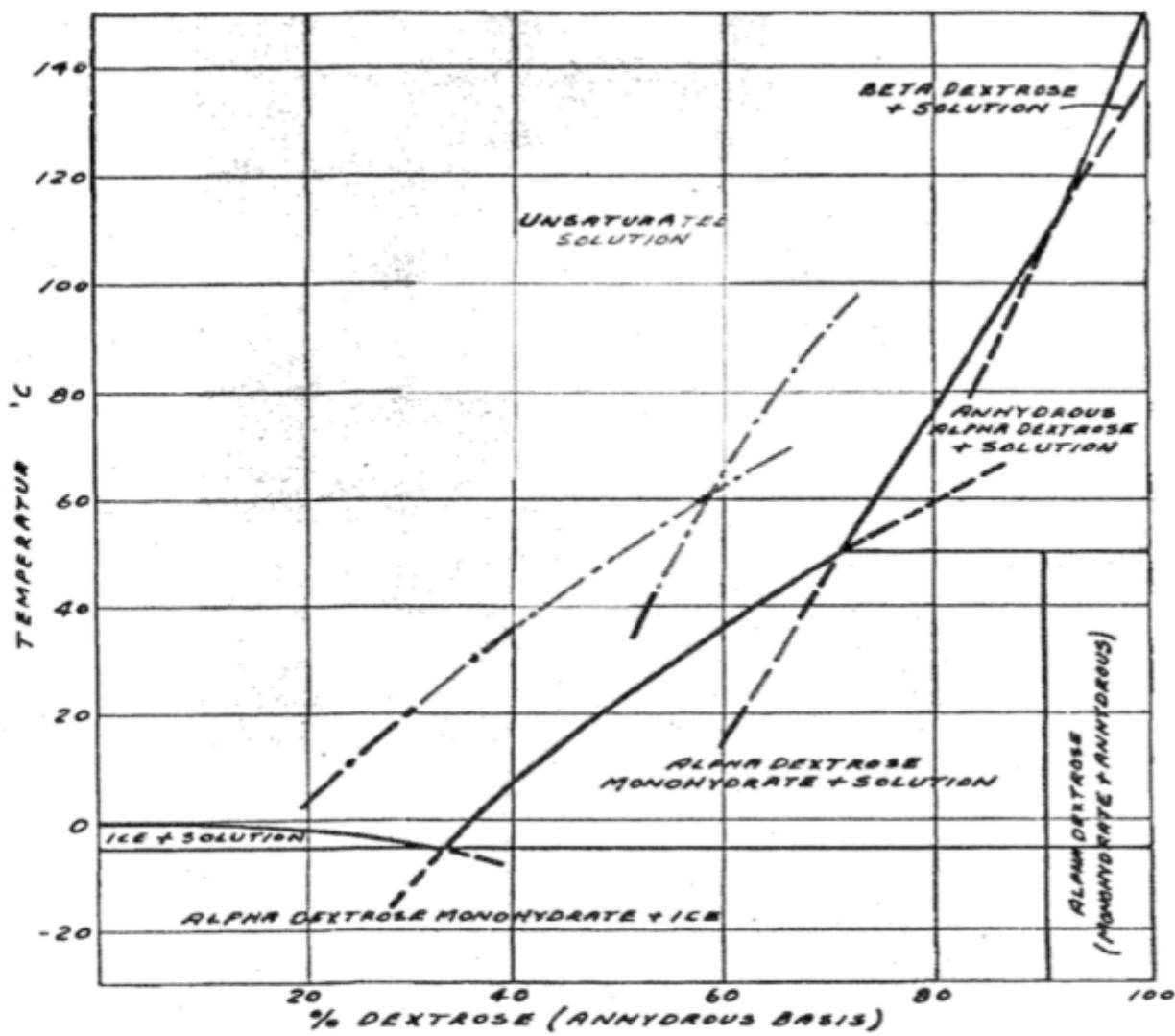
Boiling Point Elevation of Dextrose Solutions (1)

$$\log \Delta t = \alpha + \beta c + \gamma c^2 + \delta c^3$$

Pressure mm Hg	α	β	γ	δ	<u>Avg. Deviation</u>	<u>Max. deviation</u>
					°C	°C
233.72	-0.989843	5.113375X10 ⁻²	-7.377463X10 ⁻⁴	5.526503X10 ⁻⁶	<u>+0.017</u>	+0.032
355.22	-.982743	5.191070	-7.435453	5.463234	<u>.023</u>	.045
525.86	-.967871	5.239106	-7.477459	5.427242	<u>.028</u>	.055
760.00	-.944029	5.235447	-7.427223	5.345987	<u>.031</u>	
1,074.58	-.918243	5.251193	-7.490898	5.396036	<u>.033</u>	
1,489.14	-.885843	5.225459	-7.476027	5.404016	<u>.033</u>	

(1) John L. Torgesen, Vincent E. Bower and Edgar R. Smith. Jour of Res. Nat'l. Bur. of Stds., Vol. 45, No. 6 (1950 Corrected July, 1967)

PHASE DIAGRAM FOR DEXTROSE WATER SOLUTIONS



PREPARED BY G. R. D. RESEARCH DEPT., CORN PRODUCTS REFINING CO. -8-50

Dextrose Solution Density

Density of Glucose Solutions at 20 °C (2)

<u>Weight Sugar</u>	d_4^{20*}
5	1.01769
10	1.03769
15	1.05840
20	1.07981
25	1.10193
30	1.12475

*Densities of 10% solutions at 20 °C. in the reference to water at 4 °C.; glucose, 1.0377; fructose, 1.0385; maltose, 1.0386; lactose, 1.0376.

With increase in temperatures the sugar solutions expand in volume and the specific gravity becomes less.

(2) Sugar Analysis. Brown and Zerban. (1941)

Data for Density of Dextrose Solutions and Comparison with Interpolation Formula (1)

Concentration by weight in <u>vacuo %</u>	Density 20/4 °C <u>observed</u>	Density 20 /4°C calculated from <u>formula</u>	Residuals, <u>col.3 -</u> <u>col.2</u>
Per cent			
6.5	1.02361	1.02362	+0.00001
12.5	1.04799	1.04796	-.00003
18.5	1.07329	1.07331	+.00002
23.5	1.09524	1.09522	-.00002
28.9	1.11963	1.11966	+.00003

(1) Sci. Paper Bureau of Std's. No. 293, 641. (1916)

Density of Dextrose Solutions Calculated by Formula (1)

$$d^{20/4} = 0.99840 + 0.003788 p + 0.00001412 p^2$$

Concentration by weight in <u>vacuo %</u>	Density <u>20°/4°</u>	Concentration by weight in <u>vacuo %</u>	Density <u>20°/4 °</u>	Concentration by weight in <u>vacuo %</u>	Density <u>20°/4 °</u>
4	1.01378	13	1.05003	22	1.08857
5	1.01769	14	1.05421	23	1.09299
6	1.02164	15	1.05840	24	1.09745
7	1.02561	16	1.06262	25	1.10192
8	1.02961	17	1.06688	26	1.10643
9	1.03364	18	1.07116	27	1.11097
10	1.03769	19	1.07547	28	1.11553
11	1.04178	20	1.07981	29	1.12013
12	1.04589	21	1.08417	30	1.12475

(1) Scien. Paper Bur. of Std's. No. 293, 642. (1916)

p in above formula = % Dextrose by Wt. in vacuo.

Equivalents Tables for Dextrose/Glucose Solutions

Copper Acetate Titration Method for Hexoses – Sichert and Bleyer Modification of Barfoed*

Permanganate, <u>0.1 N titer</u>		Tenths of 1 ml of 0.1 N <u>permanganate</u>									
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	.08	0.9
		Milligrams of dextrose									
ml	10	26.5	26.8	27.1	27.4	27.8	28.1	28.4	28.7	29.0	29.3
	11	29.7	30.0	30.4	30.7	31.1	31.5	31.8	32.2	32.6	32.9
	12	33.3	33.7	34.1	34.5	34.9	35.4	35.8	36.2	36.6	37.0
	13	37.4	37.9	38.4	38.8	39.3	39.8	40.2	40.7	41.2	41.7
	14	42.2	42.7	43.2	43.8	44.3	44.9	45.4	46.0	46.5	47.0
	15	47.6	48.2	48.8	49.4	50.1	50.7	51.3	51.9	52.5	53.2
	16	53.8	54.5	55.2	55.9	56.6	57.3	58.0	58.7	59.4	60.2
	17	60.9	61.7	62.5	63.3	64.1	64.9	65.7	66.5	67.4	68.2
	18	69.0	69.9	70.9	71.9	72.8	73.8	74.8	75.7	76.7	77.6
	19	78.6	79.6	80.7	81.7	82.7	83.7	84.8	85.8	86.8	87.8
	20	88.9	90.0	91.2	92.3	93.5	94.7	96.0	97.2	98.5	99.7

(2) U.S. Dept. of Comm. Nat'l. Bu. Std's. Circ. C440, 607 (1942)

The table may be interpolated for hundredths of a milliliter but should not be extrapolated

Hagedorn and Jenses Dextrose Equivalents (1)

Hundredths of 1 ml of 0.005 N sodium thiosulfate

Sodium thiosulfate .00 0.005 N	.01	.02	.03	.04	.05	.06	.07	.08	.09
Milligrams of dextrose									
0.0	0.385	0.382	0.379	0.376	0.373	0.370	0.367	0.364	0.361
.1	.355	.352	.350	.348	.345	.343	.341	.338	.336
.2	.331	.329	.327	.325	.323	.321	.318	.316	.314
.3	.310	.308	.306	.304	.302	.300	.298	.296	.294
.4	.290	.288	.286	.284	.282	.280	.278	.276	.274
.5	.270	.268	.266	.264	.262	.260	.259	.257	.255
.6	.251	.249	.247	.245	.243	.241	.240	.238	.236
.7	.232	.230	.228	.226	.224	.222	.221	.219	.217
.8	.213	.211	.209	.208	.206	.204	.202	.200	.199
.9	.195	.193	.191	.190	.188	.186	.184	.182	.181
1.0	.177	.175	.173	.172	.170	.168	.166	.164	.163
1.1	.159	.157	.155	.154	.152	.150	.148	.146	.145
1.2	.142	.139	.138	.136	.134	.132	.131	.129	.127
1.3	.124	.122	.120	.119	.117	.115	.113	.111	.110
1.4	.106	.104	.102	.101	.099	.097	.095	.093	.092
1.5	.088	.086	.084	.083	.081	.079	.077	.075	.074
1.6	.070	.068	.066	.065	.063	.061	.059	.057	.056
1.7	.052	.050	.048	.047	.045	.043	.041	.039	.038
1.8	.034	.032	.031	.029	.027	.025	.024	.022	.020
1.9	.017	.015	.014	.012	.010	.008	.007	.005	.003

(1) U. S. Dept. of Comm. Nat'l. Bur. of Std's. Circ. C440, 604 (1942)

Dextrose Thiosulfate Equivalents *

Amount of dextrose corresponding to titration values when 5 ml. of solution and 5 ml. copper reagent (modified) are heated in a water bath for 15 minutes.

Tenths of 1 ml. of 0.005 N sodium thiosulfate

Thiosulfate
0.005 N

<u>ml</u>	0	1	2	3	4	5	6	7	8	9
	<u>Milligrams of dextrose in 5 ml. of solution</u>									
0	-	-	0.11	0.12	0.13	0.15	0.16	0.17	0.18	0.20
1	.21	.22	.23	.25	.26	.27	.28	.29	.31	.32
2	.33	.34	.35	.36	.38	.39	.40	.41	.42	.43
3	.45	.46	.47	.485	.495	.505	.515	.530	.540	.550
4	.565	.575	.585	.595	.605	.620	.630	.640	.650	.660
5	.670	.685	.695	.705	.715	.730	.740	.750	.760	.770
6	.785	.795	.805	.815	.825	.840	.850	.860	.870	.880
8	.895	.905	.915	.925	.935	.950	.960	.970	.980	.995
8	1.005	1.015	1.025	1.035	1.050	1.060	1.070	1.080	1.090	1.105
9	1.115	1.125	1.135	1.150#	1.160#	1.170#	1.185	1.195	1.205	1.215
10	1.225	1.24	1.25	1.26	1.27	1.28	1.295	1.305	1.315	1.325
11	1.335	1.35	1.36	1.37	1.38	1.395	1.405	1.415	1.425	1.44
12	1.450	1.460	1.470	1.480	1.495	1.505	1.515	1.525	1.54	1.55
13	1.560	1.570	1.580	1.590	1.605	1.615	1.63	1.640	1.650	1.660
14	1.670	1.685	1.695	1.705	1.715	1.725	1.735	1.750	1.760	1.170
15	1.780	1.795	1.805	1.815	1.825	1.835	1.850	1.860	1.870	1.880
16	1.89	1.905	1.915	1.930	1.940	1.950	1.960	1.970	1.98	1.990
17	2.00									

* M. Somogyi,
J. Biol. Chem.
70, 607(1926)

1 ml of 0.005 N thiosulfate equals 0.318 mg
of copper.

Recalculated, error in original pg.603 Bur. of Stds.
Cir.440. Given as 1.115, 1.116 and 1.117 Should be as
above . G.E.C.

Anhydrous Dextrose Table

145 Modulus 60/60 °F

Baume, Per Cent Anhydrous Dextrose and Pounds per Gallon at Various Temperatures

Be at 60/60 °F	Specific Gravity in Air	Per Cent Anhydrous Dextrose*	Pounds Anhydrous Dextrose per Gallon					
			60 °F	80 °F	100 °F	120 °F	140 °F	160 °F
0.	1.00000	0.00	0.000	0.000	0.000	0.000	0.000	0.000
1.	1.00695	1.79	0.150	0.150	0.149	0.148	0.148	0.147
2.	1.01400	3.59	0.303	0.302	0.301	0.300	0.298	0.296
3.	1.02115	5.39	0.459	0.458	0.456	0.454	0.451	0.449
4.	1.02840	7.20	0.617	0.615	0.613	0.610	0.607	0.603
5.	1.03576	9.01	0.777	0.775	0.772	0.768	0.764	0.759
6.	1.04322	10.83	0.940	0.937	0.934	0.929	0.924	0.918
7.	1.05079	12.65	1.107	1.104	1.100	1.094	1.088	1.082
8.	1.05846	14.47	1.267	1.263	1.258	1.252	1.245	1.238
9.	1.06626	16.30	1.448	1.444	1.438	1.431	1.423	1.414
10.	1.07416	18.14	1.623	1.618	1.611	1.604	1.595	1.585
11.	1.08219	19.98	1.801	1.795	1.788	1.779	1.770	1.759
12.	1.09033	21.83	1.982	1.976	1.967	1.958	1.947	1.935
13.	1.09860	23.68	2.167	2.160	2.151	2.140	2.129	2.116
14.	1.10700	25.54	2.355	2.347	2.337	2.326	2.313	2.299
15.	1.11552	27.41	2.546	2.537	2.527	2.514	2.500	2.486
16.	1.12418	29.28	2.741	2.731	2.720	2.706	2.692	2.676
17.	1.13297	31.16	2.940	2.929	2.916	2.902	2.887	2.870
18.	1.14190	33.04	3.142	3.130	3.116	3.101	3.085	3.067
19.	1.15097	34.93	3.349	3.336	3.321	3.305	3.288	3.269
20.	1.16019	36.83	3.559	3.546	3.530	3.513	3.494	3.473
21.	1.16956	38.74	3.774	3.760	3.743	3.725	3.705	3.683
22.	1.17908	40.66	3.993	3.978	3.961	3.941	3.920	3.896
23.	1.18875	42.58	4.216	4.200	4.182	4.161	4.139	4.114
24.	1.19859	44.52	4.444	4.427	4.408	4.387	4.362	4.336
25.	1.20858	46.46	4.676	4.657	4.636	4.614	4.590	4.564
26.	1.21875	48.41	4.914	4.894	4.872	4.848	4.823	4.796
27.	1.22909	50.37	5.156	5.135	5.112	5.087	5.060	5.032
28.	1.23960	52.34	5.404	5.381	5.357	5.331	5.304	5.274
29.	1.25030	54.33	5.657	5.633	5.608	5.580	5.552	5.521

30.	1.26118	56.32	5.915	5.890	5.863	5.835	5.805	5.773	5.739
31.	1.27226	58.32	6.180	6.154	6.126	6.096	6.065	6.032	5.996
32.	1.28353	60.34	6.450	6.422	6.393	6.363	6.331	6.298	6.263
33.	1.29500	62.37	6.726	6.697	6.607	6.635	6.602	6.568	6.533
34.	1.30667	64.41	7.009	6.979	6.947	6.914	6.880	6.845	6.810
35.	1.31856	66.46	7.298	7.265	7.232	7.199	7.165	7.128	7.088
36.	1.33067	68.53	7.594	7.559	7.525	7.491	7.456	7.418	7.376
37.	1.34300	70.61	7.897	7.865	7.831	7.794	7.756	7.716	7.674
38.	1.35557	72.70	8.207	8.175	8.140	8.102	8.062	8.020	7.978
39.	1.36837	74.81	8.525	8.493	8.458	8.418	8.376	8.332	8.289

* From Corn Products Company, October, 1964.

Dextrose - Baume - Dry Substance Relationship

145 Modulus Weight in Air 60/60 °F

Baume 60/60 °F	Specific Gravity in Air	Dextrose Weight %	Dextrose g/100 ml	Solution lbs/gal	Dextrose lbs/gal
0.	1.00000	0.00	0.00	8.33	0.000
1.	1.00695	1.79	1.80	8.39	0.150
2.	1.01400	3.59	3.63	8.44	0.303
3.	1.02115	5.39	5.50	8.50	0.459
4.	1.02840	7.20	7.39	8.56	0.617
5.	1.03576	9.01	9.31	8.63	0.777
6.	1.04322	10.83	11.27	8.69	0.940
7.	1.05079	12.65	13.26	8.75	1.107
8.	1.05846	14.47	15.29	8.82	1.276
9.	1.06626	16.30	17.35	8.88	1.448
10.	1.07416	18.14	19.45	8.95	1.623
11.	1.08219	19.98	21.58	9.01	1.801
12.	1.09033	21.83	23.75	9.08	1.982
13.	1.09860	23.68	25.97	9.15	2.167
14.	1.10700	25.54	28.22	9.22	2.355
15.	1.11552	27.41	30.51	9.29	2.546
16.	1.12418	29.28	32.85	9.36	2.741
17.	1.13297	31.16	35.23	9.44	2.940
18.	1.14190	33.04	37.66	9.51	3.142
19.	1.15097	34.93	40.13	9.59	3.349

20.	1.16019	36.83	42.66	9.66	3.559
21.	1.16956	38.74	45.23	9.74	3.774
22.	1.17908	40.66	47.85	9.82	3.993
23.	1.18875	42.58	50.53	9.90	4.216
24.	1.19859	44.52	53.26	9.98	4.444
25.	1.20858	46.46	56.04	10.07	4.676
26.	1.21875	48.41	58.89	10.15	4.914
27.	1.22909	50.37	61.80	10.24	5.156
28.	1.23960	52.34	64.76	10.32	5.404
29.	1.25030	54.33	67.80	10.41	5.657
30.	1.26118	56.32	70.89	10.50	5.915
31.	1.27226	58.32	74.06	10.60	6.180
32.	1.28353	60.34	77.30	10.69	6.450
33.	1.29500	62.37	80.61	10.79	6.726
34.	1.30667	64.41	84.00	10.88	7.009
35.	1.31856	66.46	87.47	10.98	7.298
36.	1.33067	68.53	91.02	11.08	7.594
37.	1.34300	70.61	94.65	11.18	7.897
38.	1.35557	72.70	98.37	11.29	8.207
39.	1.36837	74.81	102.17	11.40	8.525

Properties

Dextrose and Sucrose, Density and Thermal Expansion (2)

Glucose $d^t_4 = 1.5620$ t, C = 18

Sucrose $d^t_4 = 1.5877$ t, C = 18

(2) I. C. T., III, 45 (1928).

Influence of Dextrose on the Solvent Power of Water (3)

Gram, Molecules per liter	Gram Equivalents per l. water (N)	Partition Coefficient (P) for Et acetate	$(1-S_w)/N$ *
0.500	0.531	14.75	0.23
1.000	1.131	17.45	0.185
1.500	1.809	20.85	0.165
2.000	2.590	25.90	0.15

Solute Et acetate. Temp. 20 °C.

Effect of Glucose on Solvent Power of Hydrogen and Oxygen

Hydrogen	Oxygen
N	$(1-S_w)/N$
0.772	0.064
1.450	0.053
2.680	0.039
4.695	0.031
7.995	0.022

* Equivalent relative lowering of solvent power.

(3) J. C. Philip and Arthur Bramley. J. Chem. Soc. 107, 1831-7 (1915)

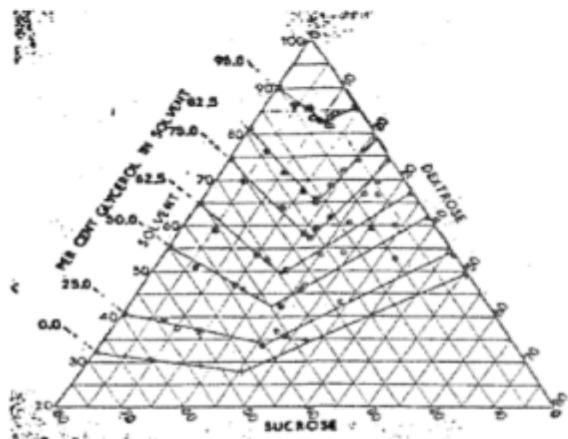


Figure 1. Solubility of sucrose and dextrose in aqueous glycerol at 25° C.

● Dextrose fixed, sucrose added to saturation
 ○ Sucrose fixed, dextrose added to saturation
 + Jackson and Silsbee data

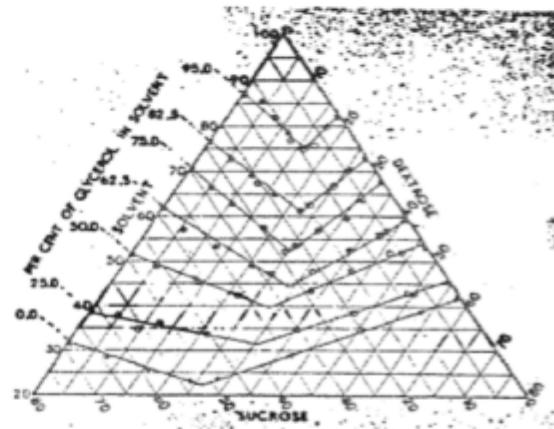
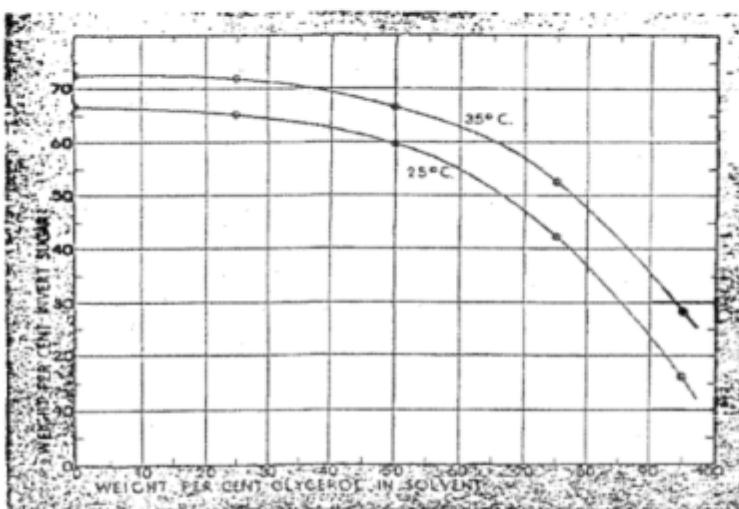


Figure 2. Solubility of sucrose and dextrose in aqueous glycerol at 35° C.

● Dextrose fixed, sucrose added to saturation
 ○ Sucrose fixed, dextrose added to saturation
 + Jackson and Silsbee data

Figure 3. Solubility of invert sugar in aqueous glycerol at 25° and 35° C.



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Glycerol. U.S.P., 95% concentration. Armour and Co., Chicago.

Sucrose, c.p., 99.9+%. Pfanstiehl Chemical Co., Waukegan, Ill.

Dextrose, c.p., anhydrous, 99.9+%. Special sample. Corn Products Refining Co., Argo, Ill.

Literature Cited

- (1) Assoc. Offic. Agr. Chemists, "Official Methods of Analysis," 7th ed., p. 503, 1950.
- (2) Bates, J. F., Natl. Bur. Standards, *Circ.* C440, 126 (1942).
- (3) *Ibid.*, p. 170.
- (4) *Ibid.*, p. 691.
- (5) Bosart, L. W., and Snoddy, A. O., *Ind. Eng. Chem.*, 19, 506-10 (1927).
- (6) Browne, C. A., and Zerban, F. W., "Physical and Chemical Methods of Sugar Analysis," 3rd ed., p. 450, New York, John Wiley & Sons, 1941.
- (7) Jackson, R. F., and Silsbee, C. G., Natl. Bur. Standards, *Tech. Paper* 18, No. 259, 277 (1924).
- (8) Segur, J. B., and Miner, C. S., Jr., *J. Agr. Food Chem.*, 1, 567-9 (1953).

Moisture Absorbed by Dextrose at Various Humidities (25 °C.) (1)

<u>Time</u>	<u>R. H. 62.7%</u>	<u>R. H. 81.8%</u>	<u>R. H. 98.8%</u>
1 Day	0.04	0.62	4.68
3 d	0.04	2.04	8.61
7 d	0.04	5.15	15.02
17 d	0.38	9.7	21.78
30 d	0.43	9.62	28.43
50 d	0.79	9.77	33.95
60 d	1.07	9.6	42.82
76 d	1.74	9.6	*

* When dextrose had absorbed 15-18% of moisture, it began to dissolve; after absorbing 42% it was completely liquefied and covered with mold.

(1) Effect of humidity on hygroscopic properties of sugars and caramel.

A. Sokolovsky. Ind. Eng. Chem. 29, 1422-3 (1937)

Moisture Absorptive Power of Different Carbohydrates Under Varying Conditions of Atmospheric Humidity (2)

% Moisture Absorbed From Air at 20 °C

<u>Anhydrous Material</u>	<u>60 Per cent Humidity</u>	<u>60 Per cent Humidity</u>	<u>100 Per cent Humidity</u>
	<u>1 hour</u>	<u>9 days</u>	<u>25 days</u>
Starch	1.04	12.98	24.37
Commercial glucose	0.29	9.00	47.14*
Levulose	0.28	0.63	73.39*
Commercial invert sugar	0.19	5.05	76.58*
Dextrose	0.07	0.07	14.50
Sucrose	0.04	0.03	18.35*

* Moisture absorption still progressing at end of 25 days.

(2) C. A. Browne. Ind. Eng. Chem. 14, 712-4 (1922)

Molecular Weight of Glucose Dissolved in Ammonia at Room Temperature (1)

Glucose Mol. Wt. 180.10

<u>Grams</u>	<u>Volume Solution</u>	<u>Weight of NH₃</u>	<u>Gr. Dis. Subst. per 100 g. NH₃.</u>	<u>P</u>	<u>M</u>
0.4820	3.363	1.9130	25.20	108	183
-	3.362	1.9123	25.21	108	183
-	3.325	1.8892	31.36	106	189
0.4992	2.862	1.5919	31.56	135	182
-	2.848	1.5832	31.56	140.5	176
-	2.847	1.5825	31.55	140	177

(1) Determination of molecular weight of substances dissolved in ammonia. A. I. Schattenstein and A. M. Monosohn.

Dielectrics: Solutions (3)

DEXTROSE

B=C₆H₁₂O₆

WT. %B

4 X 10⁸; 20 c.

0.0

10.0

20.0

30.0

40.0

(3) I.C.T. VI, 101 (1929)

Dielectric Constants of Binary Mixtures of Solutions (1)

Dextrose

Electrical Conductivity of Glucose (C₆H₁₂O₆)

Wt. of component <u>(4 X 10⁸; 20 C.)</u>	Σ	t, C. = 20 Conc range 0.4 - 0.1 (k or \wedge c) \wedge 0.4 = 0.13
0.0	81.9	
10.0	68.4	
20.0	55.7	
30.0	42.8	
40.0	30.3	

Unit of ϵ = 1 cgse unit

(1) I. C. T. VI, 101 (1929)

Dielectric Constants of Aqueous Dextrose and Sucrose Solutions (1)

Dielectric constant at T:

Dextrose

<u>wt per cent</u>	<u>20 °C</u>	<u>25 °C</u>	<u>30 °C</u>
0	80.38	78.54	76.76
5	79.17	77.37	75.64
10		76.14	
15	76.56	74.80	73.11
20	-	73.43	-
30	72.13	70.46	68.82

40	68.73	67.11	65.56
50	64.90	63.39	61.91

Sucrose

wt per cent

0	80.38	78.54	76.76
10	78.04	76.19	74.43
20	75.45	73.65	71.90
30	72.64	70.86	69.13
40	69.45	67.72	66.05
50	65.88	64.20	62.57
60	61.80	60.19	58.64

(1) J of R Nat'l. Bur. of Std's. Vol. 45, No. 4 Oct. 1950 R. P. 2137.

All data for dextrose solutions can be expressed by the equation;

$$(\text{dextrose}) = \epsilon_{\omega} - [0.227 - 1.2(10^{-3})(t-25)]C$$

$$-[1.32(10^{-3}) + 1.2(10^{-5})(t-25)]C^2$$

$$-[3.9(10^{-6}) - 2.8(10^{-7})(t-25)]C^3$$

where ϵ (dextrose) and ϵ_{ω} are, respectively, the dielectric constants of the dextrose solution and of water at the temperature, degrees Celsius, and C is the weight percent of dextrose.

For the solutions of sucrose, the corresponding equation:

$$(\text{sucrose}) = \epsilon_{\omega} - 0.226C - [6.75(10^{-4}) - 1.5(10^{-5})(t-25)]C^2$$

$$-[1.09(10^{-5}) + 4(10^{-8})(t-25)]C^3$$

Diffusion Coefficient and Particle Size of Glucose (2)

Concentration %	$D_{18}^{\circ} \times 10^6$	$A_{18}^{\circ} \times 10^8$
0.25	7.65	2.58
0.50	7.48	2.64
1.00	7.19	2.76
5.00	5.27	3.70
10.00	3.15	6.28

D = diffusion coefficient, A = radius of particle

(2) H. Sullmann. Protoplasma 13, 546-66 (1931)

Diffusion Velocity and Molecular Weight of Glucose at 25 C (3)

<u>Concentration</u>	<u>D in cm.²/day</u>	Calculated Molecular <u>Weight</u>
0.60	0.535	237
0.50	0.539	232
0.40	0.543	227
0.355	0.546	223
0.30	0.550	218
0.25	0.552	216
0.20	0.556	211
0.10	0.566	200
0.00 (extrap.)	0.586	180

(3) I. Leo Friedman and Paul G. Carpenter. J. Amer. Chem. Soc. 61, 1745-7 (1939).

Displacement of Salts from Solution by Various Precipitants (1)

Glucose at 25 °C

<u>Concn. Of Precipitant</u>	Solubility in <u>1 L. Water</u>	<u>Solute KCl</u>		<u>Solute NaCl</u>	
		<u>Molecu le</u>	<u>Solubili ty</u>	<u>Molecule Hydrat ion of Precipitant</u>	<u>1 L. Water</u>
-	362.70	4.86	4.86	-	361.40
1/4	366.10	4.91	4.91	-2.10	364.15
1/2	369.85	4.96	4.96	-2.15	364.30
1	376.25	5.04	5.04	-2.08	369.90
3	402.25	5.39	5.39	-2.01	6.32

(1) H. E. Armstrong and J. Vargas Eyre. Proc Roy. Soc (London) 84, 123-136 (1910-11).

Electrical Constants (1)

Molecular solution volume upon dilution at 20:

α-glucose 110.80 Mol.

β-glucose 111.22 Mol.

(1) Adberhalden. V 13, 337 (1931)

Hydrogen and Oxygen Electrode Titration of Dextrose (2)

Titration of 140 cc. of 0.3572 M-dextrose with 0.100 N-NaOH (18)

<u>cc. NaOH</u>	EMF against <u>N-calomel</u>	pH	Conc. NaOH <u>X 10³</u>	Total conc. NaOH & Na gluc. <u>X 10³</u>	Conc. of Na gluc. <u>X 10³</u>	Conc. of undissoc. glucose.	K=[H][Gluc.] <u>[H] [glnc.] X</u> <u>10³</u>
0	0.645	6.27	-	-	-	0.3572	8.07(a)
0.5	0.808	9.10	0.009	0.356	0.347	0.3557	7.75(a)
1.0	0.833	9.53	0.025	0.709	0.648	0.3539	5.70
3.0	0.860	10.00	0.07	2.10	2.03	0.3477	5.84
5.0	0.870	10.35	0.16	3.45	3.29	0.3416	4.30
10.0	0.887	10.47	0.21	6.67	6.49	0.3300	6.63
20.0	0.909	10.85	0.51	12.5	12.0	0.3005	5.65
30.0	0.920	11.04	0.79	17.6	16.8	0.2773	5.53
40.0	0.927	11.16	1.05	22.2	21.1	0.2567	5.69
50.0	0.933	11.27	1.35	26.3	24.9	0.2383	5.61
60.0	0.938	11.35	1.62	30.0	28.4	0.2216	5.72
70.0	0.941	11.40	1.82	33.3	31.5	0.2066	6.07
80.0	0.946	11.49	2.24	36.4	34.2	0.1931	5.73
90.0	0.948	11.53	2.46	39.1	36.6	0.1808	5.97
100.0	0.950	11.55	2.57	41.7	39.1	0.1693	6.51

(a) Omitted in calcn. mean. Mean 5.77×10^{-13}

(2) H. T. Britton. Jour. Chem. Soc. 127, 1896-1917 (1925)

Acid Dissociation Constants of Alcohols and Sugars, Especially Methyl Glycosides (3)

The following values for $k/10^{-15}$ were obtained:

Glycol	5.7	Mannose	1090
Glycerol	7	Sorbose	2780
Erythritol	12.5	α -Methylglucoside	19.7
Mannitol	34	β -Methylglucoside	26.4
Arabinose	370	Saccharose	240
Galactose	530	Lactose	600
Glucose	660		

(3) Leonor Michaelis. Ber. 46, 3683-93 (1913) C. A. 8, 693

Freezing Point Depression of Concentrated Solutions of Dextrose at 180 (1)

<u>t</u>	<u>π</u>	<u>n</u>	<u>π/n</u>
			1.83
0.498	0.499	0.262	1.904
1.04	1.041	0.525	1.983
1.435	1.436	0.700	2.052
2.305	2.308	1.049	2.20
3.25	3.256	1.399	2.327
5.605	5.625	2.100	2.68
8.71	8.76	2.782	3.148

t = observed depression of freezing point

π = calc. osmotic pressure

n = concentration in gram molecules per liter

π/n = molecular osmotic pressure

(1) Richard Abegg. Z. physikal Chem. 15, 222 (1894)

Freezing Point Data for Sugars and Ice Cream Mixes Containing Sweetener Combinations

Comparative Freezing Points for Sugar of 15% and 25% Sugar Solids (A)

	<u>15% Solids</u>	<u>25% Solids</u>
1. Corn Syrup Solids	30.55 °F.	29.07 °F.
2. Sucrose (cane or beet sugar)	30.16	28.40
3. Dextrose (refined corn sugar)	28.63	25.34
4. Invert Sugar (approximate)	28.6	25.3

Freezing Points for Ice Cream Mixes of Different Sweetener Combinations (B)

1. 16% Sucrose (no
other sugar) 39.7% 26.99 °F.
Total Solids

2. 12% Sucrose plus
4% Corn Syrup 27.18
Solids

3. 12% Sucrose plus
5% Corn Syrup 27.02
Solids

A. "Ice Cream Review" May 1942.
B. "Ice Cream Review" June 1942.
Corrected July, 1967

Heat Values for Dextrose and Other Sugars

Heat Capacity of Dextrose (1)

t, C. C_p, joule/g +-%

-250	0.0648	3
-200	0.323	1
-100	0.669	0.5
0	1.159	0
20	1.257	0

(1) I. C. T. V, 103 (1929)

Heat Capacity of Glucose - C₆H₁₂O₆ (2)

T, °K	C _p	T, °K	C _p
19.9	4.96	90.6	42.1
23.4	6.74	100.6	46.3
26.9	8.78	102.1	46.8
31.4	11.71	105.4	48.1
36.0	14.36	114.1	51.1
39.2	16.3	130.9	58.4
44.2	18.16	153.7	67.6
48.8	21.75	158.0	69.6
51.8	23.5	200.1	86.9
56.0	25.9	202.5	88.7
60.9	28.8	231.5	101.8
66.5	31.4	251.9	110.0
69.8	32.6	269.9	119.5
79.2	37.0	287.2	126.2
84.6	39.6	296.2	135.0

C_p Heat Capacity per Gram Formula-Wt.

°K Temperature, Unit Pressure 1 Atm.

(2) I. C. T. V, 86 (1929)

Heat Capacity of Dextrose Solutions at 20 C (3)

<u>%</u>	<u>C</u>	<u>%</u>	<u>C</u>
5	4.04	30	3.49
10	3.93	35	3.37
15	3.81	40	3.27
20	3.70	45	3.18
25	3.60	50	3.10
		55	3.03

(3) I. C. T. V, 125 (1939)

Heat Capacity of Pure Crystalline Dextrose (1)

The heat capacity of pure crystalline dextrose has been determined in an ice calorimeter by members of the Calorimeter Section of the Head Division of the Bureau of Standards.

They report the heat capacity of pure crystalline dextrose over the range of 0 to 100 Centigrade follows a relation:
 $C_p = 0.2665 + 0.000995t$ ($t = 25$ to 95 °C.)

where C_p represents the heat capacity in calories per gram, and t is the temperature in degrees Centigrade.

Mean observed value of the enthalpy of dextrose, in excess of that at 0 C.

<u>Temperature</u>	<u>cal/g.</u>
25	6.953
35	9.918
45	12.947
55	16.136
65	19.328
75	22.656
85	26.048
95	29.684

1 cal. = 4.184 absolute joules.

(1) J. Am. Chem. Soc. Vol. 73, 1360 (1951). T. B. Douglas, Anne F. Ball and John L. Torgensen.

Heat Capacity of Glassy Glucose (2)

Heat Capacity Measurements on Capsules Containing Water

Anhydrous c. p. Dextrose used

<u>Δt</u>	No. of Detns.	Av. H ₄ , Calc.	Av. Deviation calc.
60-35	4	2438.8	4.0
60-15	3	4385.5	1.5
60-5	5	5360.8	3.4

<u>Δt</u>	Average obsvd. sp. ht. cal./g. deg.	accepted sp. ht. cal./g. deg.	% Error
60-35	0.997	0.999	-0.2
35-15	0.994	0.999	-.5
15-5	0.996	1.002	-.6

(2) Earl W. Nelson and Roy Newton. J. Amer. Chem Soc. 63, No. 8: 2180 (1941)

Heat of Combustion and Free Energies at 25 C of some Organic Compounds (1)

Substance	Formula	Mol. Wt.	Density	<u>-Δ^U_B</u>	<u>-Δ^U_R</u>	<u>-Δ^U_R</u>
				kcal. mole ⁻¹	kcal. mole ⁻¹	kcal. mole ⁻¹
α-d-Glucose	C ₆ H ₁₂ O ₆	180.154	1.544	670.17 ± .07	669.58 ± .13	669.58
α-d-Glucose hyd.	C ₆ H ₁₄ O ₇	198.169	1.56	667.37 ± .12	666.73 ± .18	667.73
β-d-Glucose	C ₆ H ₁₂ O ₆	180.154	1.54	(671.67)c	(671.08)c	(671.08)c

<u>-ΔH_f</u>	<u>dΔ^U_R/dT</u>
Substance	<u>kcal. mole⁻¹ mole⁻¹, cal.</u>
α-d-Glucose	305.73
α-d-Glucose hyd.	376.90
β-d-Glucose	(304.23) ^c
	-65
	-71
	-65

c Calculated
(1) Hugh M. Huffman and Sidney W. Fox. J. Am. Chem. Soc. 60, 1400-3 (1938)

Heat of Combustion for Various Carbohydrates (2)

Heats of combustion in an adiabatic calorimeter gave the following values.

cal. Per gram

Dextrose	3739
Levulose	3729
Lactose	3737
Maltose	3776
Glycogen	4227

(2) A. G. Emery and F. G. Benedict. Amer. J. Physiol. 28, 301-7 (1911)

Name	Formula	Kg-cal ₁₅ per mole
Arabinose	C ₅ H ₁₀ O ₅	559.9
Xylose	C ₅ H ₁₀ O ₅	561.5
Galactose	C ₆ H ₁₂ O ₆	670.7
d-Glucose	C ₆ H ₁₂ O ₆	673
Lactose Anhyd.	C ₁₂ H ₂₂ O ₁₁	1350.8
Lactose	C ₁₂ H ₂₂ O ₁₁ .H ₂ O	1344.7
Maltose	C ₁₂ H ₂₂ O ₁₁	1350.2
Sucrose	C ₁₂ H ₂₂ O ₁₁	1349.6

(3) Kharasch, Bur. of Std's. Jour. of Res. 2, 359 (1929)

Computed Values of Heat Conductivity (kcal/mh^o) for Dextrose Solutions Relating to Temperature and Weight Percentage (1)

Temperature	0	10	20	30	40	50	60	70	80
0% (g sugar/100 g solution)	0.486	0.501	0.515	0.528	0.540	0.551	0.561	0.570	0.578
10	0.460	0.474	0.487	0.500	0.511	0.522	0.531	0.540	0.547
20	0.434	0.447	0.460	0.471	0.482	0.492	0.501	0.509	0.516
30	0.407	0.420	0.431	0.442	0.452	0.461	0.470	0.477	0.484
40	0.381	0.393	0.404	0.413	0.423	0.432	0.440	0.446	0.452
50	0.355	0.366	0.376	0.386	0.394	0.402	0.410	0.416	0.422
60	0.329	0.339	0.348	0.357	0.360	0.373	0.379	0.386	0.391

(1) Chem. Eng. Technik, 21 Jan. 1949 No. 17/18

Heat of Dilution of Dextrose (1)

Dextrose, $C_1 = 400$ = 1 M $C_6H_{12}O_6 \cdot H_2O$ and 25 M H_2O

t, °C	C2							
	300	240	200	160	100	80	60	40
0	167	268	343					
5	167	268	343					
10	167	268	343					
15	167	268	343					
20	167	268	343	431	560	606	652	690
25	167	268	343	427	544	585	623	656
30	167	268	343	418	527	560	594	623
33.5	167	268	343	414	510	543	564	594

(1) I. C. T. V, 161 (1929)

Heat of Solution of Sugars in Water (1)

Heat of Solution of β-d-Glucose Diluted to 0.0004 Mole of Sugar per Mole of Water

<u>Expt.</u>	<u>W</u>	<u>C_p</u>	<u>T</u>	<u>T_f</u>	<u>T_c</u>	<u>H. S.</u>
1	3.838	1077.4	21.5545	21.5345	0.0200	-5.64
2	5.818	1077.4	21.6550	21.6280	.0270	-5.76
3	2.428	1077.4	21.7200	21.7075	.0125	-5.54
Average value at $21.7 \pm^0$			-5.65			

Heat of Solution of d-Glucose Diluted to 0.0003 Mole of Sugar per Mole of Water

<u>Expt.</u>	<u>W</u>	<u>C_p</u>	<u>T</u>	<u>T_f</u>	<u>T_c</u>	<u>H. S.</u>
1	2.941	1073.2	25.0906	25.0525	0.0381	-14.5
2	3.319	1073.2	25.2503	25.2074	.0419	-14.5
3	3.441	1073.2	25.3239	25.2793	.0447	-14.5
Average value at $25.2 \pm^0$			-14.5			

Heat of Solution of d-Glucose Hydrate Diluted to 0.0003 Mole of Sugar per Mole of Water

<u>Expt.</u>	<u>W</u>	<u>C_p</u>	<u>T</u>	<u>T_f</u>	<u>T_c</u>	<u>H. S.</u>
1	3.257	1047.0	25.0678	24.9893	0.0785	-25.2
2	3.092	1047.1	25.0678	24.9933	.0745	-25.2

3	3.085	1047.0	25.1003	25.0258	.0745	-25.3
			Average value at 25.07 +-			-25.2

W = Weight of sugar sample

C_p = The water equivalent for the calorimeter plus its charge of water

T = Temperature of calorimeter at time sample introduced

T_f = Minimum temperature attained during solution of sugar

T_c = Temperature correction for heat of stirring

H. S. = Heat of solution per g. of solute in calories per gram of sugar.

(1) B. C. Hendricks, W. H. Steinbach, Jr., R. H. LeRoy and A. g. Moseley, Jr. J. Amer. Chem. Soc. 56, 99-101, (1934)

Heats of Solution for Organic Substances

<u>Organic Substance</u>	<u>Calories per Gram</u>	<u>Kilojoules Per Mole Solute</u>	<u>Reference</u>
Lactose, Anhydrous (c)	+7.33	+10.5	(1)
Dextrin	-0.82	-1.12	(1)
Sucrose (a)	-3.85	-5.52	(1)
Lactose, Hydrate	-10.3	-15.5	
Levulose (25 °C)	-12.0	-9.04	
Dextrose, Anhydrous (25.2 °C)	-14.5	-10.9	
Galactose (21.7 °C)	-21.4	-16.1	
Dextrose, Hydrate (25.07 °C) (b)	-25.2	-20.9	(2)

(1) I.C.T., V, 150 (1929)

(2) J.A.C.S., 56, 99 (1934) B. C. Hendricks

a) Lowest value of the common sugars

b) Highest value of the common sugars

c) Evolves heat during solution

Corrected July, 1967

Specific Heat of Crystalline α -Dextrose

<u>Temperature (degrees C.)</u>	<u>Specific Heat (cal/gram/deg. C.)</u>
0*	0.2665
10	0.2761
20	0.2856
30	0.2952
40	0.3047
50	0.3143
60	0.3238
70	0.3334
80	0.3429
90	0.3525
100*	0.3620

* Extrapolated values.

Research Project on Critical Data Physical Chemistry Section National Bureau of Standards No. 49-1,
1949.

Specific Heat of Dextrose at Low Temperatures (1)

Glucose, $C_6H_{12}O_6$, Anhydrous, M. P. 146 C

23.99 g. = 3.197 g.-atoms.

Abs. Temperature <u>T</u>	Heat Capacity of Filled Calorimeter <u>WC</u>	Heat Capacity of Glucose <u>WC_k</u>	Molecular Heat (from no. atoms in mol.) <u>C_p</u>
19.9	0.299	0.271	0.0848
26.9	0.544	0.479	0.150
36.0	0.904	0.783	0.245
44.2	1.220	1.045	0.327
51.8	1.509	1.284	0.402
60.9	1.855	1.569	0.491
69.8	2.118	1.777	0.556
84.6	2.581	2.160	0.676
100.6	3.012	2.527	0.790
114.1	3.319	2.791	0.873
153.7	4.321	3.694	1.155
296.2	8.010	7.225	2.260
16.91 g. = 2.253 g.-atoms.			
200.1	4.044	3.338	1.482
231.5	4.653	3.913	1.737

296.9	5.370	4.596	2.040
287.2	5.646	4.860	2.157

(1) Frans Simon, Ann. Physik. 68, 241-80 (1922)

Mutarotation of Dextrose/Glucose

Rotary Powers of Alpha and Beta Glucose (2)

d-Glucose, mol. wt. 180, C₆H₁₂O₆

Specific rotation in water	α -form = + 113.4
	const. rotn. = +52.2
	Mol. Rotn. Difference = + 1690

Velocity coefficient for mutarotation in water at 20° = .0065

At 20°, Solubility	α -glucose in 80% alcohol = 4.5 g. per 100 cc. soln.
	α -glucose in methyl alcohol = 1.6 g. per 100 cc. soln.
	α -glucose hydrate in 80% EtOH = 3.0 g. per 100 cc soln.
	β -glucose in 80% EtOH = 9.1 g. per 100 cc. soln.

(2) Indirect measurements of the rotary powers of some alpha and beta forms of sugar by means of solubility experiments. C. S. Hudson and E. Yanovsky. J. Amer. Chem. Soc. 39, 1013-38 (1917)

Summary of Data on Monochromatic Rotations of Dextrose Solutions (1)

The mean monochromatic rotations for five concentrations are the values converted into specific rotations by the formula:

$$[\alpha]^{20} \text{ at } 5461\text{A} = \alpha(100.00)/2(\text{weight dextrose in vacuo})$$

<u>Normality of solution</u>	<u>Vacuum weight of dextrose in 100 cc</u>	<u>rotation observed</u>	<u>Rotation calculated from formula</u>	<u>[α]_{5461A} calculated from formula</u>
	<u>g</u>	<u>$\lambda=5461A$</u> <u>deg</u>	<u>deg</u>	<u>deg</u>
N	32.2515	40.897	40.898	63.404
	25.801	32.574/5	32.576	63.129
	19.351	24.328	24.326	62.855

2/5N	12.9005	16.142	16.147	62.581
1/5N	6.4503	8.042	8.038	62.306

(1) Scien. Paper Bur. Std's. No. 293, 651. (1916)

Influence of Various Normal Salts on the Mutarotation and Specific Rotation of Dextrose (1)

<u>Solvent</u>		<u>α^{20}_D</u>
4N	KI	47.4°
	KBr	48.5
	KCl	49.6
	NH ₄ NO ₃	50.6
2N	KNO ₃	50.6
4N	NH ₄ Cl	51.2
2N	KCl	51.2
N/1	K ₂ SO ₄	51.2
2N	(NH ₄) ₂ SO ₄	51.7
	CH ₃ COOK	51.7
4N	NaNO ₃	52.3
2N	Na ₂ SO ₄	52.3
	NH ₄ Cl	52.3
	CH ₃ COONH ₄	52.3
N/1	CH ₃ COOK	52.3
	Distilled water	52.8
4N	MgCl ₂	52.8
N/1	MgCl ₂	52.8
2N	MgSO ₄	52.8
	CH ₃ COONa	52.8
N/1	CH ₃ COONa	52.8
N/1	CH ₃ COONH ₄	52.8
2N	BaCl ₂	54.7
3N	BaCl ₂	55.5
2N	CaCl ₂	56.0
4N	CaCl ₂	61.2

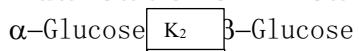
(1) Hans Murschhauser. Biochem. Z. 136, 66-70 (1923)

Influence of Temperature on the Coefficient of Acid Catalysis for the Mutarotation of Glucose (1)

<u>Temperature</u>	<u>Coefficient Observed</u>	<u>Coefficient Calculated</u>
3	0.024	0.025
14	0.13	0.089
18	0.13	0.13
20	0.17	0.16
25	0.21	0.27
25	0.37	0.27
25	0.26	0.27
30	0.46	(0.45)

(1) C. S. Hudson and J. K. Dale. J. Amer. Chem. Soc. 39, 320-8 (1917)

Mutarotation or Bi-rotation of Sugars (1)



$$k = k_1 + k_2 = \frac{1}{t} \log_e \frac{1}{1-x} = \frac{1}{t} (\log_e a^\infty / a^\infty - a)$$

Polarimetric Method; t in minutes; = 25 C.

$$k = k_w + k_s [H^+] + k_a [OH^-]$$

k_w	k_s	k_a
0.0221	0.594	22 450
0.0239	0.769	21 520

(1) I. C. T. VII, 128 (1930)

Influence of Temperature on the Rate of Mutarotation of α -and β -Glucose (2)

α Glucose ($k_1 + k_2$)	β Glucose ($k_1 + k_2$)	Calculated ($k_1 + k_2$)	
0.7	0.00074	0.00074	(0.00074)
5	.00129	.0015	.00122
10	.00225	.00223	.00216
15	.00399	.00379	.00374
20	.00635	.00654	.00633
25	.01050	.01057	(0.01057)
30	.0175	.0168	.0173
40	.0437	.0395	.0442

Variation of the Rate of Mutarotation with Concentration of β Glucose (2)

<u>Gms. Glucose</u> <u>in 100 cc.</u>	<u>$t = 25 (k_1 + k_2)$</u>	<u>Gms. Glucose</u> <u>in 100 cc.</u>	<u>$t = 25 (k_1 + k_2)$</u>
3	0.01050	16	0.01104
3	.01057	25	.01135
3	.01068	32	.01068
6	.01048	37	.01060
9.6	.01059	52	.01008
		64	.00931

(2) C. S. Hudson and J. K. Dale. J. Am. Chem. Soc. 39, 325 (1917)

Mutarotation of Carbohydrates Under the Influence of Strong Acid (1)

Acid concentration <u>N-</u> in H_2SO_4	Observed rotation 10 min. <u>after solution</u>	Specific rotation
0	5.28	52.8
10	5.60	56.0
16	6.25	62.5
18	6.50	65.0
20	6.75	67.5
22	7.25	72.5
24	8.00	80.0
26	9.10	91.0
28	10.70	107.0

5 grams glucose in 100cc. Tube = 2 dm. Temp. = 25 C

(1) B. Bleger and H. Schmidt. Bioshem. Z. 138, 119-41 (1923)

Mutarotation of α -D-Glucose in Dioxane - Water Mixtures at 25 C (2)

<u>Weight % dioxane</u>	<u>Initial rotation</u> $[\alpha]^{25}_D$	<u>Equilibrium rotation</u> $[\alpha]^{25}_D$	<u>Velocity constant</u> $(k_1 + k_2) \times 10^4$

0.0	110.5	52.6	105
20.6	111.0	54.2	63.7
40.9	111.1	55.4	36.4
50.8	111.3	56.3	25.9
60.8	111.6	57.1	16.8
70.7		58.0	11.8
80.6	111.	59.1	7.3
85.4		59.7	5.5
90.3		60.7	3.6
95.3		63.0	1.5
100		(67.0)	(0.5)

Equilibrium specific rotation in MeOH is +65.5; EtOH +65.5; Dioxane is + 67.0

(2) H. H. Rowley and Ward N. Hubbard. J. Amer. Chem. Soc. 64, 1010-11 (1942)

Mutarotation of Glucose in Acid and Alkaline Solutions (1)

pH

Solvent	H. Electrode	Quinhydrone	Glass Elec.	K _e
0.5 N HCl	0.404		-	0.216
0.1 N HCl	1.09	1.09	-	0.0529
0.05 N HCl	1.40	-	-	0.0337
0.01 N HCl	2.08	2.10	-	0.0184
Ca0.001 N HCl	3.23	-	-	0.0147
0.01 M NaHCO ₃	-	-	7.76	0.0274
0.05 M NaHCO ₃	-	-	7.92	0.0497
0.001 M Na ₂ CO ₃	-	-	8.35	0.131
0.002 M Na ₂ CO ₃	-	-	8.86	0.196

Mutarotation of Glucose in the Presence of a Weak Acid or Base (1)

Solvent pH Vel. Coeff. at 20 C

N-sodium acetate	-	0.0982
N-ammonium chloride	4.7	0.0159
N-NaOAc and N-NH ₄ Cl	6.66	0.106
0.5 N-phenol	5.8	0.0146
0.1 N-phenol	6.21	0.0147
0.1 N-pyridine & 0.1 N-phenol	7.48	0.0447

(1) T. M. Lowry and G. F. Smith. J. Chem. Soc. 2539-54 (1927)

Mutarotation of Glucose in Alkaline Solution (2)

The velocity constant C of the mutarotation of dextrose in water and sodium carbonate is given until a rotation of 5.6° was reached.

	<u>C</u>	<u>t, in minutes</u>
water	7.11	120
n/7000 Na ₂ CO ₃	7.32	117
n/6000	9.32	90
n/5000	12.70	61
n/2000	24.4	34
n/1000	56.5	17
n/500	93.1	9

(2) Hans Murshhauser. Biochem. Z. 106, 23-36 (1920)

Glucose Mutarotation Equilibria in Methanol and Mixtures of Methanol - Water (1)

<u>Mols. Water</u>	<u>Mols. Alcohol</u>	<u>[a]²⁵_{5461A}</u>	<u>k X 10³*</u>
100	0	61.5	9.6 (mean)
90	10	63.8	7.1
77.2	22.8	64.4	4.8
59.9	40.1	68.2	3.0
44.2	55.8	74.3	1.9
11.0	89.0	75.8	0.3
0	100.0		0.4 (mean)

The optical rotations of α and β -glucose $[a]^{25}_{5461A}$ are respectively 129.0 and 23.8 in water and 138.4 and 26 in MeOH. At equilibrium it may be assumed that in water there is 35.8% α -glucose and in MeOH 44.3% α -glucose – if no intermediate form is present.

<u>(2)</u> <u>Conc. HCl</u>	<u>α-Glucose k X 10³</u>	<u>Conc. NaCl</u>	<u>Glucose and pure NaCl k X 10³</u>
0	9.6	0	9.6
0.65	17.4	0.84	9.78
1.10	20.2	1.79	9.80
1.78	25.5	1.83	9.66
2.27	33.0	1.87	10.30
2.83	36.0	1.89	9.71
2.91	36.9	3.09	9.71
		3.64	9.99
	β -Glucose	4.88	10.20
		8.63	9.67

0	9.7
0.54	14.8
0.96	18.3
1.10	21.1
1.92	26.7

NaCl after heating to 120° had no accelerating effect.

(1) J. C. Andrews and F. P. Morley. J. Physical Chem. 31, 1880-3 (1927).

* I. ibid. 742.

(2) II ibid. 882-5.

Mutarotation of d-Glucose in Absolute Methanol (3)

The velocity constant expressed in common logs: ($k_1 + k_2$). Average values for α -and β -Glucose:

25°	1.8 ±0.4
35	3.4 ±0.3
45	9.0 ±0.5

(3) H. H. Rowley and S. David Bailey. J. Amer. Chem. Soc 62, 2562-3 (1940).

Rate of Mutarotation of Glucose in Hydrochloric Acid Solutions at 24.7 C (1)

No.	Concentration HCl (mol./liter)	Reading at time							K	Avg.
		0	5	15	25	35	45	60		
1	Distilled	34.2	32.4	29.2	27.0	25.3	24.0	22.5	18.5	0.0106
2	Water	32.8	30.8	28.4	25.8	24.2	22.8	21.5	17.7	0.0107
3	0.001	33.9	32.2	29.3	26.7	25.1	23.7	22.2	18.0	0.0099
4	0.001	32.7	30.8	28.2	26.2	24.4	22.8	21.2	17.2	0.0098
5	0.005	32.5	30.6	27.8	25.3	23.6	22.2	20.8	17.5	0.0112
6	0.005	32.6	30.7	27.6	25.4	23.6	22.0	20.7	17.4	0.0113
7	0.01	32.4	30.4	27.4	24.8	23.1	21.5	20.2	17.3	0.0120
8	0.01	33.2	31.2	28.0	25.5	23.6	22.2	20.8	18.0	0.0122
	time	0	5	10	15	20	25	30		
9	0.03	32.4	29.7	27.3	25.4	23.8	22.7	21.8	16.7	0.0168
10	0.03	31.8	29.3	26.8	24.9	23.5	22.3	21.3	16.6	0.0170
11	0.06	33.7	29.8	26.8	24.7	22.8	21.5	20.7	17.7	0.0244
12	0.06	34.7	30.6	27.3	25.2	23.7	22.3	21.5	18.8	0.0262
13	0.10	32.2	27.4	23.8	21.7	20.3	19.3	-	17.4	0.0357
14	0.10	31.4	27.0	23.7	21.9	20.4	19.6		17.8	0.0352

(1) J. Amer. Chem. Soc. 29, 1571-76(1907)

Solution Mutarotation Volume and Refractive Index Constants of α and β Glucose (1)

A 10% solution of glucose ($\delta^{20}_4 = 1.0378811$) was studied. The solution volume was calculated as α -glucose = 111.230 ml. and β -glucose = 111.648 ml.

The index of refraction for 10% solution was as follows;

$$\alpha \text{ glucose } n^{20}_D = 1.3477579$$

$$\text{glucose} = 1.3478477$$

$$\beta \text{-glucose} = 1.3478984$$

(1) C. N. Riiber. Ber. 57, 1599-1604 (1924)

Mutarotation of Glucose Solutions (2)

C is concentration (g. $C_6H_{12}O_6$ in 1 deciliter) of glucose solution.

<u>C</u>	<u>d^{20}_4</u>	<u>C</u>	<u>d^{20}_4</u>
0	0.998232	4.9866	1.017344
5	1.017395	9.9634	1.036304
10	1.036443	10.4710	1.038231
15	1.055371	14.9309	1.055122
20	1.074178	19.8588	1.073649
25	1.092861		

(2) C. N. Riiber. Ber. 59, 2185-2194 (1923)

Mutarotation of α d-Glucose in Ethanol-Water Mixtures at 25 C (3)

Weight of C_2H_5OH	Initial Rotation Equilibrium Rotation		
	<u>$[a]^{25}_D$</u>	<u>$[a]^{25}_D$</u>	<u>$(k_1 - k_2) \times 10^3$</u>
0	110.5	52.6	10.5
10	110.5	53.1	7.7
20	110.6	53.6	6.3
40	110.8	54.8	4.4
60	111.0	56.3	3.1
80	111.6	58.6	1.7
90	112.6	60.7	0.95
95	114.2	62.6	0.55
100	116.2	65.5	0.10

(3) H. H. Rowley and S. David Bailey. J. Amer. Chem. Soc. 62, 2563 (1940).

Osmotic/Vapor Pressure of Dextrose/Glucose Solutions

OSMOTIC PRESSURE OF DEXTROSE SOLUTIONS

Solutions of Glucose at 0 °C.

Gr. Dissolved in 1 L. Solution	Osmotic pressure in atm.		
	Nw	Calc. Nw X 22.41	Observed
199.5	1.274	28.55	29.17
319.2	2.237	50.13	53.19
448.6	3.52	78.88	87.87
548.6	4.75	106.22	121.18

Nw = weight - normal concentration.

The discrepancy is explained if it is remembered that above 30 °C. glucose crystallizes anhydrous, but at lower temperatures with one molecule of water. With water present Nw increases, as does osmotic pressure.

Solutions of Glucose

Osmotic Pressure in Atm. at 0 °C.

Nw	molecules: free : 1 mol. H ₂ O : 2 mol. H ₂ O	Observed	a
0.2	4.482	4.51	4.67
0.4	8.964	9.10	9.34
0.6	13.446	13.74	14.12
0.8	17.928	18.46	18.86
1.0	22.410	23.25	23.75
1.274	28.55	29.92	29.17
2.237	50.13	54.50	53.19
3.52	78.88	86.24	87.87
4.74	106.22	116.12	121.18

a = number of molecules of water per molecule of glucose required to cause the observed osmotic pressure.

(1) Studies on the nature of some dilute and concentrated non-electrolytes.

B. H. van Ruyven. Rec. Trav. Chim. 55, 474-91 (1936)

Osmotic Pressure of Glucose Solutions (2)

Weight - Normal Concentration

<u>Temp.</u>	<u>0.1</u>	<u>0.2</u>	<u>0.3</u>	<u>0.4</u>	<u>0.5</u>	<u>0.6</u>	<u>0.7</u>	<u>0.8</u>	<u>0.9</u>	<u>1.0</u>
30 C.	2.475	4.950	7.417	9.885	12.352	14.837	17.327	19.770	22.282	24.727
40 C.	2.553	5.112	7.664	10.205	12.756	15.325	17.870	20.411	23.000	25.533
50 C.	2.633	5.275	7.909	10.531	13.198	15.808	18.446	21.045	23.649	26.342

<u>Concn. (g. Gluc./L. soln.)</u>	<u>Obs. Osm. Pressure</u>	<u>Calc. Osm. Pressure</u>
99.8	13.21 atm.	12.42 atm.
199.5	29.17	24.82
319.2	53.19	39.72
448.6	87.87	55.83
548.6	121.18	68.27

(2) Osmotic pressure. Alexander Findlay. 2nd. Ed. 1919, p. 26.

Osmotic Pressure in the Vicinity of the Freezing Point of Water

(1)

Molecular Depression of Freezing Point of Cane Sugar

<u>Weight normal concentration</u>	<u>Osmotic Pressure of Glucose</u>	<u>Osmotic Pressure Cane Sugar</u>	<u>Observed Molecular Depression of Freezing Point of Glucose</u>	<u>Calculated</u>	<u>Observed</u>
0.1	2.40	2.44	1.92	1.95	1.95
0.2	4.65	4.80	1.92	1.98	1.96
0.3	7.01	7.16	1.92	1.96	1.95
0.4	9.30	9.40	1.92	1.94	1.96
0.5	11.65	11.85	1.92	1.95	1.97
0.6	14.01	14.25	1.92	1.95	1.98
0.7	16.37	16.81	1.92	1.97	1.99
0.8	18.77	19.33	1.92	1.98	2.02
0.9	21.25	22.13	1.92	2.00	2.03
1.0	23.59	24.78	1.92	2.02	2.07

(1) H. N. Morse, J. C. W. Frazer and F. M. Rogers. Am. Chem. J. 37, 558-95 (1907)

The Osmotic Pressure and the Depression of Freezing Points of Glucose Solutions (2)

<u>Weight Normal Concn.</u>	<u>Temp. of Solution</u>	<u>Observed Osmotic Pressure atm.</u>	<u>Observed Depression in Freezing point</u>	<u>Density of Solution at 0°</u>	<u>Osmotic Pressure at 10° (3)</u>
0.1	24.10	2.39	0.192	1.00687	2.39 atm.
0.2	24.10	4.76	0.386	1.01376	4.76
0.3	22.20	7.12	0.576	1.02041	7.11
0.4	26.90	9.70	0.762	1.02691	9.52
0.5	21.86	12.07	0.952	1.03327	11.91
0.6	22.57	14.56	1.147	1.03945	14.31
0.7	22.26	16.82	1.337	1.04551	16.70
0.8	23.00	19.27	1.528	1.05143	19.05
0.9	23.80	21.64	1.720	1.05731	21.39
1.0	22.20	24.12	1.918	1.06300	23.80

(2) H. N. Morse, J. C. W. Frazer and B. F. Lovelace. Amer. Chem. J. 37, 324-60 (1907).

(3) Ibid. 40 1-18 (1908)

Values of Pressure, Temperature and Rate of Change of Pressure with Temperature for Dextrose Solutions (1)

Concentration of dextrose solutions

	<u>Concentration of dextrose solutions</u>					
Pressure <u>mm Hg</u>	<u>10 Percent</u>	<u>20 Percent</u>	<u>30 Percent</u>			
^a 100	51.87	4.92	52.17	4.91	52.58	4.90
200	66.72	8.86	67.05	8.84	67.50	8.82
300	76.17	12.47	76.52	12.45	76.99	12.41
400	83.25	15.87	83.62	15.84	84.11	15.79
500	88.98	19.13	89.36	19.08	89.87	19.03
600	93.82	22.26	94.21	22.20	94.73	22.14
700	98.03	25.30	98.43	25.23	98.96	25.16
760	100.32	27.08	100.73	27.01	101.27	26.93
800	101.77	28.25	102.18	28.18	102.72	28.10
900	105.14	31.14	105.55	31.06	106.11	30.97
1,000	108.21	33.96	108.64	33.87	109.20	33.77
1,100	111.04	36.73	112.47	36.63	112.05	36.53
1,200	113.67	39.45	114.11	39.34	114.69	39.23
1,300	116.12	42.12	116.57	42.01	117.15	41.89
1,400	118.42	44.76	118.87	44.64	119.47	44.50
1,500	120.59	47.35	121.05	47.22	121.65	47.08
^a 1,600	122.65	49.91	123.11	49.78	123.72	49.63

	<u>40 Percent</u>		<u>50 Percent</u>		<u>60 Percent</u>	
Pressure <u>mm Hg</u>	Temperature <u>°C</u>	dp/dt <u>mm/°C</u>	Temperature <u>°C</u>	dp/dt <u>mm/°C</u>	Temperature <u>°C</u>	dp/dt <u>mm/°C</u>
^a 100	53.11	4.88	53.99	4.86	55.42	4.85
200	68.08	8.79	69.02	8.75	70.51	8.71
300	77.61	12.36	78.59	12.31	80.14	12.24
400	84.76	15.73	85.77	15.65	87.36	15.55
500	90.54	18.95	91.58	18.85	93.21	18.72
600	95.42	22.05	96.50	21.93	98.16	21.77
700	99.67	25.06	100.77	24.92	102.46	24.72
760	101.98	26.82	103.10	26.67	104.81	26.46
800	103.44	27.98	104.56	27.82	106.29	27.59
900	106.85	30.84	107.99	30.65	109.74	30.40
1,000	109.95	33.63	111.11	33.43	112.89	33.14
1,100	112.81	36.37	113.99	36.14	115.79	35.82
1,200	115.46	39.06	116.65	38.81	118.48	38.46
1,300	117.94	41.71	119.15	41.44	121.00	41.05
1,400	120.26	44.31	121.49	44.02	123.36	43.60
1,500	122.46	46.88	123.70	46.57	125.59	46.11
^a 1,600	124.54	49.41	125.79	49.08	127.70	48.59

a Extrapolated values.

(1) By John L. Torgesen, Vincent E. Bower, and Edgar R. Smith Jour. of Res. Nat'l. Bur. of Stds., Vol. 45, No. 65 (1950)

Vapor Pressure Lowering by Dextrose Solutions (2)

Dextrose at 0°

M	100R
	1.66
	1.72

p = partial vapor pressure of the solvent from the solution.

p_o = its vapor pressure in the pure state at the same temp.

M = the number of gram-formula weight of solute per 1000g. H₂O).

$$100(p_o - p)/Mp_o$$

The relation between M and 100R is linear between values marked with an arrow.

(2) I. C. T. III, 327 (1928)

Vapor Pressure – Temperature Relationships of Dextrose Solutions (1)

$$\log p = A - B/(C+t)$$

Concentration of

Dextrose	A	B	C	<u>Average deviation</u>	<u>Maximum deviation</u>
<u>Percent</u>				<u>mm Hg</u>	<u>mm Hg</u>
10	7.912637	1636.365	224.883	± 0.03	+0.08
20	7.902317	1633.713	224.618	$\pm .05$	-.14
30	7.900496	1637.294	224.907	$\pm .05$	.25
40	7.888662	1636.304	224.764	$\pm .01$	.02
50	7.853013	1622.430	223.205	$\pm .05$	-.11
60	7.779591	1587.450	219.244	$\pm .04$	.17

(1) By John L. Torgesen, Vincent E. Bower, and Edgar R. Smith, J. of Res. Nat'l. Bur. of Stds., Vol. 45, No. 6 (1950)

Rotary Power and Refractive Index of Dextrose/Glucose

Refractive Indices of Dextrose and Invert Sugar Solutions at 20 °C. (1)

Per cent Sugar by Weight in Air	<u>Refractive Index</u>		Per cent Sugar by Weight in Air	<u>Refractive Index</u>	
	Dextrose	Invert Sugar		Dextrose	Invert Sugar
0	1.33299	1.33299	40	1.39872	1.39866
1	.33442	.33441	41	.40061	.40056
2	.33587	.33583	42	.40252	.40248
3	.33732	.33727	43	.40444	.40440
4	.33878	.33872	44	.40637	.40634
5	.34025	.34018	45	.40832	.40830
6	.34173	.34165	46	.41028	.41026
7	.34322	.34313	47	.41225	.41225
8	.34472	.34462	48	.41424	.41424
9	.34623	.34612	49	.41624	.41625
10	1.34775	1.34764	50	1.41826	1.41827
11	.34929	.34916	51	.42029	.42031
12	.35083	.35070	52	.42233	.42236
13	.35238	.35225	53	.42439	.42443
14	.35394	.35381	54	.42646	.42650
15	.35552	.35538	55	.42854	.42860
16	.35711	.35696	56	.43064	.43070
17	.35870	.35856	57	.43276	.43283
18	.36031	.36016	58	.43488	.43496
19	.36193	.36178	59	.43703	.43711
20	1.36356	1.36341	60	1.43918	1.43928
21	.36520	.36506	61	.44136	.44146
22	.36686	.36671	62	.44354	.44365
23	.36852	.36838	63	.44574	.44586
24	.37020	.37006	64	.44796	.44808
25	.37189	.37175	65	.45019	.45032
26	.37359	.37345	66	.45243	.45257
27	.37530	.37517	67	.45469	.45484
28	.37703	.37690	68	.45697	.45712
29	.37877	.37864	69	.45926	.45941
30	1.38052	1.38040	70	1.46156	1.46172
31	.38228	.38217	71	.46388	.46405
32	.38406	.38395	72	.46621	.46639
33	.38584	.38574	73	.46856	.46874
34	.38765	.38755	74	.47092	.47111

35	.38946	.38937	75	.47330	.47350
36	.39129	.39120	76	.47570	.47590
37	.39313	.39305	77	.47810	.47831
38	.39498	.39491	78	.48053	.48074
39	.39684	.39678	79	.48297	.48319
			80	1.48542	1.48564

Above refractive indices derived from the following equations:

$$n^{20}_D, \text{ Dextrose} = 1.33299 + 0.001428288p + 0.000004594154p^2 + 0.00000002194551p^3 - 0.0000000006037339p^4.$$

$$n^{20}_D, \text{ Invert Sugar} = 1.33299 + 0.001411210p + 0.000005198919p^2 + 0.00000001568555p^3 - 0.0000000003776638p^4.$$

p = % Sugar by Weight

(1) J. Assoc. Official Chem. 27,
295 (1944)

Refractivity of Aqueous Solutions of Dextrose (4)

t = 20 C; $\eta_D(H_2O) = 1.33298$

α	1.423637
β	1.437518
$\alpha, \beta(\text{eq.})$	1.4325
$gB/l \text{ sol., } t$	$\eta \text{ t D}$
0	1.33298
253	1.36946 (1)
253	1.36961 (2)
280	1.37380 (2)
280	1.37397 (3)

- (1) Age of solutions, 10 min.
- (2) Age of solutions, 24 hrs.
- (3) Age of solutions, 6 hrs.
- (4) I. C. T. V11 69 (1930)

Rotation of Normal Solution and the Specific Rotation of Dextrose (1)

Jackson found for the rotation of the normal dextrose solution the value 40.897° for the wave length of 5461A. The corresponding value for sucrose is 40.763° and the rotation of the normal quartz plate is 40.690° . There is thus a considerably greater difference between the rotary dispersion curves of dextrose and quartz than between sucrose and quartz. This difference between dextrose and quartz is not as thoroughly eliminated by the dichromate filter as is the corresponding difference between sucrose and quartz.

A slight difference is color between the two halves of the field results when the quartz-wedge saccharimeter is set for a photometric match. This necessarily causes a lower degree of reproducibility for dextrose than for sucrose solutions. This difficulty is partially overcome by an increased number of settings or by increased experience on the part of the observer.

The specific rotation of dextrose solutions varies with the concentration according to the formula;

$$(a)^{120.0} \text{ }_{5461A} = 62.032 + 0.04257c,$$

where c is grams of anhydrous dextrose weighted in vacuo and contained in 100 ml. of solution, or the formula;

$$(a)^{120.0} \text{ }_{5461A} = 62.032 + 0.04220 + 0.0001897p^2,$$

where p is percentage dextrose by weight in vacuo.

(1) Circular C 440 Nat'l. Bur. of Std's. 83, (1942)

(1) OPTICAL ROTATION OF d-GLUCOSE

I. Anhydrous glucose, t = 17 C

$$[\alpha]_D = 52.50 + 0.18796p + .0051683p^2$$

II. Hydrate glucose

$$[\alpha]_D = 47.73 + 0.015534p + 0.0003883p (p^2)?$$

$$59.55 - 0.12216q + .005168q$$

Solution containing 16.46 g. glucose per 100 cc. and p.g. salt

$(\text{NH}_4)_2\text{CO}_3$

p =	0	2	4	6	8	10
$[\alpha]_D =$	52.83	52.40	52.22	51.36	51.11	50.85

Urea

15.797 g. glucose per 100cc

p =	0	4	8	12	16
$[\alpha]_D =$	52.91	52.84	52.61	52.23	51.95

Acetone

15.68 g. glucose per 100cc.

p =	0	4	8	12	16	20	24	40	50
$[\alpha]_D =$	52.89	53.29	53.63	53.94	54.23	54.53	54.81	56.19	57.03

(1) H. Lanholt, Optical Rotary, 582 (1902)

Specific Rotation (α^{20}_D) of Certain Sugars at Various Concentrations (*)

<u>Concentration</u>	<u>Sucrose</u>	<u>Dextrose</u>	<u>Fructose</u>	<u>Maltose</u>	<u>Lactose hydrate</u>
<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>
5	66.500	52.607	-89.42	138.38	52.53
10	66.527	52.740	-90.72	138.29	
15	66.541	52.898	-92.01	138.20	Remains unchanged at all concentrations.
20	66.540	53.083	-93.30	138.11	
25	66.523	53.293	-94.59	138.02	
30	66.487	53.529	-95.88	137.92	
35	66.432	53.791	-97.18	137.82	
40	66.351	54.079	-98.47		
45	66.245	54.393	-		
50	66.109	54.732			

(*) Nat'l. B of S Cir C440, 563 (1942)

Formula for Calculating Specific Rotations

c = concentration in grams per 100 ml.

p = percentage by weight.

q = percentage of water.

Sucrose	(a) $\alpha^{20}_D = 66.462 + 0.0087c - 0.000235c^2$. (1)
Dextrose	(a) $\alpha^{20}_D = 52.50 + 0.0188p + 0.000517p^2$.
Dextrose	(a) $\alpha^{20}_D = 62.032 + 0.04257c$. (2).
Dextrose	(a) $\alpha^{20}_{5461A} = 62.032 + 0.04220 + 0.0001897p^2$. (2)
Fructose	(a) $\alpha^{20}_D = -113.96 + 0.258q$.
Maltose	(a) $\alpha^{20}_D = 138.475 - 0.01837p$.
Lactose	(a) $\alpha^{20}_D = 52.53$.
Invert sugar	(a) $\alpha^{20}_D = -(19.415 + 0.07065c - 0.00054c^2)$. (3).
Invert sugar temperature correction	(a) $t_D = (a)^{20}_D + (0.283 + 0.0014c)(t - 20^\circ C)$. (3).

(1) Cir. C440 Nat'l. Bur. of Std's.

(2) R. F. Jackson, Bul. B of S 13, 663 (1916) S 293.

(3) F. W. Zerban, J. Am. Chem. Soc. 47, 1104 (1925).

Dextrose Solubility, Solutions, and Solutions with Sucrose

The Possibility of Separation of Glucose from Sucrose (1)

Comparison of Results

Time Hours	Glucose Orig. in Tube, Dialyzed			Approx. Ratio of Glucose to Sucrose Dialyzed		
	I. B. %	I. C. %	I. C. %	I. B. %	I. C. %	I. C. %
0.5	2.04	3.96	17.04	3.3	3.5	14.8
1.0	2.82	5.87	22.84	2.5	4.9	11.0
2.0	4.42	8.27	22.67	2.4	2.1	6.2
3.0	5.56	11.50	28.80	2.4	2.5	5.8
4.5	6.49	16.03	29.04	2.1	2.5	4.3
5.5	10.42	16.69	29.12	2.1	2.2	4.1
7.0	10.02	12.89	32.11	1.7	1.8	5.5
24.5	22.65	26.88	59.65	3.7	2.5	5.0
			Average	2.5	2.8	7.1

(1) The influence of glucose on the dialysis of sucrose through a parchment membrane. The possibility of a separation of glucose from sucrose by dialysis.

L. A. Congdon and H. R. Ingersoll. J. Am. Chem. Soc. 43, 2588-97 (1921).

The Solubility of Dextrose in Pure Water (1)

Temperature in degrees centigrade	Solid phase	Per cent Dextrose in solution (a)	(1) Dextrose per 100 g of water
-0.772 (b)	Ice	6.83	-
-2.117 (b)	do	16.65	-
-2.305 (c)	do	17.59	
-5.605 (c)	do	33.02	
-5.3	Cryohydrate	31.75	
+0.50	$\alpha\text{-C}_6\text{H}_{12}\text{O}_6\cdot\text{H}_2\text{O}$	35.20	54.32
15.00 (d)	do	44.96	-
22.98	do	49.37	97.51
28.07	do	52.99	112.72
30.00	do	54.64	120.46
35.00	do	58.02	138.21
40.40	do	62.13	164.06
41.45	do	62.82	168.96
45.00	do	65.71	191.63

50.00	Transition	70.91	243.76
28.00	$\alpha\text{-C}_6\text{H}_{12}\text{O}_6$ Metastable	67.00	203
28.00	do	67.9	-
40.00	do	67.6	209
45.00	do	69.69	230
55.22	$\alpha\text{-C}_6\text{H}_{12}\text{O}_6$	73.08	261.7
64.75	do	76.36	323.0
70.2	do	78.23	359.3
80.5	do	81.49	440.2
90.8	do	84.90	562.3

(a) Estimated as anhydrous dextrose.

(b) Roth, Zeit. Phys. Chem., 43, p. 552; (1903)

(c) Abegg, Zeit. Phys. Chem., 15, p. 222; (1894)

(d) Anthon, v. Lippmann, Die Chemic der Zuckerartein, 1, p. 266; (1894).

(1) S. P. Bur. of Std's. No. 437, 721 (1922)

(2) Nat'l. bur. of Std's. Cir. 440, 1942

See page 136.

Stability of Dextrose Solutions of Varying pH (1)

<u>Time min.</u>	<u>Rotation °S</u>	<u>Time min.</u>	<u>Rotation °S</u>
<u>pH - 2.6</u>			<u>pH 8</u>
	30.53	0	26.
	30.59	50,040	26.
	31.34	94,985	26.
	31.96	$k = 7.7 \times 10^{-7}; \log 1/k = 6.1$	
	32.33		
	32.80		
	33.31		

$$k = 2.2 \times 10^{-2}$$

$$\log 1/k = 1.6$$

<u>pH - 1.78</u>		<u>pH 8.6</u>	
0	31.74	0	27.83
1,364	33.23	1,463	27.56
3,015	33.89	11,360	27.04
4,345	34.50	71,760	25.08
8,940	35.05	215,926	25.10

$k = 1.6 \times 10^{-4}$

$\log 1/k = 3.8$

$k = 5.4 \times 10^{-6}$

$\log 1/k = 5.3$

pH - 1.44

0	31.02
1,360	32.10
4,506	32.85
7,236	33.03
k = 2.2X10 ⁻⁴ ; log 1/k = 3.6	

pH 9.6

0	30.07
710	28.65
1,361	28.33
6,044	26.68
15,840	22.76
k = 5.2X10 ⁻⁵	
log 1/k = 4.3	

pH - 0

0	29.05
191,660	30.10
289,550	30.29
423,530	30.38
k = 3.9X10 ⁻⁶ log; 1/k = 5.4	

pH 10.7

0	29.78
1,450	22.06
2,873	17.05
4,636	12.82
5,993	10.62
9,960	7.48
12,812	6.50
20,460	6.05

$$k = 1.3X10^{-4} \log 1/k = 3.9$$

Calculated equilibrium rotation expressed as per cent of initial rotation.

<u>pH</u>	<u>Equilibrium rotation</u>	<u>pH</u>	<u>Equilibrium rotation</u>
-2.6	108.5	8	76.6
-1.78	107.0	8.6	70.0
-1.44	106.6	9.6	65.0
0	104.6	10.7	25.0

(1) J. of R Nat'l. Bur. of Stnd's. Vol. 45, No. 3 Sept. 1950 R. P. 2124

Decomposition of Dextrose at 70 C. in 5 M HCl pH-0.92

Min.	<u>Polarization</u>		Munson and Walker <u>reducing sugar method</u>		<u>Somogyi fermentation method</u>	
	Percentage of initial reading	<u>k X 10³</u>	Percentage of initial reading	<u>k X 10³</u>	Percentage of initial reading	<u>k X 10³</u>
0	100	-	100	-	100	
46	101.7	5.2	96.5	6.7	96.81	4.1
	103.1	5.2	94.7	5.3	93.62	4.4
	103.5	5.1	93.8	5.6	-	
283	-	—	93.3	<u>5.6</u>	93.09	<u>4.1</u>
Average	-	5.2	-	5.8	-	4.2

(1) Jour. of Res. Nat'l. Bur. of Std's. Vol. 45. No. 3, Sept. 1950 Research Paper 2124

Decomposition of Dextrose at 5 °C. in 12.5 M NaOH (pH-12.1)

(2)

Time Min.	<u>Polarization</u>		Dextrose by Munson and Walker <u>reducing sugar method</u>	
	Percentage of initial reading	<u>k X 10⁵</u>	Percentage of initial reading	<u>k X 10⁵</u>
0	100	-	100	
4,595	84.2	1.8	99.18	1.0
11,375	59.5	1.9	98.10	1.0
30,181	26.1	1.8	95.5	1.2
43,260	11.1	1.9	95.2	.9
60,810	4.5	<u>1.8</u>	92.4	<u>2.1</u>
Average	-	1.8	-	1.2

(2) Jour. of Res. Nat'l. Bur. Std's. Vol. 45. No. 3, Sept. 1950 Research Paper 2124.

Solubility of Dextrose and Sucrose in Glycerol in Aqueous Glycerol

J. B. SEGUR and C. S. MINER, JR. The Miner Laboratories, Chicago, Ill. AGRICULTURAL AND FOOD CHEMISTRY VOL 2, NO. 3, FEBRUARY 3, 1954

Sucrose, dextrose, and invert sugar are used in foods, candies, syrups, and pharmaceutical preparations and, at times, glycerol is included as a softener or a humectant, or for its effect upon texture. Consequently. It is desirable to know the amount of sugar that can be dissolved in aqueous glycerol, so that maximum sugar concentrations can be estimated. Higher concentrations of dissolved sugar can be attained with mixtures of sucrose and dextrose than with either sugar alone. Invert sugar is also a mixture but of constant composition, its equimolar dextrose-levulose composition fixed by its origin. Used by itself, it shows the same type of solubility curve as do the single sugars-i.e., solubility decreases with decreasing temperature and increasing glycerol concentration. Its solubility is limited by its dextrose component.

Solubility of Dextrose in Aqueous Glycerol Containing a Fixed Amount of Sucrose

Solvent Glyc., Water Ratio	at 25 °C.					at 35 °C.				
	<u>Solution</u>	<u>Solution, % Composition</u>				<u>Solution</u>	<u>Solution, % Composition</u>			
	Sp.gr., <u>25/25</u>	<u>n²¹D</u>	<u>Dextrose</u>	<u>Sucrose</u>	<u>Solvent</u>	Sp.gr., <u>25/25</u>	<u>n²¹D</u>	<u>Dextrose</u>	<u>Sucrose</u>	<u>Solvent</u>
25:75	1.2481	1.4323	46.5	0.0	53.5	1.2836	1.4463	54.5	0.0	45.5
	1.2662	1.4381	37.8	9.5	52.6	1.3010	1.4509	49.1	8.1	42.8
	1.3008	1.4511	33.9	23.3	42.8	1.3181	1.4569	42.3	19.1	38.6
	1.3338	1.4640	27.0	36.2	36.8	1.3437	1.4689	35.3	30.4	34.3
	1.3347	1.4630	10.3	52.1	37.6	1.3482	1.4688	9.9	55.6	34.5
50:50	1.2585	1.4430	38.1	0.0	61.9	1.2915	1.4541	46.6	0.0	53.4
	1.2732	1.4478	33.9	6.1	60.0	1.2944	1.4569	41.6	6.8	51.6
	1.2974	1.4565	28.9	17.3	53.8	1.3182	1.4640	37.2	15.3	47.5
	1.3249	1.4660	27.4	26.3	46.3	1.3442	1.4730	33.3	23.4	43.3
	1.3286	1.4672	16.3	37.8	45.9	1.3364	1.4695	13.8	41.1	44.6
62.5:37.5	1.2647	1.4503	33.0	0.0	67.0	1.2918	1.4587	40.9	0.0	59.1
	1.2745	1.4531	27.8	5.4	66.8	1.3056	1.4631	38.1	6.2	55.7
	1.2989	1.4610	26.2	13.5	60.3	1.3200	1.4682	34.8	13.0	52.2
	1.3156	1.4673	25.0	21.6	53.4	1.3366	1.4734	31.3	21.3	47.4
	1.3229	1.4696	17.6	30.3	52.7	1.3531	1.4795	24.9	28.1	47.0
75:25	1.2673	1.4570	25.6	0.0	74.4	1.2869	1.4636	32.5	0.0	67.5
	1.2862	1.4630	26.4	4.3	69.3	1.3025	1.4674	31.1	5.3	63.6
	1.2965	1.4660	25.1	7.9	67.0	1.3142	1.4715	30.8	9.9	59.3
	1.3111	1.4703	22.2	16.1	61.7	1.3257	1.4747	27.6	15.8	56.6

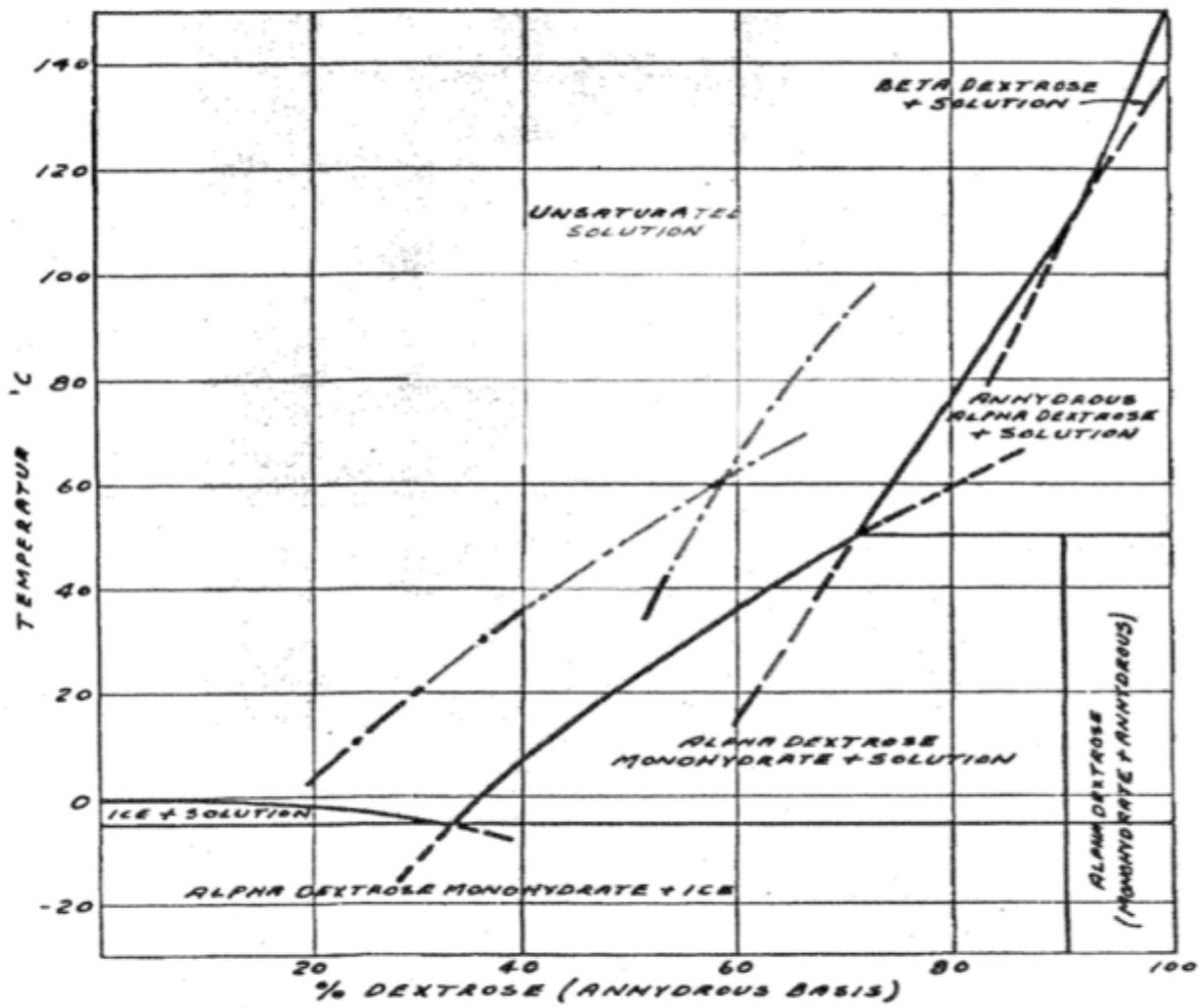
	1.3255	1.4748	21.7	21.3	57.0	1.3397	1.4794	24.3	23.7	52.0
82.5:17.5	1.2690	1.4620	21.0	0.0	79.0	1.2862	1.4670	27.1	0.0	72.9
	1.2879	1.4672	20.7	5.0	74.3	1.2995	1.4708	25.6	4.0	70.4
	1.2954	1.4700	19.5	8.5	72.0	1.3099	1.4736	24.9	8.7	66.4
	1.3058	1.4725	19.1	12.3	68.6	1.3202	1.4764	23.4	13.8	62.8
	1.3156	1.4753	18.8	16.2	65.0	1.3089	1.4732	12.4	20.2	67.4
95:5	1.2723	1.4711	14.3	0.0	85.7	1.2833	1.4740	17.3	0.0	82.7
	1.2897	1.4761	11.7	4.3	84.0	1.2996	1.4775	17.3	3.1	79.6
	1.2922	1.4766	11.2	5.6	83.2	1.3073	1.4808	17.4	6.9	75.7
	1.2931	1.4772	9.8	7.8	82.4	1.3113	1.4813	16.0	8.4	75.6
	1.2782	1.4731	8.9	8.0	83.1	1.3156	1.4828	12.8	10.2	77.0

Solubility of Sucrose in Aqueous Glycerol Containing a Fixed Amount of Dextrose

Solvent Glyc., Water Ratio	At 25 °C.					At 35 °C.					
	<u>Solution</u>		<u>Solution, % Composition</u>			<u>Solution</u>		<u>Solution, % Composition</u>			
	<u>Sp.gr.,</u>	<u>25/25</u>	<u>n²¹D</u>	<u>Sucrose</u>	<u>Dextrose</u>	<u>Solvent</u>	<u>Sp.gr.,</u>	<u>25/25</u>	<u>n²¹D</u>	<u>Sucrose</u>	<u>Dextrose</u>	Solvent
25:75	1.3175	1.4571	59.4	0.0	40.6	1.3286	1.4610	61.9	0.0	38.1	
	1.3249	1.4600	53.5	7.4	39.1	1.3369	1.4650	57.9	4.9	37.2	
	1.3365	1.4639	49.7	13.8	36.5	1.3464	1.4689	51.9	12.5	35.6	
	1.3527	1.4704	40.2	26.1	33.7	1.3588	1.4731	45.4	21.5	33.1	
	1.3349	1.4635	35.9	28.6	35.5	1.3041	1.4523	7.3	50.2	42.5	
50:50	1.2963	1.4564	44.8	0.0	55.2	1.3077	1.4599	48.7	0.0	51.3	
	1.3094	1.4603	43.0	6.4	50.6	1.3203	1.4650	45.7	5.5	48.8	
	1.3224	1.4650	38.8	14.6	46.4	1.3319	1.4695	41.3	13.0	45.7	
	1.3388	1.4704	33.1	24.8	42.1	1.3456	1.4740	36.1	21.7	42.2	
	1.3264	1.4665	28.0	26.2	45.8	1.3029	1.4586	4.7	43.6	51.7	
62.5:37.5	1.2830	1.4570	35.3	0.0	64.7	1.2988	1.4610	38.4	0.0	61.6	
	1.2991	1.4613	35.7	5.4	58.9	1.3096	1.4660	37.6	5.7	56.7	
	1.3157	1.4665	31.1	15.2	53.7	1.3225	1.4699	34.1	12.9	53.0	
	1.3280	1.4704	28.7	21.3	50.0	1.3371	1.4751	30.4	20.9	48.7	
	1.2944	1.4592	10.2	30.3	59.5	1.3039	1.4633	4.7	38.9	56.4	
75:25	1.2733	1.4597	25.4	0.0	74.6	1.2894	1.4639	29.5	0.0	70.5	
	1.2898	1.4634	25.6	4.9	69.5	1.2988	1.4678	28.3	5.3	66.4	
	1.3033	1.4671	22.3	13.7	64.0	1.3109	1.4710	26.8	10.5	62.7	
	1.3214	1.4731	20.5	21.1	58.4	1.3248	1.4750	24.3	18.3	57.4	
	1.3189	1.4722	19.3	21.6	59.1	1.3391	1.4790	21.0	25.7	53.3	
82.5:17.5	1.2610	1.4640	19.0	0.0	81.0	1.2835	1.4666	23.3	0.0	76.7	
	1.2843	1.4649	18.5	5.2	76.3	1.2930	1.4688	22.2	5.1	72.7	

	1.2949	1.4689	17.6	10.5	71.9	1.3048	1.4728	20.6	10.4	69.0
	1.3060	1.4724	17.2	15.5	67.3	1.3168	1.4760	19.0	16.2	64.8
	1.3127	1.4740	16.3	18.2	65.5	1.3270	1.4789	16.3	22.4	61.3
95:5	1.2753	1.4723	9.9	0.0	90.1	1.2812	1.4743	13.0	0.0	87.0
	1.2827	1.4737	9.1	4.3	86.6	1.2856	1.4750	10.6	3.9	85.5
	1.2889	1.4750	7.6	7.1	85.3	1.2946	1.4774	10.4	7.6	82.0
	1.2953	1.4772	6.4	11.8	81.8	1.3022	1.4796	9.8	11.5	78.7
	1.2916	1.4764	6.4	12.2	81.4	1.3114	1.4816	8.7	16.2	75.1

PHASE DIAGRAM FOR DEXTROSE WATER SOLUTIONS



PREPARED BY G. R. D. RESEARCH DEPT. CORN PRODUCTS REFINING CO.

-8-50

Solubility of Dextrose and Sucrose in Water

(From Jackson and Silsbee)

Composition of Solution, %

Weight

<u>Dextrose</u>	<u>Sucrose</u>	<u>Water</u>
-----------------	----------------	--------------

At 25 °C.

0.0	68.0	32.0
4.8	64.0	31.2
9.4	60.2	30.4
18.0	53.0	29.0
25.7	46.9	27.4
32.7	32.6	34.7
40.5	19.4	40.1
50.8	0.0	49.2

At 35 °C.

0.0	68.1	31.9
7.6	64.2	28.2
15.5	60.6	23.9
23.4	53.4	23.2
28.0	48.8	23.2
37.1	34.0	28.9
45.8	19.8	34.4
53.6	7.5	38.9
58.0	0.0	42.0

Solubility, Specific Gravity, and Refractive Index of Aqueous Glycerol Saturated with Invert Sugar

Solution Saturated at 25 °C.

<u>Solvent, Glyc. Water Ratio</u>	<u>Sugar, % wt.</u>	<u>Sugar, g./100 ml.</u>	<u>Sp. Gr. 25/25</u>	<u>n²¹_D</u>
0:100	66.2(4)	-	-	-
25:75	65.0	86.7	1.3332	1.4621
50:50	59.7	79.6	1.3327	1.4686
75:25	42.4	55.9	1.3174	1.4710
95:5	16.0	20.6	1.2874	1.4750

Solution Saturated 35 °C.

<u>Sugar,</u>	<u>Sugar,</u>	<u>Sp. Gr.</u>	<u>n²¹_D</u>
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	<u>% wt.</u>	<u>g./100 ml.</u>	<u>25/25</u>	
0:100	72.2	-	-	-
25:75	71.6	98.6	1.3765	1.4781
50:50	66.2	90.3	1.3643	1.4785
75:25	52.5	70.8	1.3482	1.4804
95:5	28.7	37.9	1.3190	1.4829

Surface Tension of Aqueous Solutions of Dextrose

(1)

<u>% Wt. Dextrose</u>	<u>t, °C</u>	<u>△γ (air)</u>
1.0	25	0.25 = 0.2
8.8	15	0.8 = 0.4
17.1	15	1.4 = 0.4

(1) I. C. T. 1V, 469 (1928)

Surface Tension of Dextrose (1)

Surface Tension	71.73	
Parachor	358.8	
Temperature	170	
Gas	Nitrogen	
	<u>mol. %</u>	<u>Surface tension</u>
Aqueous Solution	0	70.59
	0.6582	71.60
	0.7741	72.04
t = 32°	1.196	72.21
	1.556	72.91
Pyridine Solution	0	35.32
	1.153	35.72
	1.536	35.74

(1) Physical Properties of Dextrose. P. Auger and D. G. Dervichian. Annual Tables of Constants and Numerical Data, V (1937) Sect. 7, pgs. 6 and 12.

The Influence of Non-electrolytes on the Solubility of Carbon Dioxide in Water

(2)

<u>0.5 N Solution of</u>	<u>Absorption Coefficient</u>	<u>Sp. Gr. of N/2 Solution</u>	<u>Sp. Gravity of Solid</u>
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Dextrose	0.792	1.0328
Mannitol	0.782	1.03031

Carbon dioxide dissolved by 1,000 g. of water in cc. for

Dextrose, 841

Sucrose, 797

Mannitol, 833

Water, 878

(2) Francis Lawry Usher. J. Chem. Soc. 66-78 (1910).

The System: Sucrose, Dextrose and Water at 30 °C. (1)

<u>Solid phase.</u>	<u>Sucrose.</u>	<u>Dextrose</u>	<u>Sucrose on</u>	<u>Dextrose on 100%</u>	<u>30°</u>
	<u>Per cent</u>	<u>Per cent</u>	<u>100% water g</u>	<u>water. g</u>	<u>D-C</u>
Sucrose	(68.11	0	213.58	0	1.3301
	(64.22	4.89	207.90	15.83	1.3356
	(60.40	9.70	202.07	32.45	1.3411
	(53.19	18.58	188.41	65.82	1.3507
	(48.60	24.61	181.41	91.68	1.3588
Sucrose and hydrated dextrose	47.10	26.59	179.02	101.06	
Hydrated Dextrose	(33.79	33.88	104.51	104.79	1.3227
	(19.66	41.97	51.24	109.38	1.2867
	(7.35	50.00	17.23	117.23	1.2592
	(0	54.64	0	120.46	1.2434

**The System: Dextrose, Levulose and Water at
30 C with Hydrated Dextrose as the Solid
Phase.**

(1)

Dextrose	Levulose	30° D—C 4°
<u>Per cent</u>	<u>Per cent</u>	
54.64	0.00	1.2434
49.34	8.94	1.2639
49.32	8.94	1.2650
45.97	14.50	1.2779
41.01	23.23	1.3000
35.76	33.09	1.3286
34.48	35.69	1.3359
33.67	37.10	1.3408
32.55	39.39	1.3480

**Approximate Composition of Invert Sugar Solutions Saturated with Respect to
Dextrose at Various Temperatures (computed)**

(1)

Temperature: Dextrose
in water. (2) Composition of invert sugar solutions
saturated with dextrose.

<u>°C.</u>	<u>Per cent</u>	<u>Per cent</u>
0	35.0	50.80
10.0	40.8	56.56
15.0	44.0	59.8
20.0	47.2	62.6
25.0	50.8	66.2
30.0	54.64	69.7 (3)
35.0	58.02	72.2
40.0	61.87	74.8
45.0	65.71	78.0
50.0	70.91	81.9

(1) Tech. P. Bureau of Std's. No. 259 (1924)

(2) B.S. Sci. Paper No. 437.

(3) Determined experimentally.

Glucose

t = 25 C

Mol B/kg A g C/kg A

NaCl

0	361.4	A = H ₂ O
0.25	364.2	B = Dextrose
0.50	364.3	C = NaCl/KCl
1.0	369.9	

t = 25 C

KCl

0	362.7
0.25	366.1
0.50	369.9
1.0	376.3
3.0	402.3

(2) I. C. T. IV, 417

(1928)

Thermal Chemistry of d-Glucose and Other Sugars in NaOH Solutions

(2)

	<u>1.</u>	<u>2.</u>	<u>3.</u>	<u>4.</u>	
Alkali N	0.483	0.996	0.523	0.523	0.525
Δt	0.0673 C.	0.0732	0.0488	0.0518	0.0072
Wt. sugar	3.76 g.	3.29	2.20	2.14	2.64
Wt. alkali	9.97	1013	1010	1010	961
Calc. heat of reaction (av)	6.14 per mole	6.65	6.56	6.52	1.17
Alkali-absorbed per mole sugar	0.55 moles	0.295	0.216	0.216	none
Heat of Neutralization	0.7 Cal. Per mole	4.1	2.96	2.96	

1. Heat of reaction of crystal d-glucose with NaOH at 25.2 ± 0.3 C.

2. α-d glucose with NaOH at 25.1 ± 0.3 C.

3. β-d-glucose with NaOH at 25.1 ± 0.3 C.

4. α-methyl-d-glucose with NaOH at 25.2 ± 0.3 C.

(2) B. Clifford Hendricks and Warren H. Steinbach. J. Phys. Chem. 42, 335-42(1938)

Thermodynamic Relation of Glassy and α-Crystalline Glucose. (3)

Heat of solution for α-crystals in Cal./lg. mean value -13.73

Solubility and related data.

<u>Solvent</u>	Glass Soly.	Crystal Soly. of	Soly.	Δ F 293
----------------	-------------	------------------	-------	---------

	<u>in g. 1000</u>	<u>solvent</u>	<u>Ratio</u>	<u>(cal./mol.)</u>
MeOH	289	12.2	23.7	1810
EtOH	32.0	1.55	20.6	1760
isoPrOH	10.1	0.62	16.3	1630

(3) G. C. Parks, L. J. Snyder and F. R. Cattoir. J. Chem. Phys. 2, 595-8 (1934)

Viscosity of Glucose/Dextrose Solutions

Viscosity of Corn Syrup and Dextrose Mixtures (2)

	<u>Solution (in poises)</u>	<u>d²⁵₂₅</u>	<u>n²⁵</u>
1	Original syrup plus dextrose	1.470	165000
2	Original syrup plus dextrose	1.447	14000
3	Original syrup	1.436	5000
4	Original syrup plus water	1.420	764
5	Original syrup plus water	1.379	36.6
6	Original syrup plus water	1.331	3.7

(2) I.T.C.V. 23 (1929)

The Viscosity of Undercooled Liquid Glucose

(1)

Effect of Heating at 67° C. on Glucose Viscosity at 100°

<u>Hours of Heating</u>	<u>Time for Falling Sphere (Seconds)</u>	<u>η at 100 (poises)</u>
0	384.3	182.7
24	378.8	180.1
48	374.1	177.8
72	369.9	175.9

Ageing Causes an Increase in Viscosity

Viscosity Data for Undercooled Glucose

<u>Temperature °C</u>	<u>Viscosity in Poises</u>	<u>Log 10n</u>
22.0	9.1×10^{13}	13.96
24.0	2.6×10^{13}	13.41
26.0	7.3×10^{12}	12.86
30.0	6.6×10^{11}	11.82
40.0	2.8×10^9	9.44
50.0	3.0×10^7	7.48

60.0	9.3×10^5	5.97
70.0	6.3×10^4	4.80
80.0	6.6×10^3	3.82
90.0	1.05×10^3	3.02
100.0	2.5×10^2	2.40
110.0	8.0×10	1.90
120.0	3.2×10	1.50
130.0	1.45×10	1.16
140.0	7.6	0.88
145.0	5.6	0.75

(1) G. S. Parke, L. E. Barton, M. E. Spaght and J. W. Richardson. Physics 5, 193-9 (1934)

Relative Viscosities of Dextrose Solutions (2)

% by Vol.	% by Wt.	N-concn.	25 °C.	30 °C.	35 °C.	40 °C.	45 °C.	50 °C.
60	49.30	3.33	9.860	9.026	8.344	7.789	7.171	6.722
50	42.30	2.78	5.853	5.494	5.196	4.911	4.658	4.438
40	34.92	2.22	3.725	3.599	3.432	3.312	3.180	3.080
30	27.06	1.67	2.494	2.435	2.359	2.301	2.228	2.174
20	18.65	1.11	1.773	1.738	1.703	1.667	1.636	1.609
10	9.66	0.56	1.308	1.297	1.281	1.277	1.261	1.255

The effect of temperature on viscosity is about 3.5% for 1 at 10% concentration, very similar to the effect of sucrose solutions.

(2) C. W. R. Powell. J. Chem. Soc. 105, 1-23 (1914)

Viscosity of Dextrose + Acetamide Sucrose + Dextrose or Levulose

in millipoises

% Sucrose	20	20	20	20	10	5	0
% Dextrose	0	5	10	20	20	20	20

η^{25}	16.8	21.0	26.5	47.5	26.0	21.1	16.8
% Sucrose	20	20	20	20	10	5	0
% Levulose	0	5	10	20	20	20	20
η^{25}	16.8	21.4	26.2	45.2	25.3	19.8	16.3

A mixture containing 8.2 Wt. % each of sucrose, dextrose and levulose had $25 = 19.4$

(1) I. C. T. V, 24(1929)

Viscosity of Aqueous Solutions of Dextrose

(1)

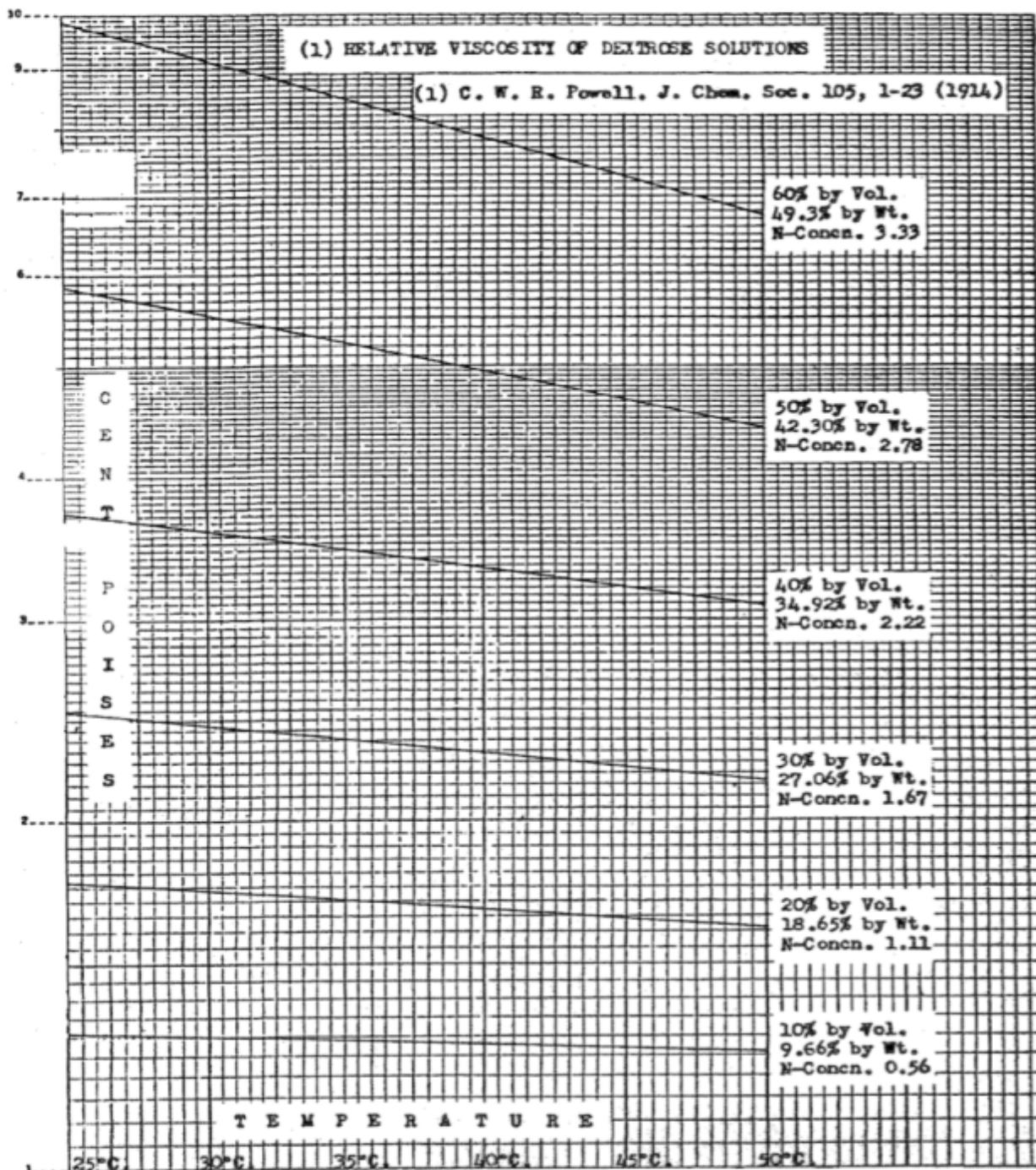
η in millipoises	Temp °C							
<u>wt. % in vacuo</u>	<u>25</u>	<u>30</u>	<u>35</u>	<u>40</u>	<u>45</u>	<u>50</u>		
9.67	11.70	10.38	9.24	8.34	7.52	6.89		
18.66	15.86	13.91	12.27	10.89	9.76	8.84		
27.08	22.31	19.49	17.00	15.03	13.30	11.93		
34.94	33.3	28.80	24.73	21.64	18.98	16.90		
42.33	52.4	44.0	37.4	32.2	27.80	24.35		
49.33	88.2	72.2	60.2	50.9	42.8	36.9		
$\eta/\eta\omega$								
F/I	5	10	15	20	25	30	35	40
0.1	1.212	1.024	1.048	1.027	1.047	1.049	1.013	1.020
0.25	1.363	1.210	1.197	1.186	1.198	1.199	1.169	1.167
0.5	1.450	1.329	1.266	1.289	1.324	1.294	1.237	1.188
0.75	1.739	1.526	1.476	1.447	1.447	1.464	1.411	1.414
1.0	1.889	1.637	1.611	1.621	1.588	1.597	1.528	1.514
Solution (in poises)	<u>d</u> ²⁵ ₂₅	<u>n</u> ²⁵						
1.	Original syrup + dextrose	1.470	16 5000					
2.	Original syrup + dextrose	1.447	1 4000					
3.	Original syrup	1.436	5 000					
4.	Original syrup + water	1.420	76 4					
5.	Original syrup + water	1.379	36.6					
6	Original syrup + water	1.331	3.7					

F = Gram-formula-weight

η = Viscosity in poises

$\eta/\eta\omega$ = Viscosity relative to water at the same temperature

(1) I. C. I.V, 23 (1929)



The Relation of Concentration to Viscosity for Glucose and Sucrose (1)

Carbohydrates in Water

	<u>Conc. in g. 100cc. Solution</u>	<u>Conc. in cc./100cc. Solution</u>	<u>ηr</u>	<u>V_0 from formula I</u>
Glucose at 25 °C.	10.02	6.41	1.307	1.57
	20.07	12.83	1.770	1.55
	30.20	19.34	2.49	1.55
	40.10	25.65	3.72	1.57
	50.15	32.10	5.85	1.57
	60.30	38.60	9.85	1.56
$a = 0.18$				
Sucrose at 20 °C.	21.62	13.61	1.951	1.68
	47.06	29.63	6.173	1.68
	77.19	48.61	56.2	1.68
$a = 0.13$				

$$\eta r = [1 + (2.5V_0^{-1}/6)C_v]^6 \quad a \quad \text{Formula 1}$$

$$V_0 C_v = V_0^{-1} c v (1 + V_0^{-1} C_v)^{a-1} \quad b$$

(1) H. L. Bredee and J. de Booys. Koll. Z. 91, 39-46 (1940)

Viscosity of Dilute Solutions of Non-electrolytes (dextrose) (2)

Glucose Solutions

<u>35°C</u>			<u>45°C</u>		
$C \times 10^3$	η/η_0	a	$C \times 10^3$	η/η_0	a
2.969	1.0016	0.539	2.127	1.0013	0.611
4.342	1.0022	0.507	4.000	1.0022	0.550
6.240	1.0027	0.433	7.111	1.0032	0.450
9.347	1.0039	0.417	9.160	1.0039	0.426
10.484	1.0043	0.410	11.480	1.0052	0.453
13.751	1.0060	0.436	13.658	1.0060	0.439

15.315	1.0070	0.451	15.853	1.0068	0.429
18.387	1.0073	0.397	18.124	1.0074	0.408
20.849	1.0085	0.408	20.271	1.0085	0.419
25.715	1.0106	0.412	24.453	1.0104	0.425

Mean value of a = 0.441; Mean value of a for last nine figures only = 0.444. The viscosities can be represented by the equation $\eta/\eta_0 = 1 + aC$, where a is independent of temperature but not of the solute. The concentration range is 2×10^{-3} to 27×10^{-3} g. molecule s per liter.

(2) Balabhadra Prasad. J. Indian Chem. Soc. 12, 499-503 (1935)

Sugar Conversion Factors

Weight Per United States Gallon and Weight per Cubic Foot of Sugar *Note Table may contain several transcription errors*

(Sucrose) Solutions at 20 °C. (68 °F.)

Per Cent Sugar by Weight (Brix)	Weight per Gallon in Lbs.	Weight per Cu. Ft. in Lbs.	Specific Gravity at 20 / 20 C.	Baume Modulus 145
0	8.32162	62.25004	1.00000	0.00
1	8.35399	62.49218	1.00389	0.56
2	8.38645	62.73500	1.00779	1.12
3	8.41915	62.97961	1.01172	1.68
4	8.45202	63.22550	1.01567	2.24
5	8.48514	63.47325	1.01965	2.79
6	8.51851	63.72288	1.02366	3.35
7	8.55213	63.97437	1.02770	3.91
8	8.58591	64.22706	1.03176	4.46
9	8.62003	64.48230	1.03586	5.02
10	8.65432	64.73881	1.03998	5.57
11	8.68885	64.99711	1.04413	6.13
12	8.72364	65.25735	1.04831	6.68
13	8.75867	65.51940	1.05252	7.24
14	8.79404	65.78398	1.05677	7.79
15	8.82957	66.04977	1.06104	8.34
16	8.86535	66.31742	1.06534	8.89
17	8.90147	66.58762	1.06968	9.45
18	8.93775	66.85901	1.07404	10.00
19	8.97437	67.13295	1.07844	10.55

20	9.01123	67.40868	1.08287	11.10
21	9.04835	67.68635	1.08733	11.65
22	9.08579	67.96642	1.09183	12.20
23	9.12349	68.24844	1.09636	12.74
24	9.16144	68.53233	1.10092	13.29
25	9.19903	68.81801	1.10551	13.84
26	9.23816	69.10623	1.11014	14.39
27	9.27694	69.39633	1.11480	14.93
28	9.31597	69.68829	1.11949	15.48
29	9.35533	69.98272	1.12422	16.02
30	9.39494	70.27903	1.12898	16.57
31	9.43489	70.57787	1.13378	17.11
32	9.47508	70.87852	1.13861	17.65
33	9.51552	71.18103	1.14347	18.19
34	9.55630	71.48608	1.14837	18.73
35	9.59741	71.79361	1.15331	19.28
36	9.63877	72.10300	1.15828	19.81
37	9.68040	72.41486	1.16329	20.35
38	9.72240	72.72860	1.16833	80.89
39	9.76467	73.04480	1.17341	21.43
40	9.80728	73.36354	1.17853	21.97
41	9.85014	73.68416	1.18308	22.50
42	9.89332	74.00717	1.18887	23.04
43	9.93685	74.33280	1.19410	23.57
44	9.98062	74.66022	1.19936	24.10
45	10.02481	74.99078	1.20407	24.63
46	10.06924	75.32314	1.21001	25.17
47	10.11393	75.65745	1.21538	25.70
48	10.15903	75.99482	1.22080	26.23
49	10.20439	76.33413	1.22625	26.75
50	10.25007	76.67584	1.23174	27.28
51	10.29609	77.02010	1.23727	27.81
52	10.34244	77.36682	1.24284	28.33
53	10.38904	77.71541	1.24844	28.86
54	10.43598	78.06655	1.25408	29.38
55	10.48324	78.42008	1.25976	29.90
56	10.53084	78.77615	1.26548	30.42
57	10.57869	79.13409	1.27123	30.94
58	10.62696	79.49518	1.27703	31.46
59	10.67547	79.85806	1.28286	31.97
60	10.72432	80.22348	1.28873	32.40

61	10.77350	80.59137	1.29464	33.00
62	10.82302	80.90181	1.30059	33.51
63	10.87278	81.33404	1.30657	34.02
64	10.92296	81.70941	1.31260	34.53
65	10.97339	82.08665	1.31866	35.04
66	11.02415	82.46636	1.32476	35.55
67	11.07524	82.84854	1.33090	36.05
68	11.12867	83.23327	1.33708	36.55
69	11.17843	83.62046	1.34330	37.06
70	11.23053	84.01049	1.34956	37.56
71	11.28287	84.40172	1.35585	38.06
72	11.33554	84.79572	1.36218	38.55
73	11.38864	85.19294	1.36856	39.05
74	11.44189	85.59128	1.37496	39.54
75	11.49557	85.99283	1.38441	40.03
76	11.54938	86.39685	1.38790	40.53
77	11.60303	86.80267	1.39442	41.01
78	11.65842	87.21103	1.40098	41.50
79	11.71335	87.62194	1.40758	41.99
80	11.76852	88.03464	1.41421	42.47
81	11.82402	88.44981	1.42088	42.95
82	11.87986	88.80752	1.42759	43.43
83	11.93603	89.28770	1.43434	43.91
84	11.99245	89.70975	1.44112	44.38
85	12.04921	90.13434	1.44794	44.86
86	12.10629	90.56133	1.45480	45.33
87	12.16371	90.99086	1.46170	45.80
88	12.22130	91.42167	1.46862	46.27
89	12.27930	91.85554	1.47559	46.73
90	12.33755	92.29128	1.48259	47.20

Technologic Paper 115 Bureau of Standards.

Weight per Gallon in Lbs. = Specific Gravity X 8.32162.

Weight per Cu. Ft. In Lbs. = Weight per Gal. in Lbs. X 7.480519.

Corrections to be Applied to Brix Readings made at Temperatures other than 20 °C. (68 °F.)

Wiss. Abb. Der Kaiserlichen NEK, Vol. 2, p140.

Observed Degrees
Brix

Temp

Deg. C.

		<u>0</u>	<u>5</u>	<u>10</u>	<u>15</u>	<u>20</u>	<u>25</u>	<u>30</u>
Subtract Correction	15	0.20	0.22	0.24	0.26	0.28	0.30	0.32
	16	0.17	0.18	0.20	0.22	0.23	0.25	0.26
	17	0.13	0.14	0.15	0.16	0.18	0.19	0.20
	18	0.09	0.10	0.10	0.11	0.12	0.13	0.13
	<u>19</u>	<u>0.05</u>	<u>0.05</u>	<u>0.05</u>	<u>0.06</u>	<u>0.06</u>	<u>0.06</u>	<u>0.07</u>
Add Correction	21	0.04	0.05	0.05	0.06	0.06	0.07	0.07
	22	0.10	0.10	0.11	0.12	0.12	0.13	0.14
	23	0.16	0.16	0.17	0.17	0.19	0.20	0.21
	24	0.21	0.22	0.23	0.24	0.26	0.27	0.28
	25	0.27	0.28	0.30	0.31	0.32	0.34	0.35
	26	0.28	0.34	0.36	0.37	0.40	0.40	0.42
	27	0.40	0.41	0.42	0.44	0.46	0.48	0.50
	28	0.46	0.47	0.49	0.51	0.54	0.56	0.58
	29	0.54	0.55	0.56	0.59	0.61	0.63	0.66
	30	0.61	0.62	0.63	0.66	0.68	0.71	0.73

Temp Deg. C

		<u>35</u>	<u>40</u>	<u>45</u>	<u>50</u>	<u>55</u>	<u>60</u>	<u>70</u>
Subtract correction	15	0.33	0.34	0.36	0.36	0.37	0.38	0.39
	16	0.27	0.28	0.28	0.29	0.30	0.31	0.32
	17	0.20	0.21	0.21	0.22	0.23	0.23	0.24
	18	0.14	0.14	0.14	0.15	0.15	0.15	0.16
	<u>19</u>	<u>0.07</u>	<u>0.07</u>	<u>0.07</u>	<u>0.08</u>	<u>0.08</u>	<u>0.08</u>	<u>0.08</u>
Add correction	21	0.07	0.07	0.08	0.08	0.08	0.08	0.09
	22	0.14	0.15	0.15	0.16	0.16	0.16	0.16
	23	0.21	0.22	0.23	0.24	0.24	0.24	0.24
	24	0.29	0.30	0.31	0.32	0.32	0.32	0.32
	25	0.36	0.38	0.38	0.39	0.39	0.40	0.39
	26	0.44	0.46	0.47	0.47	0.48	0.48	0.48
	27	0.52	0.54	0.54	0.55	0.56	0.56	0.56
	28	0.60	0.61	0.62	0.63	0.64	0.64	0.64
	29	0.68	0.70	0.70	0.71	0.72	0.72	0.72
	30	0.76	0.78	0.78	0.79	0.80	0.80	0.81

**Degrees Brix, Pounds Sucrose to Be Added to One Gallon of Water, Volume of Syrup
Prepared from One Gallon of Water and Weight of Sugar in One Gallon of Syrup**

<u>Degrees Brix, 68 F.</u>	<u>Pounds of Sugar to be added to Each Gallon of Water</u>	<u>Volume of Syrup from one Gallon of Water in Gallons</u>	<u>Weight of Sugar Contained in One Gallon of Syrup in Pounds</u>
10	.925	1.068	.865
11	1.029	1.076	.956
12	1.135	1.084	1.047
13	1.243	1.092	1.139
14	1.355	1.100	1.231
15	1.469	1.109	1.324
16	1.585	1.117	1.418
17	1.704	1.126	1.513
18	1.827	1.135	1.609
19	1.952	1.145	1.705
20	2.080	1.154	1.802
21	2.212	1.164	1.900
22	2.347	1.174	1.999
23	2.486	1.185	2.098
24	2.628	1.195	2.199
25	2.774	1.206	2.300
26	2.924	1.217	2.402
27	3.078	1.229	2.505
28	3.236	1.241	2.608
29	3.399	1.253	2.713
30	3.566	1.265	2.818
31	3.739	1.278	2.925
32	3.916	1.292	3.032
33	4.099	1.305	3.140
34	4.287	1.319	3.249
35	4.481	1.334	3.359
36	4.681	1.349	3.470
37	4.887	1.364	3.582
38	5.100	1.381	3.695
39	5.320	1.397	3.808
40	5.548	1.414	3.923
41	5.783	1.432	4.039
42	6.026	1.450	4.155
43	6.278	1.469	4.273
44	6.538	1.489	4.391
45	6.809	1.509	4.511

46	7.089	1.530	4.632
47	7.380	1.552	4.754
48	7.681	1.575	4.876
49	7.995	1.599	5.000
50	8.322	1.624	5.125
51	8.661	1.649	5.251
52	9.015	1.676	5.378
53	9.384	1.704	5.506
54	9.769	1.733	5.635
55	10.171	1.764	5.766
56	10.591	1.796	5.897
57	11.031	1.829	6.030
58	11.492	1.864	6.164
59	11.975	1.901	6.299
60	12.482	1.940	6.435
61	13.016	1.981	6.572
62	13.577	2.023	6.710
63	14.169	2.009	6.850
64	14.794	2.116	6.991
65	15.454	2.167	7.133
66	16.154	2.220	7.276
67	16.885	2.277	7.420
68	17.683	2.337	7.566
69	18.522	2.401	7.713
70	19.417	2.470	7.861

Examples:

- How much sugar is required to add to 50 gallons of water to make a 45° Brix sugar syrup and what will be the resulting volume of the syrup?

From column two opposite 45° Brix it is shown that 6.809 pounds of sugar are required per gallon of water. Therefore $6.809 \times 50 = 340.5$ pounds of sugar.

The total volume of syrup would be the number of gallons of water used times that factor in the third column opposite 45° Brix or $50 \times 1.500 = 75.5$ gallons.

- How much sugar is there in 80 gallons of 40° Brix syrup?

Weight of sugar is equal to $80 \times 3.923 = 313.8$ pounds.

- How much sugar and water are required to make 100 gallons of 45° Brix syrup?

Amount of water = $100 \div 1.509 = 66.27$ gallons.

Amount of sugar = $66.27 \times 6.809 = 451.2$ pounds.

STARCH

Water Sorption of Corn Starch Samples at Various Humidities at 25 °C. (1)

Percent water sorbed in equilibrium with air for designated relative humidity

<u>Sample</u>	<u>93%</u>	<u>85%</u>	<u>75%</u>	<u>56%</u>	<u>43%</u>	<u>20%</u>	<u>12%</u>
L-1	26.5	22.1	19.4	16.7	13.9	10.6	7.7
L-2	26.1	22.1	19.5	16.7	-	10.6	7.6
L-3	26.3	22.1	19.6	16.3	14.2	10.6	-
L-4	27.0	22.3	19.7	16.3	14.2	10.6	7.6
PP-1	26.4	21.9	19.2	16.0	13.9	10.5	7.6
C-1	25.7	22.0	18.9	15.8	13.5	7.2	
C-2	26.6	21.8	19.1	15.5	13.2	10.3	7.5
C-3	26.2	22.2	19.0	15.7	13.4	10.4	7.6
C-4	26.5	21.9	18.9	15.7	13.4	10.4	7.7
C-5	26.0	22.1	19.0	16.0	13.8	10.6	7.6
Average	26.2	22.0	19.2	16.0	13.7	10.4	7.6
PP-1-wet	26.5	22.7	20.0	-	14.2	10.3	7.4
C-1-wet	26.9	22.9	20.0	16.6	14.1	10.3	7.4

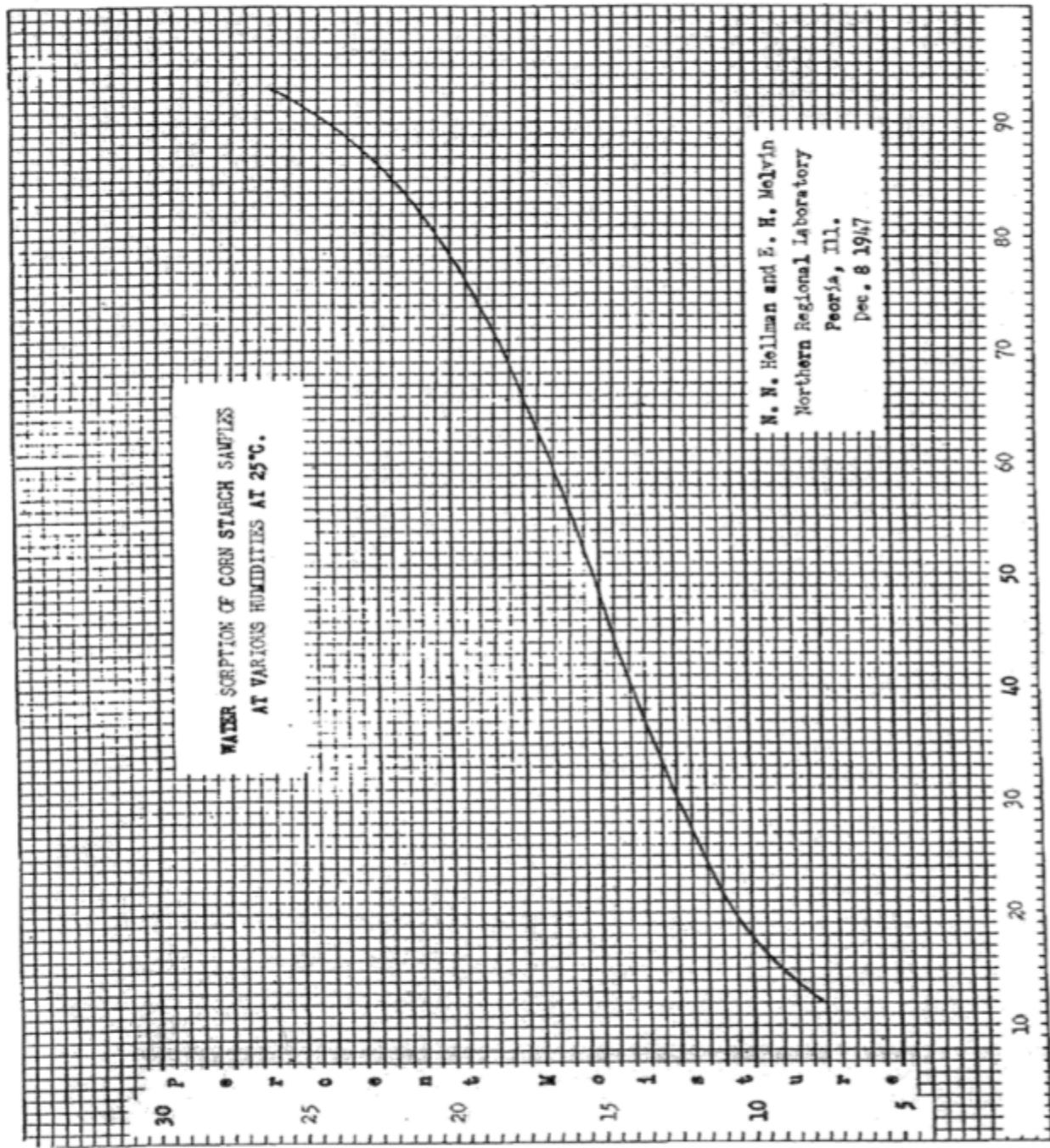
(1) N. N. Hellman & E. H. Melvin, Northern Regional Laboratory, Peoria, Illinois, 12/8/47

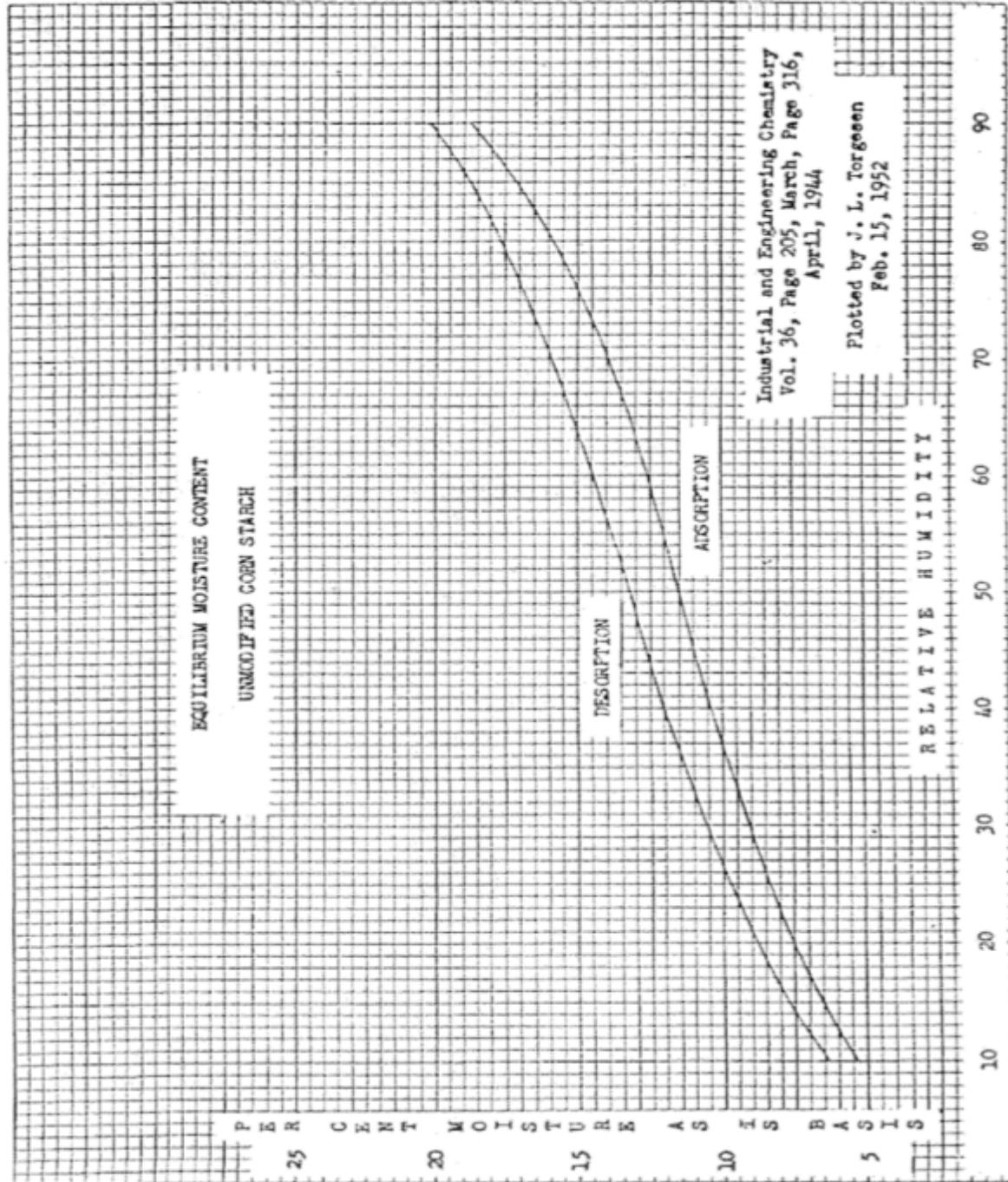
Water Sorption of Corn Starch at Various Temperatures and Relative Humidities

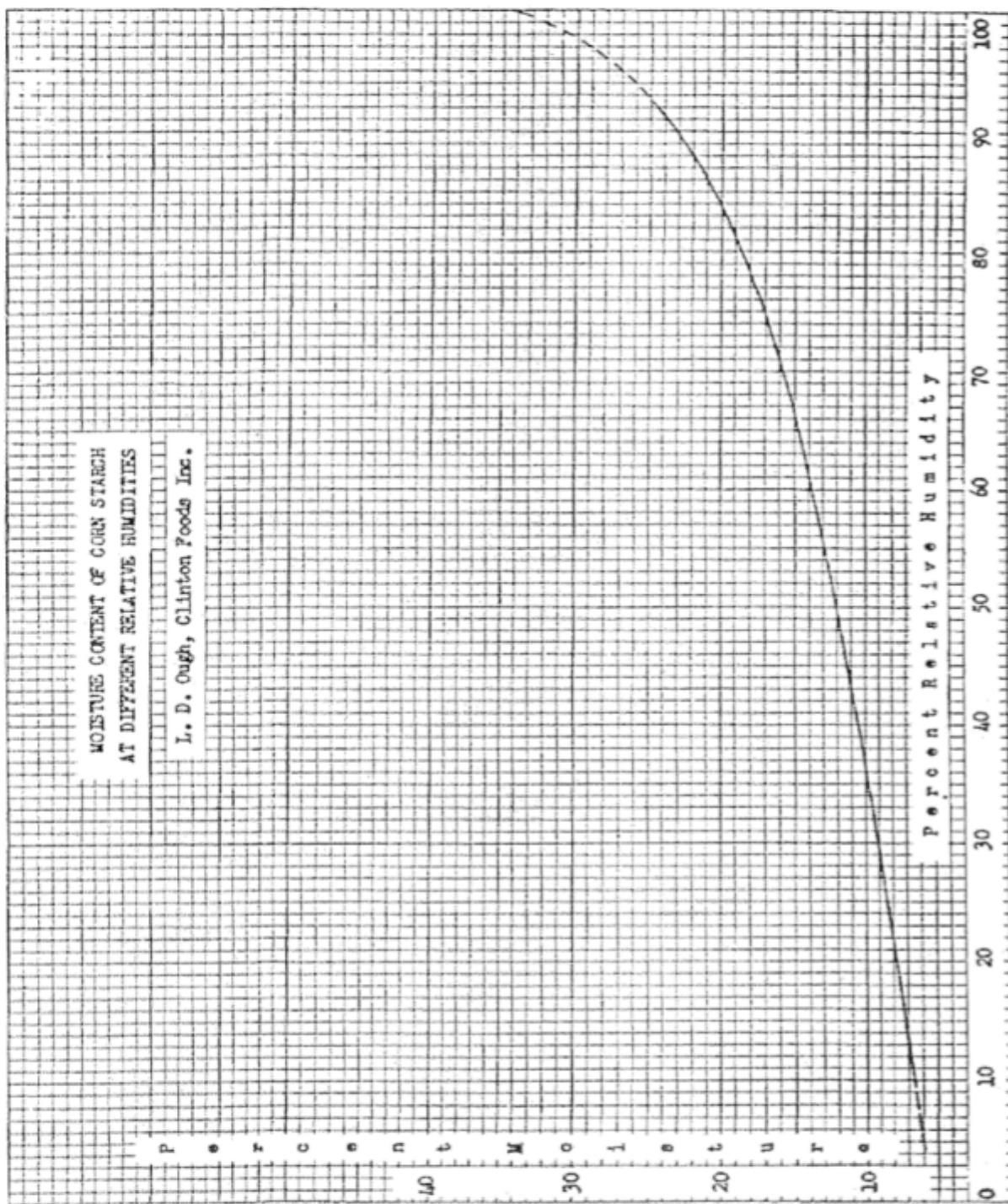
(1)

<u>25 °C (77 °F)</u>		<u>40 °C (104 °F)</u>		<u>50 °C (122 °F.)</u>		<u>60 °C (140 °F)</u>		<u>70 °C (158 °F.)</u>	
<u>% R. H.</u>	<u>%H₂O Adsorb.</u>	<u>% R. H.</u>	<u>%H₂O Adsorb.</u>	<u>% R. H.</u>	<u>%H₂O Adsorb.</u>	<u>% R. H.</u>	<u>%H₂O Adsorb.</u>	<u>% R. H.</u>	<u>%H₂O Adsorb.</u>
12	7.6	10.6	5.6	10.4	5.9	10.2	4.0	9.9	4.4
20	10.4	31.5	9.6	30.4	9.6	29.5	7.3	28.1	7.7
43	13.7	52.8	12.8	46.5	12.1	41.9	9.3	36.3	9.1
56	16.0	70.8	16.0	68.4	15.3	66.1	12.7	63.4	12.6
75	19.2	86.4	20.8	86.0	21.4	84.9	19.7	84.2	15.6
85	22.0	96.4	30.3	96.0	31.7	95.6	26.2	95.0	(b)
93	26.2	100.0	35.3	100.0	33.8	100.0	30.5	100.0	(b)

(b) These samples became partially gelatinized due to high temperature and high relative humidity.







WATER SORPTION BY CORN STARCH AS INFLUENCED BY PREPARATORY PROCEDURES AND STORAGE TIME

N. N. Hellman and E. H. Melvin, Northern Regional Laboratory, Peoria, Illinois, 12/8/47

Ten corn starch samples were selected which represent different preparative methods and periods of storage. Approximately 2-g. samples of the various starches at the moisture content at which they were normally stored (10-13%) were placed in aluminum moisture dishes. The samples were then placed in a vacuum desiccator over a saturated salt solution selected to give the appropriate vapor pressure of water. The solutions used are given below.

<u>Salt</u>	<u>Relative humidity</u>
KNO ₃	93.5
KCl	85.0
NaNO ₃	74.5
NaBr	56.4
K ₂ CO ₃	43.0
KC ₂ H ₃ O ₂	20.0
LiCl	12.2

To hasten equilibrium, the desiccators were evacuated with a two-stage, rotary, oil, vacuum pump and, to ensure complete removal of air, were pumped for 1 hour after the pressure had been reduced to the pressure of the water in the salt solution. The desiccators were then placed in a constant-temperature room, controlled at 25 ± 1 C., and allowed to stand 2 to 4 weeks, a period shown by other trials to be ample for equilibration.

At the conclusion of the period of equilibration the pressure of the atmosphere within the desiccators were measured with an ordinary closed-end, mercury, U-tube manometer to assure that the pressure of water was that anticipated from the literature data. Dry air was then admitted, the desiccator opened, and the moisture content of the starch samples determined. Moisture contents were determined by heating in a vacuum oven at 105°C. for 24 hours. Tests of the reproducibility of results by use of this technique showed that within the same desiccator the per cent moisture content of triplicate samples agreed to within 0.3

Rate of Moisture Adsorption of Starch and Dextrins at 16 °C, 33% Relative Humidity (1)

Per cent Moisture Adsorbed

<u>Time in Hrs.</u>	<u>Starch</u>	<u>*Globe*</u> <u>Dextrin</u>	<u>*Fragd*</u> <u>Dextrin</u>
0	0.2	0.2	0.2
1	1.0	0.6	0.6
2	1.7	1.2	1.3
3	2.2	1.3	1.8
4	2.6	1.6	2.2
5	3.0	2.0	2.7
6	3.5	2.3	3.1
7	3.9	2.6	3.5
8	4.3	2.9	3.9
9	4.7	3.2	4.2
10	-	3.5	4.5
24	7.5	5.5	5.7
28	8.1	5.8	5.9
32	8.4	6.1	6.1
49	9.5	6.8	6.5
53	9.6		6.6
57	9.7	7.0	6.7
73	10.2	7.2	6.8
81	10.3	7.3	-
97	10.4	7.3	-
121	-	-	7.0
145	10.7	7.5	7.0
169	10.8	7.5	-
193	10.8	7.5	7.0

(1) Research Laboratory, Corn Products Refining Co., Milan, Italy.

Rate of Moisture Adsorption of Starch and Dextrins at 16 °C, 66% Relative

Humidity (1)Per cent Moisture Adsorbed

<u>Time in Hrs.</u>	<u>Starch (a)</u>	<u>*Globe*</u> <u>Dextrin (a)</u>	<u>*Fragd*</u> <u>Dextrin (a)</u>
0	0.2	0.3	0.3
1	0.9	1.5	1.1
2	2.0	2.3	1.9
5	4.7	4.7	4.2
7	6.5	6.7	5.5
10	8.5	8.0	6.4 (b)
24	12.0	10.0	9.9
32	12.9	10.7	10.4
48	14.5	11.5	11.1
72	15.3	-	11.7
90	15.6	-	-
96	-	12.7	12.0
144	16.1	13.0	12.6
168	16.1	13.1	12.7
216	16.1	13.2	12.9
264	-	13.3	13.0
312	-	13.3	13.1
336	-	-	13.1

(a) The starch and dextrin samples are of current Italian production. The dextrans are of canary type, with solubilities greater than 97 per cent.

(b) Nine hour samples.

(1) Research Laboratory, Corn Products Refining Co., Milan, Italy.

Starch Conversion Table

Baume Be. at <u>60 °F</u>	°F	Specific Gravity in Air	Modulus 145 % D.S. Starch	Weight Pounds per Gallon	Specific Gravity Grams D.S. Starch per 100 ml.	60°/60 Pounds D.S. Starch per Gallon
0.0	0.0000	0.000	0.000	8.328	0.000	0.000
0.1	1.0007	0.178	0.178	8.334	0.178	0.015
0.2	1.0014	0.354	0.354	8.340	0.359	0.030
0.3	1.0021	0.531	0.531	8.346	0.527	0.044
0.4	1.0028	0.708	0.708	8.352	0.707	0.059
0.5	1.0035	0.885	0.885	8.357	0.887	0.074
0.6	1.0041	1.062	1.062	8.362	1.066	0.089
0.7	1.0048	1.239	1.239	8.368	1.246	0.104
0.8	1.0055	1.416	1.416	8.374	1.426	0.119
0.9	1.0062	1.593	1.593	8.380	1.594	0.133
1.0	1.0069	1.777	1.777	8.386	1.785	0.149
1.1	1.0076	1.955	1.955	8.392	1.965	0.164
1.2	1.0083	2.132	2.132	8.397	2.145	0.179
1.3	1.0090	2.310	2.310	8.403	2.325	0.194
1.4	1.0097	2.488	2.488	8.409	2.504	0.209
1.5	1.0105	2.666	2.666	8.416	2.684	0.224
1.6	1.0112	2.843	2.843	8.422	2.864	0.239
1.7	1.0119	3.021	3.021	8.427	3.044	0.254
1.8	1.0126	3.199	3.199	8.433	3.235	0.270
1.9	1.0133	3.376	3.376	8.439	3.415	0.285
2.0	1.0140	3.554	3.554	8.445	3.595	0.300
2.1	1.0147	3.732	3.732	8.451	3.775	0.315
2.2	1.0154	3.909	3.909	8.456	3.966	0.331
2.3	1.0161	4.087	4.087	8.462	4.146	0.346
2.4	1.0168	4.265	4.265	8.468	4.326	0.361
2.5	1.0176	4.443	4.443	8.475	4.518	0.377
2.6	1.0183	4.620	4.620	8.481	4.697	0.392
2.7	1.0190	4.798	4.798	8.486	4.877	0.407
2.8	1.0197	4.976	4.976	8.492	5.069	0.423
2.9	1.0204	5.153	5.153	8.498	5.249	0.438
3.0	1.0211	5.331	5.331	8.504	5.428	0.453
3.1	1.0218	5.509	5.509	8.510	5.620	0.469
3.2	1.0226	5.686	5.686	8.516	5.800	0.484
3.3	1.0233	5.864	5.864	8.522	5.991	0.500
3.4	1.0241	6.042	6.042	8.529	6.171	0.515
3.5	1.0248	6.220	6.220	8.535	6.363	0.531
3.6	1.0255	6.397	6.397	8.541	6.543	0.546

3.7	1.0263	6.575	8.547	6.734	0.562
3.8	1.0270	6.753	8.553	6.926	0.578
3.9	1.0278	6.930	8.560	7.106	0.593
4.0	1.0285	7.108	8.566	7.298	0.609
4.1	1.0292	7.286	8.571	7.477	0.624
4.2	1.0300	7.463	8.578	7.669	0.640
4.3	1.0307	7.641	8.584	7.861	0.656
4.4	1.0314	7.819	8.590	8.053	0.672
4.5	1.0322	7.997	8.596	8.232	0.687
4.6	1.0329	8.174	8.602	8.424	0.703
4.7	1.0336	8.352	8.608	8.616	0.719
4.8	1.0343	8.530	8.614	8.807	0.735
4.9	1.0351	8.707	8.621	8.999	0.751
5.0	1.0358	8.885	8.626	9.179	0.766
5.1	1.0366	9.063	8.633	9.371	0.782
5.2	1.0373	9.240	8.639	9.562	0.798
5.3	1.0381	9.418	8.646	9.754	0.814
5.4	1.0388	9.596	8.651	9.946	0.830
5.5	1.0396	9.774	8.658	10.138	0.846
5.6	1.0403	9.951	8.664	10.329	0.862
5.7	1.0411	10.129	8.671	10.521	0.878
5.8	1.0418	10.307	8.676	10.713	0.894
5.9	1.0426	10.484	8.683	10.904	0.910
6.0	1.0433	10.662	8.689	11.096	0.926
6.1	0.0441	10.840	8.696	11.300	0.943
6.2	1.0448	11.017	8.701	11.492	0.959
6.3	1.0456	11.195	8.708	11.683	0.975
6.4	1.0463	11.373	8.714	11.875	0.991
6.5	1.0471	11.551	8.720	12.067	1.007
6.6	1.0478	11.728	8.726	12.259	1.023
6.7	1.0486	11.906	8.733	12.462	1.040
6.8	1.0493	12.084	8.739	12.654	1.056
6.9	1.0501	12.261	8.745	12.846	1.072
7.0	1.0508	12.439	8.751	13.049	1.089
7.1	1.0516	12.617	8.758	13.241	1.105
7.2	1.0523	12.794	8.764	13.433	1.121
7.3	1.0531	12.972	8.770	13.637	1.138
7.4	1.0539	13.150	8.777	13.828	1.154
7.5	1.0547	13.328	8.784	14.032	1.171
7.6	1.0554	13.505	8.790	14.224	1.187
7.7	1.0562	13.683	8.796	14.427	1.204
7.8	1.0570	13.861	8.803	14.619	1.220
7.9	1.0577	14.038	8.809	14.823	1.237

8.0	1.0585	14.216	8.815	15.015	1.253
8.1	1.0593	14.394	8.822	15.218	1.270
8.2	1.0601	14.571	8.829	15.410	1.286
8.3	1.0608	14.749	8.835	15.614	1.303
8.4	1.0616	14.927	8.841	15.817	1.320
8.5	1.0624	15.105	8.848	16.009	1.336
8.6	1.0632	15.282	8.855	16.213	1.355
8.7	1.0640	15.460	8.861	16.417	1.370
8.8	1.0647	15.638	8.867	16.620	1.387
8.9	1.0655	15.815	8.874	16.812	1.403
9.0	1.0663	15.993	8.880	17.016	1.420
9.1	1.0671	16.171	8.887	17.219	1.437
9.2	1.0679	16.348	8.894	17.423	1.454
9.3	1.0687	16.526	8.900	17.627	1.471
9.4	1.0695	16.704	8.907	17.831	1.488
9.5	1.0703	16.882	8.914	18.034	1.505
9.6	1.0710	17.059	8.920	18.238	1.522
9.7	1.0718	17.237	8.926	18.442	1.539
9.8	1.0726	17.415	8.933	18.645	1.556
9.9	1.0734	17.592	8.940	18.849	1.573
10.0	1.0742	17.770	8.946	19.053	1.590
10.1	1.0750	17.948	8.953	19.257	1.607
10.2	1.0758	18.125	8.960	19.460	1.624
10.3	1.0766	18.305	8.966	19.664	1.641
10.4	1.0774	18.481	8.973	19.868	1.658
10.5	1.0782	18.659	8.979	20.071	1.675
10.6	1.0790	18.836	8.986	20.287	1.693
10.7	1.0798	19.014	8.993	20.491	1.710
10.8	1.0806	19.192	8.999	20.694	1.727
10.9	1.0814	19.369	9.006	20.898	1.744
11.0	1.0822	19.547	9.013	21.114	1.762
11.1	1.0830	19.725	9.019	21.318	1.779
11.2	1.0838	19.902	9.026	21.521	1.796
11.3	1.0846	20.080	9.033	21.737	1.814
11.4	1.0854	20.258	9.039	21.941	1.831
11.5	1.0863	20.436	9.047	22.156	1.849
11.6	1.0871	20.613	9.054	22.360	1.866
11.7	1.0879	20.791	9.060	22.576	1.884
11.8	1.0887	20.969	9.067	22.779	1.901
11.9	1.0895	21.146	9.074	22.995	1.919
12.0	1.0903	21.324	9.080	23.199	1.936
12.1	1.0911	21.502	9.087	23.415	1.954
12.2	1.0920	21.679	9.094	23.618	1.972

12.3	1.0928	21.857	9.101	23.834	1.989
12.4	1.0936	22.035	9.108	24.050	2.007
12.5	1.0945	22.213	9.115	24.265	2.025
12.6	1.0953	22.390	9.122	24.469	2.042
12.7	1.0961	22.568	9.129	24.685	2.060
12.8	1.0969	22.746	9.135	24.900	2.078
12.9	1.0978	22.923	9.143	25.116	2.096
13.0	1.0986	23.101	9.149	25.332	2.114
13.1	1.0995	23.279	9.157	25.548	2.132
13.2	1.1003	23.459	9.164	25.763	2.150
13.3	1.1012	23.634	9.171	25.967	2.167
13.4	1.1020	23.812	9.178	26.183	2.185
13.5	1.1029	23.990	9.185	26.398	2.203
13.6	1.1037	24.167	9.192	26.614	2.221
13.7	1.1046	24.345	9.199	26.830	2.239
13.8	1.1054	24.523	9.206	27.057	2.258
13.9	1.1063	24.700	9.214	27.273	2.276
14.0	1.1071	24.878	9.220	27.489	2.294
14.1	1.1080	25.056	9.228	27.704	2.312
14.2	1.1088	25.233	9.234	27.920	2.330
14.3	1.1097	25.411	9.242	28.136	2.348
14.4	1.1105	25.589	9.248	28.352	2.366
14.5	1.1114	25.767	9.256	28.579	2.385
14.6	1.1122	25.944	9.263	28.795	2.403
14.7	1.1131	26.122	9.270	29.023	2.422
14.8	1.1139	26.300	9.277	29.238	2.440
14.9	1.1148	26.477	9.284	29.454	2.458
15.0	1.1156	26.655	9.291	29.682	2.477
15.1	1.1165	26.833	9.298	29.885	2.495
15.2	1.1173	27.010	9.305	30.113	2.513
15.3	1.1182	27.188	9.313	30.341	2.532
15.4	1.1190	27.366	9.319	30.556	2.550
15.5	1.1199	27.544	9.327	30.784	2.569
15.6	1.1208	27.721	9.334	31.000	2.587
15.7	1.1216	27.899	9.341	31.227	2.606
15.8	1.1225	28.077	9.348	31.455	2.625
15.9	1.1233	28.254	9.355	31.671	2.643
16.0	1.1242	28.432	9.363	31.898	2.662
16.1	1.1251	28.610	9.370	32.126	2.681
16.2	1.1260	28.787	9.378	32.354	2.700
16.3	1.1268	28.965	9.384	32.570	2.718
16.4	1.1277	29.143	9.392	32.797	2.737
16.5	1.1286	29.321	9.399	33.025	2.756

16.6	1.1295	29.498	9.407	33.253	2.775
16.7	1.1304	29.675	9.414	33.480	2.794
16.8	1.1312	29.854	9.421	33.708	2.813
16.9	1.1321	30.031	9.428	33.924	2.831
17.0	1.1330	30.209	9.436	34.163	2.851
17.1	1.1339	30.387	9.443	34.379	2.869
17.2	1.1348	30.564	9.451	34.619	2.889
17.3	1.1357	30.742	9.458	34.846	2.908
17.4	1.1366	30.920	9.466	35.074	2.927
17.5	1.1375	31.098	9.473	35.302	2.946
17.6	1.1383	31.275	9.480	35.529	2.965
17.7	1.1392	31.453	9.488	35.757	2.984
17.8	1.1401	31.631	9.495	35.985	3.003
17.9	1.1410	31.808	9.503	36.224	3.023
18.0	1.1419	31.986	9.510	36.452	3.042
18.1	1.1428	32.164	9.518	36.680	3.061
18.2	1.1437	32.341	9.525	36.907	3.080
18.3	1.1446	32.519	9.532	37.147	3.100
18.4	1.1455	32.697	9.540	37.375	3.119
18.5	1.1465	32.875	9.548	37.614	3.139
18.6	1.1474	33.052	9.556	37.842	3.158
18.7	1.1483	33.230	9.563	38.082	3.178
18.8	1.1492	33.408	9.571	38.309	3.197
18.9	1.1501	33.585	9.578	38.549	3.217
19.0	1.1510	33.763	9.586	38.789	3.237
19.1	1.1519	33.941	9.593	39.016	3.256
19.2	1.1528	34.118	9.601	39.256	3.276
19.3	1.1538	34.296	9.609	39.496	3.296
19.4	1.1547	34.474	9.617	39.723	3.315
19.5	1.1556	34.652	9.624	39.963	3.335
19.6	1.1565	34.829	9.632	40.203	3.355
19.7	1.1574	35.007	9.639	40.430	3.374
19.8	1.1584	35.185	9.647	40.670	3.394
19.9	1.1593	35.362	9.655	40.910	3.414
20.0	1.1602	35.540	9.662	41.149	3.434
20.1	1.1611	35.718	9.670	41.389	3.454
20.2	1.1621	35.895	9.678	41.629	3.474
20.3	1.1630	36.073	9.686	41.868	3.494
20.4	1.1640	36.251	9.694	42.108	3.514
20.5	1.1649	36.429	9.702	42.348	3.534
20.6	1.1658	36.606	9.709	42.587	3.554
20.7	1.1668	36.784	9.717	42.827	3.574
20.8	1.1677	36.962	9.725	43.079	3.595

20.9	1.1687	37.139	9.733	43.318	3.615
21.0	1.1696	37.317	9.741	43.558	3.635
21.1	1.1706	37.495	9.749	43.797	3.655
21.2	1.1715	37.672	9.757	44.049	3.676
21.3	1.1725	37.850	9.765	44.289	3.696
21.4	1.1734	38.028	9.772	44.528	3.716
21.5	1.1744	38.206	9.781	44.780	3.737
21.6	1.1753	38.383	9.788	45.020	3.757
21.7	1.1763	38.561	9.796	45.259	3.777
21.8	1.1772	38.739	9.804	45.511	3.798
21.9	1.1782	38.916	9.812	45.751	3.818
22.0	1.1791	39.094	9.820	46.002	3.839
22.1	1.1801	39.272	9.828	46.254	3.860
22.2	1.1810	39.449	9.836	46.494	3.880
22.3	1.1820	39.627	9.844	46.745	3.901
22.4	1.1830	39.805	9.852	46.997	3.922
22.5	1.1840	39.983	9.861	47.249	3.943
22.6	1.1849	40.160	9.868	47.488	3.963
22.7	1.1859	40.338	9.876	47.740	3.984
22.8	1.1869	40.516	9.885	47.992	4.005
22.9	1.1878	40.693	9.892	48.231	4.025
23.0	1.1888	40.871	9.901	48.495	4.047
23.1	1.1898	41.049	9.909	48.746	4.068
23.2	1.1908	41.226	9.917	48.986	4.088
23.3	1.1917	41.404	9.925	49.238	4.109
23.4	1.1927	41.582	9.933	49.489	4.130
23.5	1.1937	41.760	9.941	49.741	4.151
23.6	1.1947	41.937	9.950	50.005	4.173
23.7	1.1957	42.115	9.958	50.256	4.194
23.8	1.1966	42.293	9.966	50.508	4.215
23.9	1.1976	42.470	9.974	50.760	4.236
24.0	1.1986	42.648	9.982	51.011	4.257
24.1	1.1996	42.826	9.991	51.275	4.279
24.2	1.2006	43.003	9.999	51.526	4.300
24.3	1.2016	43.181	10.007	51.778	4.321
24.4	2.2026	43.359	10.016	52.042	4.343
24.5	1.2036	43.537	10.024	52.293	4.364
24.6	1.2046	43.714	10.032	52.545	4.385
24.7	1.2056	43.892	10.041	52.809	4.407
24.8	1.2066	44.070	10.049	53.072	4.429
24.9	1.2076	44.247	10.057	53.324	4.450
25.0	1.2086	44.425	10.065	53.576	4.471

Temperature Corrections for Starch Suspensions

(1)

Add to Observed Baume to reduce to Baume at 60 °F.

<u>Be.</u>	<u>70 °F.</u>	<u>80 °F.</u>	<u>90 °F.</u>	<u>100 °F.</u>	<u>110 °F.</u>	<u>120 °F.</u>	<u>130 °F.</u>	<u>140 °F.</u>
0	0.18	0.35	0.53	0.71	0.98	1.24	1.61	1.98
5	0.17	0.34	0.52	0.69	0.95	1.20	1.56	1.92
10	0.17	0.33	0.50	0.67	0.92	1.17	1.51	1.85
15	0.16	0.32	0.49	0.65	0.89	1.13	1.45	1.78
20	0.16	0.31	0.47	0.63	0.86	1.09	1.40	1.72
25	0.15	0.30	0.46	0.61	0.83	1.05	1.35	1.65

(1) J. E. Cleland, E. E. Fauser and W. R. Fetzer. Anal. Ed. Ind. and Eng. Chem. Vol. 15, Page 334, May 15, 1943.

Weight of One Gallon of Water at 60 °F. = 8.32823 Pounds.

11.982897 X Pounds D.S. Starch per Gallon = Grams D.S. Starch per 100 ml.

In the above correction table, 70, 80 and 90 F. values by extrapolation. 130 F. value by interpolation.

G. E. C.

Osmotic Pressure of Colloids (1)

<u>Substance</u>	<u>Wt.%</u>	<u>t,C</u>	<u>mm Hg.</u>
Dextrin	1	1.59	166

B Dextrin, t = 25 C; Collodian Membrane. Solubility, 1.76 at 22C

<u>Wt.%</u>	0.0452	0.0818	0.158	0.321	0.513
<u>mm Hg.</u>	5.70	8.24	12.7	15.8	18.7

Dextrin (Kahlbaum, Purified) t = 25; Collodian Membrane

<u>Wt.%</u>	0.076	0.125	0.268	0.445	0.663	1.020	1.675
<u>mm Hg.</u>	3.47	5.75	8.1	10.4	12.3	13.1	15.0

(1) I. C. T. IV, 430 (1928)

Specific Heat of Dextrin and Starch

I. C. T., V, 103 (1929) gives the Specific Heat of Dextrin ($C_6H_{10}O_5)_x$ at 0 to 90 °C. as $1.22 + 0.0040t$ in joule/g. at 15 C. $1.22 + 0.0040 \times 15 = 1.28$ joule/g.

Rubber Handbook 33d. Ed. 1882, gives the Specific Heat of Dextrin ($C_6H_{10}O_5)_x$ at 15 C. = 0.292 cal/g. Changing cal/g to joule/g = 0.292×4.182 or 1.222 joule/g.

Penick and Ford submitted a figure of 0.3 as the Specific Heat of starch to the Technical Advisory Committee in 1938. It was assumed this was in cal/g. at 15 °C
 Changing this figure to joule/g., $0.3 \times 4.185 = 1.256$ joule/g. as the Specific Heat of starch.

Surface Tension Corn Starch (1)

<u>Temp. C.</u>	Surface Tension in Dynes of Corn Starch		
	<u>1%</u>	<u>2%</u>	<u>3%</u>
70	46.55	50.54	61.84
60	55.19	57.85	65.83
50	63.17	63.17	67.83
40	69.16	67.16	69.82
30	73.15	70.48	71.48
20	74.48	72.48	73.15

$$S.T. = M.g/2C$$

M = Mass in grams necessary to tear the film

g = 981

C = Circumference in cm. of ring.

Starch suspended in distilled water, boiled 5 min.

(1)Am. Jour. Pharm. 820 - 1924

General Properties

Density of Corn Starch 1.5 to 1.

F.

Heat of Combustion of Corn Starch 4179 g-cal/g P. & F.
 4179 g-cal/g I. C. T.

Heat of Swelling (1) I. C. T. V. 143 (1929)

Starch with Water at 0 C.

Starch Dried for 21 Days in Partial Vacuum Above H₂SO₄

$Q = 110.5 \text{ joul/g.}$

Dextrin with Water

$Q = 67.6 \text{ joule/g.}$

Heat of Wetting

Heat of Wetting

$110 \text{ joule/g P. \& F.}$

$110.5 \text{ joule/g I. C. T.}$

VISCOSITY OF CORN STARCH SLURRIES AT 25°C.

Data on Mc Michael Viscosimeter by D. W. Hansen
A. E. Staley Manufacturing Co.

30

V

1

8

25

C

O

S

1

t

Y

Y

C

e

15

n

t

1

1

P

0

1

10

s

6

8

5

3

0

-

+

Baumé at 60° F.

25

20

15

10

5

0

CORN OIL

Density of Refined Corn and Soybean Oils (1)

<u>Pounds per Gallon</u>							
<u>Temp. °F.</u>	<u>Density</u>	<u>Temp. °F.</u>	<u>Density</u>	<u>Temp. °F.</u>	<u>Density</u>	<u>Temp. °F.</u>	<u>Density</u>
30	7.792	70	7.669	110	7.545	150	7.422
31	7.789	71	7.666	111	7.542	151	7.419
32	7.786	72	7.662	112	7.539	152	7.416
33	7.783	73	7.659	113	7.536	153	7.413
34	7.780	74	7.656	114	7.533	154	7.410
35	7.776	75	7.653	115	7.530	155	7.407
36	7.773	76	7.650	116	7.527	156	7.404
37	7.770	77	7.647	117	7.524	157	7.401
38	7.767	78	7.644	118	7.521	158	7.398
39	7.764	79	7.641	119	7.518	159	7.395
40	7.761	80	7.638	120	7.515	160	7.391
41	7.758	81	7.635	121	7.512	161	7.388
42	7.755	82	7.632	122	7.508	162	7.385
43	7.752	83	7.629	123	7.505	163	7.382
44	7.749	84	7.626	124	7.502	164	7.379
45	7.746	85	7.622	125	7.499	165	7.376
46	7.743	86	7.619	126	7.496	166	7.373
47	7.739	87	7.616	127	7.493	167	7.370
48	7.736	88	7.613	128	7.490	168	7.367
49	7.733	89	7.610	129	7.487	169	7.364
50	7.730	90	7.607	130	7.484	170	7.361
51	7.727	91	7.604	131	7.481	171	7.358
52	7.724	92	7.601	132	7.478	172	7.354
53	7.721	93	7.598	133	7.475	173	7.351
54	7.718	94	7.595	134	7.472	174	7.348
55	7.715	95	7.592	135	7.468	175	7.345
56	7.712	96	7.589	136	7.465	176	7.342
57	7.709	97	7.585	137	7.462	177	7.339

58	7.706	98	7.582	138	7.459	178	7.336
59	7.703	99	7.579	139	7.456	179	7.333
60	7.699	100	7.576	140	7.453	180	7.330
61	7.696	101	7.573	141	7.450	181	7.327
62	7.693	102	7.570	142	7.447	182	7.324
63	7.690	103	7.567	143	7.444	183	7.321
64	7.687	104	7.564	144	7.441	184	7.318
65	7.684	105	7.561	145	7.438	185	7.315
66	7.681	106	7.558	146	7.435	186	7.312
67	7.678	107	7.555	147	7.431	187	7.309
68	7.675	108	7.552	148	7.428	188	7.306
69	6.672	109	7.549	149	7.425	189	7.303
					190		7.300

(1)Based on Specific Gravities Determined at 43/60, 60/60, 80/60, 100/60, 120/60, 140/60, 160/60 and 176/60 °F. by D. W. Hansen and A. Lippincott, A. E. Staley Mfg. Co. 4/29/52

Heat of Combustion of Corn Oil (2)

Heat of combustion per gram

	<u>Spgr. at 15.5/15.5</u>	<u>Iodine adsorption</u>	<u>Free acid as oleic</u>	<u>Constant Volume Calories</u>	<u>Constant Pressure Calories</u>
Maize Oil I	0.924	120.3	3.32	9413	9428
Maize Oil II	0.926	120.7	2.56	9436	9451
Maize Oil III crude	0.926	122.4	1.68	9419	9434

I. Glucose Sugar Refining Co.

II. Purchased on open market.

III. Crude of unknown history.

(2) Jour. Am. Chem. Soc. Vo. 23, (1901)

Heat of Combustion of Corn Oil II (3)

	<u>Iodine Value</u>	<u>Free acids as Oleic</u>	<u>Hv</u>
Refined	120.3	3.32	39.39
Crude	122.4	1.68	39.42

Hv = heat of combustion, at constant volume, in kilojules per

gram.

$$1 \text{ kJg}^{-1} = 238.0 \text{ cal}_{15} \text{ g}^{-1} = 430.1 \text{ BTU}_{60} \text{ lb}^{-1}$$

(3) I. C. T. II, 210 (1928)

Flash Point and Fire Point of Corn Oil (4)

Flash Point Fire Point

<u>°F.</u>	<u>°C.</u>	<u>°F.</u>	<u>°C.</u>
480	249	635	335

(4) I. C. T. II, 211 (1928)

Common Properties of Some Vegetable Oils (1)

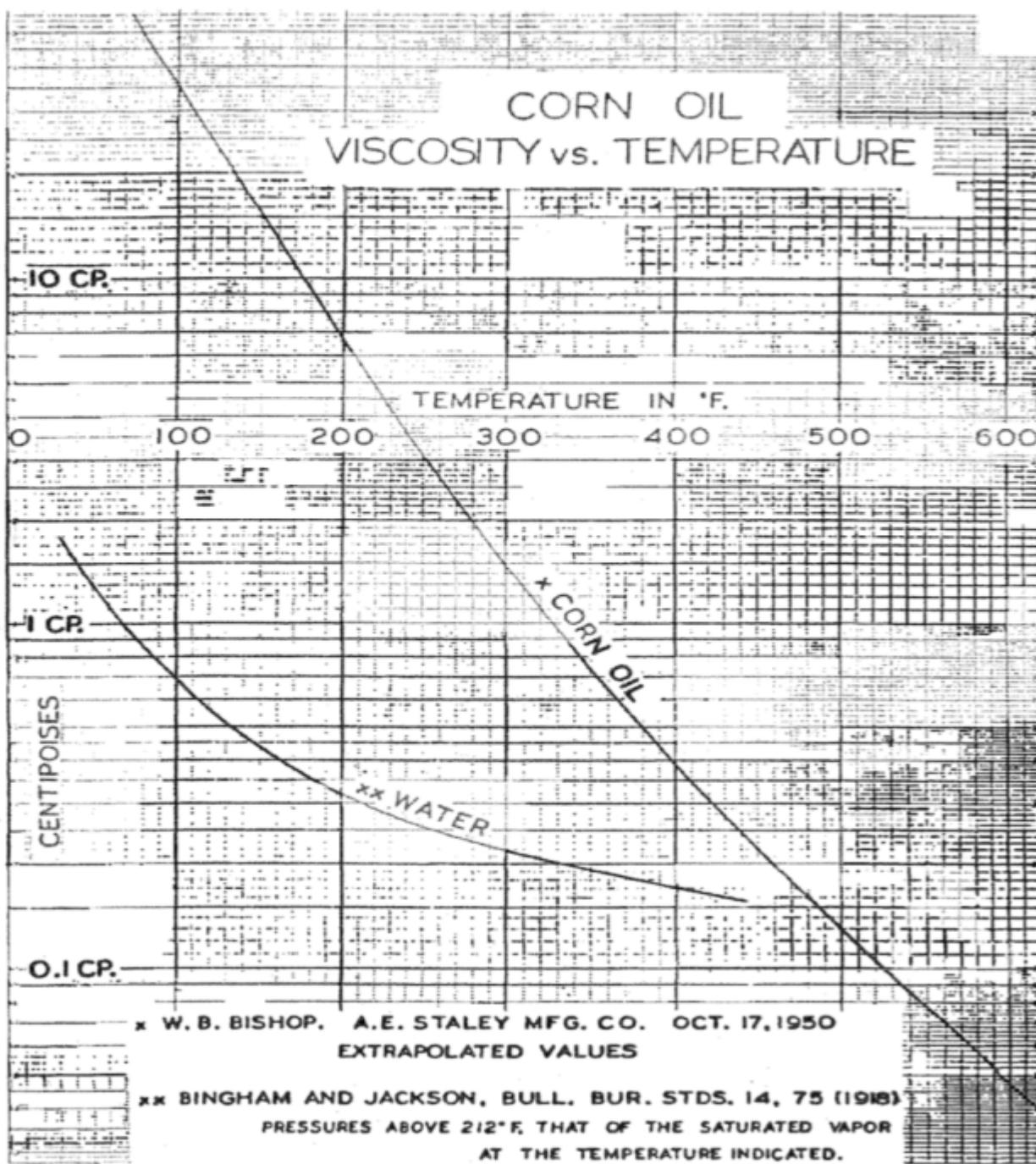
<u>Name of Oil</u>	<u>Density d 15/15 °C.</u>	<u>Solidifying Point °C.</u>	<u>Saponification Value</u>	<u>Iodine Value</u>	<u>Hehner's Number</u>
Corn	0.921 - 0.928 0.8529 - 100 C.	-10 to -20	187 - 193	111 - 128	93 - 95
Soybean	0.924 - 0.927	-10 to -16	189 - 193.5	122 - 134	93 -
Cotton seed	0.917 - 0.918 at 25/25 °C.	+12 to -13	194 - 196	103 - 111.3	95.7
Peanut	0.917 - 0.926	3	186 - 194	88 - 98	95
Olive	0.915 - 0.920	+ 2 turbid to - 6 solid	185 - 196	79 - 88	95
Linseed	0.930 - 0.938	-19 to -27	188 - 195	175 - 202	94.5 - 95.5
<u>Name of Oil</u>	<u>Maumene Number</u>	<u>Acid Value</u>	<u>Acetyl Value</u>	<u>Refractive Index C.</u>	<u>Reichert Meissl No.</u>
Corn	81 - 86	1.37 - 2.02	7.5 - 11.5	1.4733 at 25°	4.3
Soybean	87 - 88	0.3 1.8	4.9	1.4723 - 1.4756 at 25°	0.5 - 2.8
Cotton seed	75 - 90	0.6 - 0.9	21 - 25	1.4743 - 1.4752 at 15°	0.95
					1.1

Peanut	45 - 67	0.8	3.5	1.4620 - 1.4653 at 40°	0.4	0.5 - 0.9
Olive	41.5 - 47	0.3 - 1.0	10.5	1.4657 - 1.4667 at 25°	0.6 - 1.5	0.4 - 1.0
Linseed	103 - 126	1 - 3.5	-	1.4797 - 1.4802 at 25°	0.95	0.4 - 1.2

<u>Name of Oil</u>	<u>Melting Point C.</u>	<u>Solidifying Point C.</u>	<u>Iodine Value</u>	<u>Acid Value</u>
Corn	17 - 20	14 - 16	113 - 125	198.4
Soybean	26.2 - 27.5	21.2	122	
Cotton seed	34.5	32 - 35	111 - 115	201.6 - 203.9
Peanut	-	30.5 - 39	95.5 - 103.4	201.6
Olive	26 - 30	19.6 - 26.4	86 - 90	193
Linseed	20 - 24	16 - 20.6	179 - 209.8	196 - 198.8

(1) I. C. T. Vol. II, 201-9 (1929). Chemical Rubber Pub. Co. Handbook (1951) Jour. Am. Chem. Soc. Vol. 23 (1901)

Additional up to date international standards tables for oils may be found on the CODEX website.



MISCELLANEOUS CONVERSION FACTORS

Tankage

Gallons, United States Per Ft+Inch in Cylinders of "X" Diameter

Feet	0	1	2	3	4 Gal	<u>Inches</u>						
						5	6	7	8	9	10	11
0	.0000	.0034	.0136	.0306	.0544	.0850	.1224	.1666	.2176	.2754	.3400	.4114
1	.4896	.5746	.6664	.7650	.8704	.9826	1.102	1.227	1.360	1.499	1.646	1.799
2	1.958	2.125	2.298	2.479	2.666	2.859	3.060	3.267	3.482	3.703	3.930	4.165
3	4.406	4.665	4.910	5.171	5.440	5.715	5.998	6.287	6.582	6.885	7.194	7.511
4	7.834	8.163	8.500	8.843	9.194	9.551	9.914	10.28	10.66	11.05	11.44	11.84
5	12.24	12.65	13.07	13.49	13.93	14.36	14.81	15.26	15.72	16.19	16.66	17.14
6	17.63	18.12	18.62	19.12	19.64	20.16	20.69	21.22	21.76	22.31	22.86	23.42
7	23.99	24.56	25.15	25.73	26.33	26.93	27.54	28.16	28.78	29.41	30.04	30.68
8	31.33	31.99	32.65	33.32	34.00	34.68	35.37	36.07	36.77	37.41	38.20	38.93
9	39.66	40.40	41.14	41.89	42.65	43.41	44.19	44.96	45.75	46.54	47.34	48.15
10	48.96	49.78	50.61	51.44	52.28	53.13	53.98	54.84	55.71	56.58	57.46	58.35
11	59.24	60.14	61.05	61.96	62.89	63.81	64.75	65.69	66.64	67.60	68.56	69.53
12	70.50	71.48	72.47	73.47	74.47	75.48	76.50	77.52	78.55	79.59	80.63	81.68
13	82.74	83.81	84.88	85.96	87.04	88.13	89.23	90.33	91.45	92.56	93.69	94.82
14	95.96	97.11	98.26	99.42	100.6	101.8	102.9	104.1	105.3	106.5	107.7	108.9
15	110.2	111.4	112.6	113.9	115.1	116.4	117.6	118.9	120.2	121.5	122.7	124.0
16	125.3	126.6	128.0	129.3	130.6	132.0	133.3	134.6	136.0	137.4	138.7	140

Capacity of Rectangular Tanks in U. S. Gallons for Each Foot in Depth

Width of Tank Ft., in.	Length of Tank									
	Ft. 2, In. 0	Ft. 2, In. 6	Ft. 3, In. 0	Ft. 3, In. 6	Ft. 4, In. 0	Ft. 4 , In. 6	Ft. 5, In. 0	Ft. 5, In. 6	Ft. 6, In. 0	Ft. 6 , In. 6
2' 0"	29.92	37.40	44.88	52.36	59.84	67.32	74.81	82.29	89.77	97.25
2' 6"		46.75	56.10	65.45	74.81	84.16	93.51	102.86	112.21	121.55
3' 0"			67.32	78.55	89.77	100.99	112.21	123.43	134.65	145.87
3' 6"				91.64	104.73	117.82	130.91	144.00	157.09	170.18
4' 0"					115.89	134.65	149.61	164.57	179.53	194.49

4' 6"					151.48	168.31	185.14	201.97	218.81
5' 0"					187.01	205.71	224.42	243.12	
5' 6"						226.29	246.86	267.43	
6' 0"							269.30	291.74	
6' 6"								315.05	

Length of Tank

Width of Tank	Ft. 7 <u>In. 0</u>	Ft. 7 <u>In. 6</u>	Ft. 8 <u>In. 0</u>	Ft. 8 <u>In. 6</u>	Ft. 9 <u>In. 0</u>	Ft. 9 <u>In. 6</u>	Ft. 10 <u>In. 0</u>	Ft. 10 <u>In. 6</u>	Ft. 11 <u>In. 0</u>
2' 0"	104.73	112.21	119.69	127.17	134.65	142.13	149.61	157.09	164.57
2' 6"	130.91	140.26	149.61	158.96	168.31	177.60	187.01	196.36	205.71
3' 0"	157.09	168.31	179.53	190.75	201.97	213.19	224.42	235.54	246.86
3' 6"	183.27	196.36	209.45	222.55	235.64	248.78	261.82	274.91	288.00
4' 0"	209.45	224.42	239.38	254.34	269.30	284.26	299.22	314.18	329.14
4' 6"	235.64	252.47	269.30	286.13	302.96	319.79	336.62	353.45	370.29
5' 0"	261.82	280.52	299.22	317.92	336.02	356.32	374.03	392.73	411.43
5' 6"	288.00	308.67	329.14	349.71	370.29	390.86	411.43	432.00	452.57
6' 0"	314.18	336.62	359.06	381.61	403.95	426.39	448.83	471.27	493.71
6' 6"	340.36	364.58	388.99	413.30	437.61	461.92	486.23	510.65	534.86
7' 0"	366.55	392.73	418.91	445.09	471.27	497.45	523.64	549.82	576.00
7' 6"		420.78	448.83	476.88	504.94	532.99	561.04	589.09	617.14
8' 0"			478.78	508.68	538.60	568.62	598.44	628.36	658.29
8' 6"				540.47	572.26	604.05	635.84	667.64	599.43
9' 0"					605.92	639.58	673.25	706.91	740.57
9' 6"						625.12	710.65	746.18	781.71
10' 0"							748.05	785.45	822.86
10' 6"								824.73	864.00
11' 0"									905.14

Length of Tank

Width of Tank	Ft. 11 <u>In. 6</u>	Ft. 12 <u>In. 0</u>	Ft. 12 <u>In. 6</u>	Ft. 13 <u>In. 0</u>	Ft. 13 <u>In. 6</u>	Ft. 14 <u>In. 0</u>	Ft. 14 <u>In. 6</u>	Ft. 15 <u>In. 0</u>	Ft. 15 <u>In. 6</u>
2' 0"	172.05	178.53	187.01	194.49	201.97	209.45	216.94	224.42	231.90
2' 6"	215.08	224.42	233.77	243.12	252.47	261.82	271.17	280.52	289.87
3' 0"	358.08	269.30	280.52	291.74	302.96	314.18	325.40	336.62	347.84
3' 6"	301.09	314.18	327.27	340.36	353.45	366.55	379.64	392.73	405.82
4' 0"	344.10	359.08	374.03	388.99	403.95	418.91	433.87	448.83	463.79
4' 6"	387.12	403.95	420.78	437.61	454.44	471.27	488.10	504.94	521.77

5' 0"	430.13	448.83	467.53	486.23	504.94	523.64	542.34	561.04	579.74
5' 6"	473.14	493.71	514.29	534.86	555.43	576.00	596.57	617.14	637.71
6' 0"	516.16	538.60	561.04	583.48	605.92	628.35	650.84	673.25	695.69
6' 6"	559.17	583.48	607.79	632.10	656.42	659.73	705.04	729.35	753.66
7' 0"	602.18	628.36	654.55	680.73	706.91	733.09	759.27	785.45	811.64
7' 6"	645.19	673.25	702.30	729.35	757.40	785.45	813.51	841.56	869.61
8' 0"	688.21	718.13	748.05	777.97	807.90	837.82	867.74	897.66	927.58
8' 6"	731.22	763.01	794.81	826.60	858.39	890.18	921.97	953.77	985.58
9' 0"	774.23	807.90	841.56	875.22	908.88	942.55	976.21	1009.87	1043.53
9' 6"	817.25	852.78	888.31	923.84	959.38	994.91	1030.44	1065.97	1101.51
10' 0"	860.26	897.66	935.06	972.47	1009.87	1047.27	1084.08	1122.08	1159.48
10' 6"	903.27	942.55	981.82	1021.09	1060.38	1099.64	1138.91	1178.18	1217.45
11' 0"	946.29	987.43	1028.57	1069.71	1110.88	1152.00	1193.14	1234.29	1275.43
11' 6"	989.30	1032.31	1075.32	1118.34	1161.35	1204.86	1247.38	1290.39	1333.40
12' 0"		1077.19	1122.08	1166.94	1211.84	1256.73	1301.61	1345.49	1391.38
12' 6"			1108.83	1215.58	1262.34	1309.09	1356.84	1402.60	1449.35
13' 0"				1264.81	1312.83	1361.45	1410.08	1458.70	1507.32
13' 6"					1364.32	1413.82	1464.31	1514.81	1565.30
14' 0"						1466.18	1518.55	1570.91	1623.27
14' 6"							1572.78	1627.01	1681.25
15' 0"								1683.12	1739.22
15' 6"									1797.19

Length of Tank

Width of

Tank	Ft. 16	Ft. 16	Ft. 17	Ft. 17	Ft. 18	Ft. 18	Ft. 19	Ft. 19	Ft. 20
Ft. in.	In. 0	In. 6	In. 0	In. 6	In. 0	In. 6	In. 0	In. 6	In. 0
2' 0"	239.38	246.86	254.34	261.82	269.36	276.78	284.26	291.74	299.22
2' 6"	299.22	308.57	317.92	327.27	336.62	345.97	355.32	364.68	374.03
3' 0"	359.06	370.29	381.51	392.73	403.96	415.17	426.39	437.61	448.83
3' 6"	418.91	432.00	445.09	458.18	471.27	484.36	497.45	510.55	523.64
4' 0"	478.75	493.71	508.68	523.64	538.60	553.56	568.52	583.48	598.41
4' 6"	538.60	555.43	572.26	589.09	605.92	622.75	639.58	656.42	673.25
5' 0"	598.44	617.14	635.84	654.55	673.23	691.95	710.65	729.35	748.06
5' 6"	658.29	678.80	699.43	720.00	740.57	761.14	781.71	802.29	822.86
6' 0"	718.13	740.57	763.01	785.45	807.90	830.34	852.78	875.22	897.66
6' 6"	777.97	802.29	826.60	850.91	875.22	899.53	923.84	948.16	972.47
7' 0"	837.82	864.00	890.18	916.36	942.55	968.73	994.91	1021.00	1047.27
7' 6"	897.68	925.71	953.77	981.82	1009.87	1037.92	1065.97	1094.03	1122.08
8' 0"	857.31	987.43	1017.35	1047.27	1077.19	1107.12	1137.04	1166.96	1196.88

8' 6"	1017.35	1049.14	1080.93	1112.73	1144.52	1176.31	1208.10	1239.00	1271.69
9' 0"	1077.19	1110.86	1144.52	1178.18	1211.84	1245.51	1279.17	1312.83	1346.49
9' 6"	1137.04	1172.57	1208.10	1243.54	1279.17	1314.70	1350.23	1385.77	1421.30
10' 0"	1196.88	1234.29	1271.69	1309.09	1346.49	1383.90	1421.30	1458.70	1496.10
10' 6"	1256.73	1296.00	1335.27	1374.55	1413.82	1453.09	1492.30	1531.64	1570.91
11' 0"	1316.57	1357.71	1398.86	1440.00	1481.14	1522.29	1563.43	1604.57	1645.71
11' 6"	1376.42	1419.43	1462.44	1505.45	1548.47	1591.48	1634.40	1677.61	1720.52
12' 0"	1436.26	1481.14	1526.03	1570.91	1615.79	1660.68	1705.56	1750.44	1795.32
12' 6"	1496.10	1542.86	1589.61	1636.36	1683.12	1729.87	1776.62	1823.38	1870.13
13' 0"	1555.95	1604.57	1653.19	1701.82	1750.44	1799.06	1847.69	1896.31	1944.93
13' 6"	1615.79	1666.29	1716.78	1767.27	1817.77	1808.26	1918.75	1969.25	2019.74
14' 0"	1675.64	1728.00	1780.36	1832.73	1885.09	1937.45	1989.82	2042.18	2094.55
14' 6"	1735.48	1789.71	1843.95	1898.18	1952.42	2008.65	2060.88	2115.12	2169.35
15' 0"	1795.32	1851.43	1907.53	1963.84	2019.74	2075.84	2131.95	2188.05	2244.16
15' 6"	1855.17	1913.14	1971.12	2029.09	2087.06	2145.04	2203.01	2260.99	2318.96
16' 0"	1915.01	1974.86	2034.70	2094.55	2154.39	2214.23	2274.08	2333.92	2393.77
16' 6"		2036.57	2098.29	2160.00	2221.71	2283.43	2345.14	2403.86	2468.57
17' 0"			2161.87	2225.45	2289.04	2352.62	2416.21	2479.79	2543.38
17' 6"				2290.91	2356.36	2421.82	2487.27	2552.73	2618.18
18' 0"					2423.69	2491.01	2558.34	2625.60	2692.99
18' 6"						2569.21	2629.40	2698.60	2767.79
19' 0"							2700.47	2771.53	2842.60
19' 6"								2844.47	2917.40
20' 0"									2992.21

Conversion Factors for Units of Specific Energy Per Degree (1)

	Abs j/g °C	int j/g °C	cal/g °C	cal/lb °C	cal/lb °F	IT cal/g °C	BTU/** lb °F
Abs j/g °C	1	0.99984	0.23901	108.41	60.229	0.23885	0.23885
Int j/g °C	1.000165	1	0.23905	108.43	60.238	0.23889	0.23889
cal/g °C	4.1840	4.1833	1	453.59	252.00	0.99935	0.99935
cal/lb °C	0.0092241	0.0092226	0.0022046	1	0.55556	0.0022032	0.0022032
cal/lb °F	0.016603	0.016601	0.0039683	1.8	1	0.0039657	0.0039657
IT cal/g °C	4.1867	4.1861	1.00065	453.89	252.16	1	1
BTU/lb °F	4.1867	4.1861	1.00065	453.89	252.16	1	1

* To convert the numerical value of a property expressed in one of the units in the left-hand column of the table to the numerical value of the same property expressed in one of the units in the top row of the table, multiply the former value by the factor in the block common to both units.

** 1 defined BTU = 1 IT calorie = 1054.866 int. joules = 1055.040 abs. j.

Also 1 60 °F. BTU = 1054.6 abs. joules; 1 mean BTU - 1056.1 abs. joules

(1) Expression of "scientific" units to "engineering" units.

J. L. Torgesen, Nat'l. Bur. of Std's. Phys. Chem. Sec. Quarterly Report Research Project Dec. 1950.

Conversion Table, Brix and Baume

(Modulus 145)

<u>Brix</u>	<u>Baume</u>	<u>Brix</u>	<u>Baume</u>
1.79	0.56	87.45	46 25.17
3.57	2 1.12	89.58	47 25.70
5.38	3 1.68	91.73	48 26.23
7.17	4 2.24	xxxxx	49 26.75
8.97	5 2.79		50 27.28
10.78	6 3.35		51 27.81
12.57	7 3.91		52 28.33
14.38	8 4.46		53 28.86
16.19	9 5.02		54 29.38
18.00	10 5.57		55 29.90
19.82	11 6.13		56 30.42
21.65	12 6.68		57 30.94
23.47	13 7.24		58 31.46
25.30	14 7.79		59 31.97
27.12	15 8.34		60 32.49
28.96	16 8.89		61 33.00
30.80	17 9.45		62 33.51
32.65	18 10.00		63 34.02
34.49	19 10.55		64 34.53
36.32	20 11.10		65 35.04
38.18	21 11.65		66 35.55
40.06	22 12.20		67 36.05
41.93	23 12.74		68 36.55
43.82	24 13.29		69 37.06
45.70	25 13.84		70 37.56
47.61	26 14.39		71 38.06
49.19	27 14.93		72 38.55
51.38	28 15.48		73 39.05
53.30	29 16.02		74 39.54
55.20	30 16.57		75 40.03

57.13	31	17.11	76	40.53
59.07	32	17.65	77	41.01
61.00	33	18.19	78	41.50
(62.93)	34	18.73	79	41.98
(64.53)	35	19.28	80	42.47
66.89	36	19.81	81	42.95
68.89	37	20.35	82	43.43
70.91	38	20.89	83	43.91
72.93	39	21.43	84	44.38
74.96	40	21.97	85	44.86
77.00	41	22.50	86	45.33
79.04	42	23.04	87	45.80
81.10	43	23.57	88	46.27
83.16	44	24.10	89	46.73
85.28	45	24.63	90	47.20

Conversion of Thermometer Scales

The three thermometers in common use are the Centigrade (C.), the Fahrenheit (F.) and the Reaumur (R.) All scales have two fixed points indicating the temperature of melting ice and temperature of boiling water at normal pressure. On the Centigrade and Reaumur thermometers the melting point of ice is zero while on the Fahrenheit it is 32. The boiling point of water on Fahrenheit is indicated by 212, on the Centigrade by 100 and on the Reaumur by 80.

From the above the following conversions may be made:

C to R Multiply by 4 and divide by 5

C to F Multiply by 9 and divide by 5 then add 32

R to C Multiply by 5 and divide by 4

R to F Multiply by 9 and divide by 4 then add 32

F to C Subtract 32, multiply by 5 and divide by 9

F to R Subtract 32, multiply by 4 and divide 8

Conversion Table, Centigrade, Fahrenheit, Reaumur

TABLE I

To °C	F/C Value
-17.	0
-17.	1
-16.	2

TABLE II

To °F
32.00
33.80
35.60

TABLE III

To R	R/F Value
-14.22	0
-13.78	1
-13.33	2

To °C
-0.00
1.25
2.50

C/R Value
0
1
2

To R
0.00
0.80
1.60

To °F
32.00
34.25
36.50

-16.	3	37.40	3.75	3	2.40	-12.89	3	38.75
-15.	4	39.20	5.00	4	3.20	-12.44	4	41.00
-15.	5	41.00	6.25	5	4.00	-12.00	5	43.25
-14.	6	42.80	7.50	6	4.80	-11.56	6	45.50
-13.	7	44.60	8.75	7	5.60	-11.11	7	47.75
-13.	8	46.40	10.00	8	6.40	-10.67	8	50.00
-12.	9	48.20	11.25	9	7.20	-10.22	9	52.25
-12.	10	50.00	12.50	10	8.00	-9.78	10	54.50
-11.	11	51.80	13.75	11	8.80	-9.33	11	56.75
-11.	12	53.60	15.00	12	9.60	-8.89	12	59.00
-10.	13	55.40	16.25	13	10.40	-8.44	13	61.25
-10.	14	57.20	17.50	14	11.20	-8.00	14	63.50
-9.	15	59.00	18.75	15	12.00	-7.56	15	65.75
-8.	16	60.80	20.00	16	12.80	-7.11	16	68.00
-8.	17	62.60	21.25	17	13.60	-6.67	17	70.25
-7.	18	64.40	22.50	18	14.40	-6.22	18	72.50
-7.	19	66.20	23.75	19	15.20	-5.78	19	74.75
-6.	20	68.00	25.00	20	16.00	-5.33	20	77.00
-6.	21	69.80	26.25	21	16.80	-4.89	21	79.25
-5.	22	71.60	27.50	22	17.60	-4.44	22	81.50
-5.	23	73.40	28.75	23	18.40	-4.00	23	83.75
-4.	24	75.20	30.00	24	19.20	-3.56	24	86.00
-3.	25	77.00	31.25	25	20.00	-3.11	25	88.25
-3.	26	78.80	32.50	26	20.80	-2.67	26	90.50
-2.	27	80.60	33.75	27	21.60	-2.22	27	92.75
-2.	28	82.40	35.00	28	22.40	-1.78	28	95.00
-1.	29	84.20	36.25	29	23.20	-1.33	29	97.25
-1.	30	86.00	37.50	30	24.00	-0.89	30	99.50
-0.	31	87.80	38.75	31	24.80	-0.44	31	101.75
0.	32	89.60	40.00	32	25.60	0.00	32	104.00
0.	33	91.40	41.25	33	26.40	0.44	33	106.25
1.	34	93.20	42.50	34	27.20	0.89	34	108.50
1.	35	95.00	43.75	35	28.00	1.33	35	110.75
2.	36	96.80	45.00	36	28.80	1.78	36	113.00
2.	37	98.60	46.25	37	29.60	2.22	37	115.25
3.	38	100.40	47.50	38	30.40	2.67	38	117.50
3.	39	102.20	48.75	39	31.20	3.11	39	119.75
4.	40	104.00	50.00	40	32.00	3.56	40	122.00
5.	41	105.80	51.25	41	32.80	4.00	41	124.25
5.	42	107.60	52.50	42	33.00	4.44	42	126.50
6.	43	109.40	53.75	43	34.40	4.89	43	128.75

6.	44	111.20	55.00	44	35.20	5.33	44	131.00
7.	45	113.00	56.25	45	36.00	5.78	45	133.25
7.	46	114.80	57.50	46	36.80	6.22	46	135.50
8.	47	116.60	58.75	47	37.60	6.67	47	137.75
8.	48	118.40	60.00	48	38.40	7.11	48	140.00
9.	49	120.20	61.25	49	39.20	7.56	49	142.25
10.	50	122.00	62.50	50	40.00	8.00	50	144.50
	51	123.80	63.75	51	40.80	8.44	51	146.75
	52	125.60	65.00	52	41.60	8.89	52	149.00
	53	127.40	66.25	53	42.40	9.33	53	151.25
	54	129.20	67.50	54	43.20	9.78	54	153.50
	55	131.00	68.75	55	44.00	10.22	55	155.75
	56	132.80	70.00	56	44.80	10.67	56	158.00
	57	134.60	71.25	57	45.60	11.11	57	160.25
	58	136.40	72.50	58	46.40	11.56	58	162.50
	59	138.20	73.75	59	47.20	12.00	59	164.75
60	140.00	75.00	60	48.00	12.44	60	167.00	
61	141.80	76.25	61	48.80	12.89	61	169.25	
62	143.60	77.50	62	49.60	13.33	62	171.50	
63	145.40	78.75	63	50.40	13.78	63	173.75	
64	147.20	80.00	64	51.20	14.22	64	176.00	
65	149.00	81.25	65	52.00	14.67	65	178.25	
66	150.80	82.50	66	52.80	15.11	66	180.50	
67	152.60	83.75	67	53.60	15.56	67	182.75	
68	154.40	85.00	68	54.40	16.00	68	185.00	
69	156.20	86.25	69	55.20	16.44	69	187.25	
70	158.00	87.50	70	56.00	16.89	70	189.50	
71	159.80	88.75	71	56.80	17.33	71	191.75	
72	161.60	90.00	72	57.60	17.78	72	194.00	
73	163.40	91.25	73	58.40	18.22	73	196.25	
74	165.20	92.50	74	59.20	18.67	74	198.50	
75	167.00	93.75	75	60.00	19.11	75	200.75	
76	168.80	95.00	76	60.80	19.56	76	203.00	
77	170.60	96.25	77	61.60	20.00	77	205.25	
78	172.40	97.50	78	62.40	20.44	78	207.50	
79	174.20	98.75	79	63.20	20.89	79	209.75	
80	176.00	100.00	80	64.00	21.33	80	212.00	
81	177.80	101.25	81	64.80	21.78	81	214.25	
82	179.60	102.50	82	65.60	22.22	82	216.50	
83	181.40	103.75	83	66.40	22.67	83	218.75	
84	183.20	105.00	84	67.20	23.11	84	221.00	

85	185.00	106.25	85	68.00	23.56	85	223.25
86	186.80	107.50	86	68.80	24.00	86	225.50
87	188.60	108.75	87	69.60	24.44	87	227.75
88	190.40	110.00	88	70.40	24.89	88	230.00
89	192.20	111.25	89	71.20	25.33	89	232.25
90	194.00	112.50	90	72.00	25.78	90	234.50
91	195.80	113.75	91	72.80	26.22	91	236.75
92	197.60	115.00	92	73.60	26.67	92	239.00
93	199.40	116.25	93	74.40	27.11	93	241.25
94	201.20	117.50	94	75.20	27.56	94	243.50
95	203.00	118.75	95	76.00	28.00	95	245.75
96	204.80	120.00	96	76.80	28.44	96	248.00
97	206.60	121.25	97	77.60	28.89	97	250.25
98	208.40	122.50	98	78.40	29.33	98	252.50
99	210.20	123.75	99	79.20	29.78	99	254.75
100	212.00	125.00	100	80.00	30.22	100	257.00
110	230.00	137.50	110	88.00	34.67	110	279.50
120	248.00	150.00	120	96.00	39.11	120	302.00
130	266.00	162.50	130	104.00	43.56	130	324.50
140	284.00	175.00	140	112.00	48.00	140	347.00
150	302.00	187.50	150	120.00	52.44	150	369.50
160	320.00	200.00	160	128.00	50.89	160	392.00
170	338.00	212.50	170	136.00	61.33	170	414.50
180	356.00	225.00	180	144.00	65.78	180	437.00
190	374.00	237.50	190	152.00	70.22	190	459.50
200	392.00	250.00	200	160.00	74.07	200	482.00
210	410.00	262.50	210	168.00	79.11	210	504.50
212	413.60	265.00	212	169.60	80.00	212	509.00
220	428.00	275.00	220	176.00	83.56	220	527.00
230	446.00	287.50	230	184.00	88.00	230	549.50
240	464.00	300.00	240	192.00	92.44	240	572.00
250	482.00	312.50	250	200.00	96.89	250	594.50

To find the temperature Reaumur corresponding to a given temperature Centigrade, select the degree Centigrade in the center column of Table II and to the right will be found the corresponding temperature in degrees Reaumur. For example; 2 C. = 1.6 R. Similarly 2 R. = 2.5 C. From Table I, 2 F. = -16.67 C. and 2 C. = 35.6 F.

Baume, Brix, Temp Conversions

Temperature Corrections in Baume to be Added to Observed Baume to Reduce to 60 °F

(1)

Temp.	<u>Observed Baume</u>									
	0	5	10	15	20	25	30	35	40	45
60 °F.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65	0.08	0.09	0.09	0.10	0.11	0.11	0.11	0.11	0.11	0.10
70	0.16	0.18	0.19	0.20	0.21	0.22	0.22	0.21	0.21	0.19
75	0.24	0.27	0.29	0.30	0.32	0.33	0.33	0.32	0.31	0.28
80	0.33	0.36	0.40	0.41	0.43	0.44	0.44	0.43	0.41	0.37
85	0.42	0.46	0.50	0.52	0.54	0.55	0.55	0.55	0.52	0.47
90	0.51	0.56	0.61	0.63	0.66	0.67	0.66	0.66	0.62	0.56
95	0.61	0.67	0.72	0.75	0.77	0.79	0.78	0.77	0.73	0.66
100	0.72	0.79	0.84	0.87	0.90	0.91	0.90	0.88	0.83	0.75
105	0.84	0.91	0.96	0.99	1.02	1.03	1.02	1.00	0.93	0.85
110	0.96	1.03	1.09	1.12	1.15	1.16	1.14	1.11	1.04	0.94
115	1.09	1.17	1.23	1.26	1.29	1.29	1.26	1.23	1.15	1.03
120	1.23	1.31	1.37	1.41	1.43	1.42	1.39	1.34	1.25	1.13
125	1.39	1.47	1.53	1.56	1.57	1.56	1.52	1.46	1.36	1.23
130	1.57	1.64	1.69	1.71	1.72	1.70	1.65	1.59	1.47	1.33
135	1.78	1.84	1.87	1.88	1.88	1.85	1.79	1.71	1.58	1.42
140	2.03	2.06	2.07	2.06	2.04	2.00	1.93	1.83	1.69	1.52

(1) E. E. Fauser, J. E. Cleland, J. W. Evans and W. R. Fetzer. Anal. Ed. Ind. and Eng. Chem. Vol. 15, Page 193, March 15, 43.

Temperature Corrections to be Added or Subtracted to Observed Baume to Reduce to 100 °F. (1)

For Corn Syrups and Corn Sugar Syrups

Temperature, F.	<u>Observed Baume</u>									
	0.0	5	10	15	20	25	30	35	40	45
	Subtract from Observed Baume									
60	0.72	0.79	0.84	0.87	0.90	0.91	0.90	0.88	0.84	0.77
65	0.64	0.70	0.75	0.77	0.79	0.80	0.79	0.77	0.73	0.66
70	0.56	0.61	0.65	0.67	0.69	0.69	0.68	0.67	0.63	0.57
75	0.48	0.52	0.55	0.57	0.58	0.58	0.57	0.56	0.52	0.48
80	0.39	0.43	0.44	0.46	0.47	0.47	0.46	0.45	0.42	0.39
85	0.30	0.33	0.34	0.35	0.36	0.36	0.35	0.33	0.31	0.29
90	0.21	0.23	0.23	0.24	0.24	0.24	0.24	0.22	0.21	0.19
95	0.11	0.12	0.12	0.12	0.13	0.12	0.12	0.11	0.10	0.09
Add to Observed Baume										
105	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.10	0.10
110	0.24	0.24	0.25	0.25	0.25	0.25	0.24	0.23	0.21	0.19

115	0.37	0.38	0.39	0.39	0.39	0.38	0.36	0.35	0.32	0.29
120	0.51	0.52	0.53	0.54	0.53	0.51	0.49	0.46	0.43	0.39
125	0.66	0.68	0.69	0.69	0.67	0.65	0.62	0.58	0.54	0.49
130	0.84	0.84	0.85	0.84	0.82	0.79	0.75	0.71	0.65	0.59
135	1.05	1.04	1.03	1.01	0.98	0.94	0.89	0.83	0.76	0.69
140	1.29	1.26	1.23	1.19	1.14	1.09	1.03	0.96	0.88	0.79

(1) Ind. And Eng. Chem. 15, 193 March 15, 1943

Corrections to be Applied to Brix Readings Made at

Temperature Other Than 20 °C.

Wiss, Ahh, der Kaiserlichen, NEK, Vol. 2, p140.

		<u>Observed Degrees</u>		<u>Brix</u>													
		<u>Temp.</u>	<u>Deg. C.</u>	0	5	10	15	20	25	30	35	40	45	50	55	60	70
Subtract Correction	15	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39		
	16	0.17	0.18	0.20	0.22	0.23	0.25	0.26	0.27	0.28	0.28	0.29	0.30	0.31	0.32		
	17	0.13	0.14	0.15	0.16	0.18	0.19	0.20	0.20	0.21	0.21	0.21	0.22	0.23	0.23	0.24	
	18	0.09	0.10	0.10	0.11	0.12	0.13	0.13	0.14	0.14	0.14	0.14	0.15	0.15	0.16	0.16	
	19	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	
Add Correction	0.04	0.05	0.00	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.09	
	0.10	0.10	0.11	0.12	0.12	0.13	0.14	0.14	0.14	0.15	0.15	0.16	0.16	0.16	0.16	0.16	
	0.16	0.16	0.17	0.17	0.19	0.20	0.21	0.21	0.22	0.23	0.23	0.24	0.24	0.24	0.24	0.24	
	0.21	0.22	0.23	0.24	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.32	0.32	0.32	0.32	0.32	
	0.27	0.28	0.30	0.31	0.32	0.34	0.35	0.36	0.38	0.38	0.39	0.39	0.40	0.39	0.39	0.39	
	0.33	0.34	0.36	0.37	0.40	0.40	0.42	0.44	0.46	0.47	0.47	0.48	0.48	0.48	0.48	0.48	
	0.40	0.41	0.42	0.44	0.46	0.48	0.50	0.52	0.54	0.54	0.55	0.56	0.56	0.56	0.56	0.56	
	0.46	0.47	0.49	0.51	0.54	0.56	0.58	0.60	0.61	0.62	0.63	0.64	0.64	0.64	0.64	0.64	
	0.54	0.55	0.56	0.59	0.61	0.63	0.66	0.68	0.70	0.70	0.71	0.72	0.72	0.72	0.72	0.72	
	0.61	0.62	0.63	0.66	0.68	0.71	0.73	0.76	0.78	0.78	0.79	0.80	0.80	0.80	0.80	0.81	

Temperature Corrections for 10° Hydrometer

(1)

Observed <u>Be</u>	140 °F. to <u>100 °F.</u>	140 °F. to <u>60 °F.</u>	100 °F. to <u>60 °F.</u>
-----------------------	------------------------------	-----------------------------	-----------------------------

42.00 D.E. C.S.U.

-2.01	1.30	2.01	
-0.71	1.29	2.02	0.71
0.00	1.29	2.02	0.72
5.00	1.26	2.04	0.77
10.00	1.23	2.06	0.82
15.00	1.19	2.06	0.86
20.00	1.15	2.03	0.88
25.00	1.10	1.99	0.89
30.00	1.04	1.93	0.89
35.00	0.97	1.83	0.87
40.00	0.89	1.70	0.83
45.00	0.79	1.53	0.75

55.00 D.E. C.S.U.

-2.01	1.30	2.01	
-0.71	1.29	2.02	0.71
0.00	1.29	2.03	0.72
5.00	1.25	2.06	0.79
10.00	1.22	2.07	0.84
15.00	1.18	2.06	0.87
20.00	1.14	2.04	0.90
25.00	1.09	2.00	0.91
30.00	1.03	1.93	0.90
35.00	0.96	1.83	0.88
40.00	0.88	1.69	0.83
45.00	0.79	1.52	0.75

89.00 D.E. SUGAR

-2.01	1.30	2.01	
-0.71	1.30	2.03	0.71
0.00	1.29	2.03	0.72
5.00	1.26	2.06	0.79
10.00	1.23	2.08	0.84
15.00	1.18	2.08	0.89
20.00	1.14	2.06	0.91
25.00	1.09	2.01	0.92
30.00	1.03	1.93	0.91
35.00	0.96	1.82	0.88

40.00	0.87	1.68	0.82
45.00	0.77	1.50	0.74

(1) Ind. Eng. Chem. Anal. Ed. Vol. 15, pg 193, 1943.

Temperature Corrections for Starch Suspensions (Expanded) (1)

To be Added

Baume	<u>100 to 60 °F.</u>	<u>120 to 60 °F.</u>	<u>140 to 60 °F.</u>	<u>120 to 100 °F.</u>
0	0.710	1.240	1.980	0.520
1	0.706	1.232	1.968	0.518
2	0.702	1.224	1.956	0.516
3	0.698	1.216	1.944	0.514
4	0.694	1.208	1.932	0.512
5	0.690	1.200	1.920	0.510
6	0.686	1.194	1.906	0.506
7	0.682	1.188	1.892	0.502
8	0.678	1.182	1.878	0.498
9	0.674	1.176	1.864	0.494
10	0.670	1.170	1.850	0.490
11	0.666	1.162	1.836	0.488
12	0.662	1.154	1.822	0.486
13	0.658	1.146	1.808	0.484
14	0.654	1.138	1.794	0.482
15	0.650	1.130	1.780	0.480
16	0.646	1.122	1.768	0.476
17	0.642	1.114	1.756	0.472
18	0.638	1.106	1.744	0.468
19	0.634	1.098	1.732	0.464
20	0.630	1.090	1.720	0.460
21	0.626	1.082	1.706	0.456
22	0.622	1.074	1.692	0.452
23	0.618	1.066	1.678	0.448
24	0.614	1.058	1.664	0.444
25	0.610	1.050	1.650	0.440

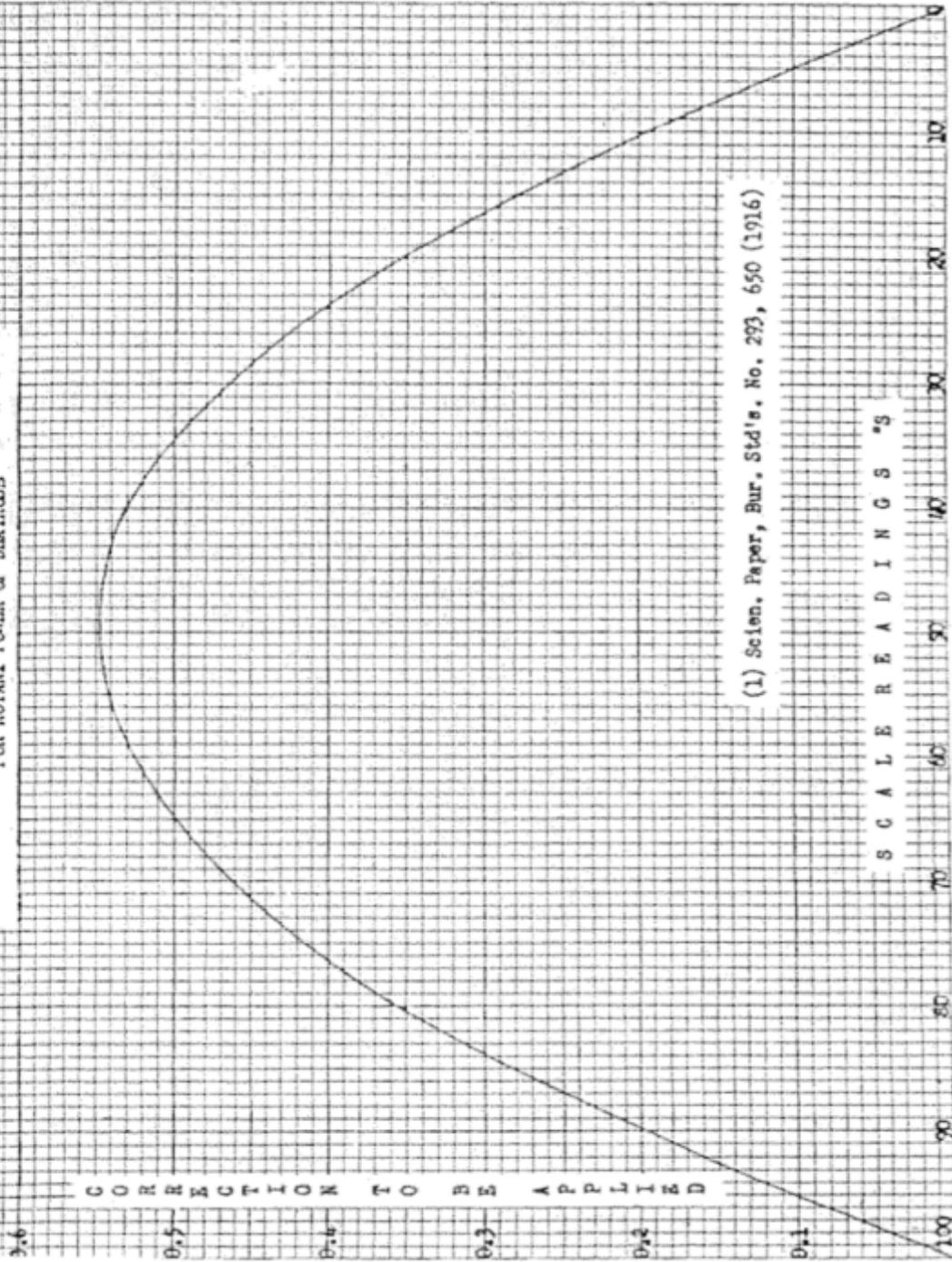
(1) Ind. and Eng. Chem. An. Ed. 15, 335 May 15, 1943

Corrections to be Applied to Saccharimetric Readings of Dextrose Solutions (1)

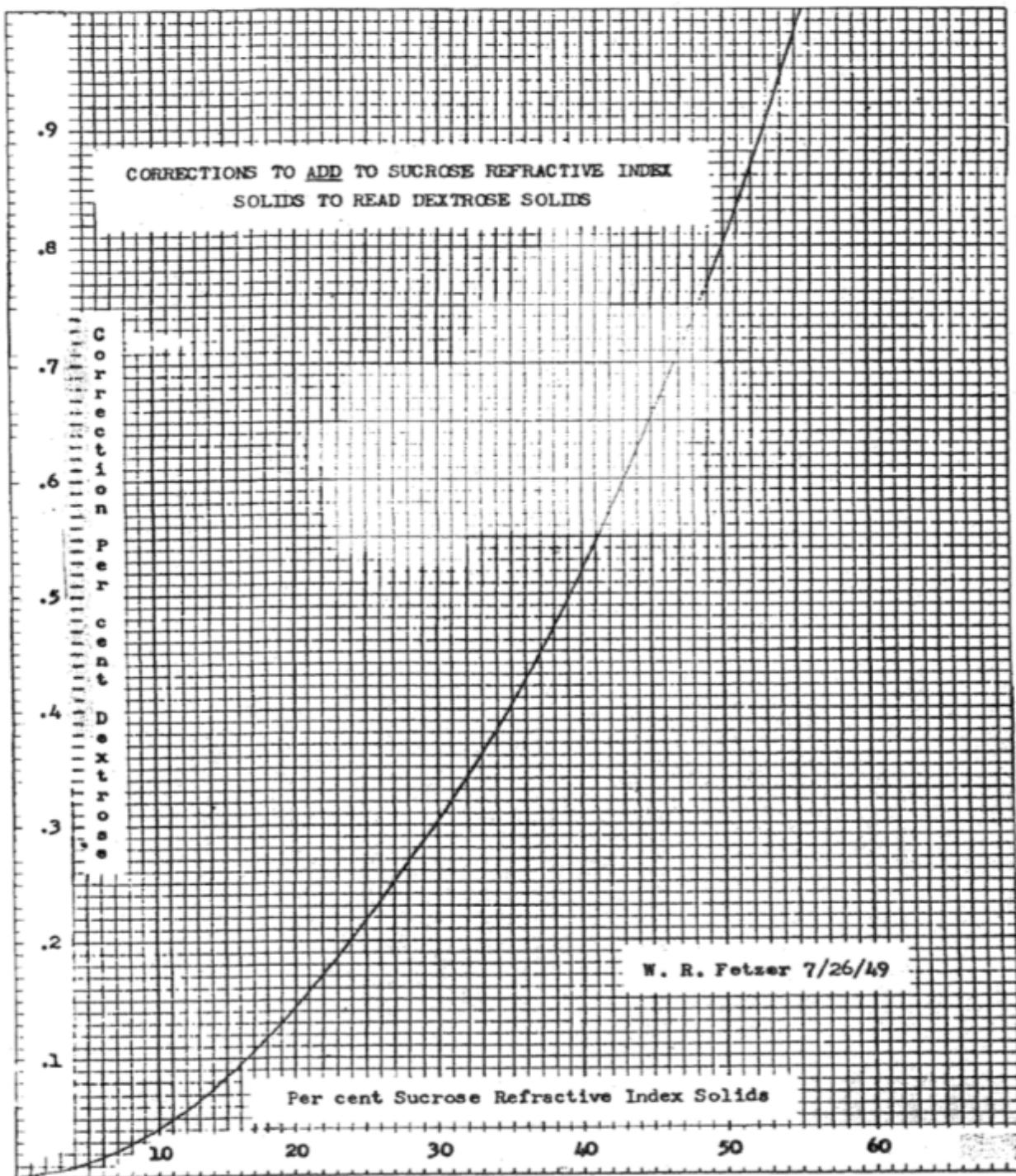
<u>Scale reading</u>	<u>Correction to be added</u>	<u>Scale reading</u>	<u>Correction to be added</u>	<u>Scale reading</u>	<u>Correction to be added</u>
100	0	65	0.50	30	0.46
95	0.10	60	0.525	25	0.41
90	0.20	55	0.54	20	0.35
85	0.28	50	0.55	15	0.28
80	0.35	45	0.54	10	0.20
75	0.41	40	0.53	5	0.10
70	0.46	35	0.50	2	0.05

(1) Scien. Paper Bur. Std's. No. 293, 650. (1916)

(1) CORRECTIONS TO BE APPLIED TO SACCHARIMETER READINGS
FOR ROTARY POWER OF DEXTROSE



(1) Scien. Paper, Bur. Stds., No. 293, 650 (1916)



Relative Humidity Solutions

Salt Solutions Used for Constant Humidity

	<u>Relative Humidity</u>
	93.5
	85.0
NaNO ₃	74.5
	56.4
K ₂ CO ₃	43.0
KC ₂ H ₃ O ₂	20.0
LiCl	12.2

Solutions to Produce Various Relative Humidities

Table 1. A partial list of some salts and the relative humidity of their saturated solutions at three different temperatures. (1)

<u>Salts</u>	<u>Relative Humidity, %</u>	73 °F.	86 °F.	100 °F.
Lithium chloride		11.1	11.2	11.1
Potassium acetate		22.9	22.0	20.4
Magnesium chloride		32.9	32.4	31.9
Chromium trioxide		39.2	40.0	40.2
Sodium dichromate		54.1	52.0	50.0
Sodium bromide		58.5	56.3	53.7
Sodium nitrite		64.8	63.3	61.8
Sodium chloride		75.5	75.2	75.1
Ammonium sulfate		80.1	79.6	79.1
Potassium chromate		86.5	86.3	85.6
Ammonium mono phosphate		92.9	92.0	91.1

(1) Institute of Paper Chemistry, Report No. 40, "The Equilibrium Relative Humidities above Saturated Solutions at Various temperatures," Feb. 15, 1945.

Sulfuric Acid Solutions to Provide Specified Relative Humidities at 25° C

R. H. %	Specific gravity	Normality	* cc. H ₂ SO ₄ : cc. H ₂ O
---------	------------------	-----------	-------------------------------------------------------------

0	1.835	-	500:0
5	1.608	22.0	285:215
10	1.552	19.5	255.5:244.5
15	1.512	18.0	235.3:264.7
20	1.478	16.8	219.2:280.8
25	1.450	15.8	205.0:295.0
30	1.425	14.8	192.2:307.8
35	1.400	13.9	179.7:320.3
40	1.377	13.1	170.1:329.9
45	1.355	12.3	159.9:340.1
50	1.335	11.5	149.4:350.6
55	1.314	10.8	139.3:360.7
60	1.293	10.0	129.1:370.9
65	1.271	9.2	119.1:380.9
70	1.248	8.3	108.5:391.5
75	1.224	7.4	97.0:403.0
80	1.197	6.3	84.1:415.9
85	1.165	5.2	71.0:429.0
90	1.127	3.9	54.5:445.5
95	1.076	2.3	32.2:467.8
100	1.000	0.0	0:500

* Assuming 98% pure commercial C. P. acid of 1.84 specific gravity.

Note: Recalculated from Lange's Handbook of Chemistry, 6th. ed. 1946, 1319-1320, Handbook Pub. Co., Sandusky, Ohio. and by Stokes, R.H.

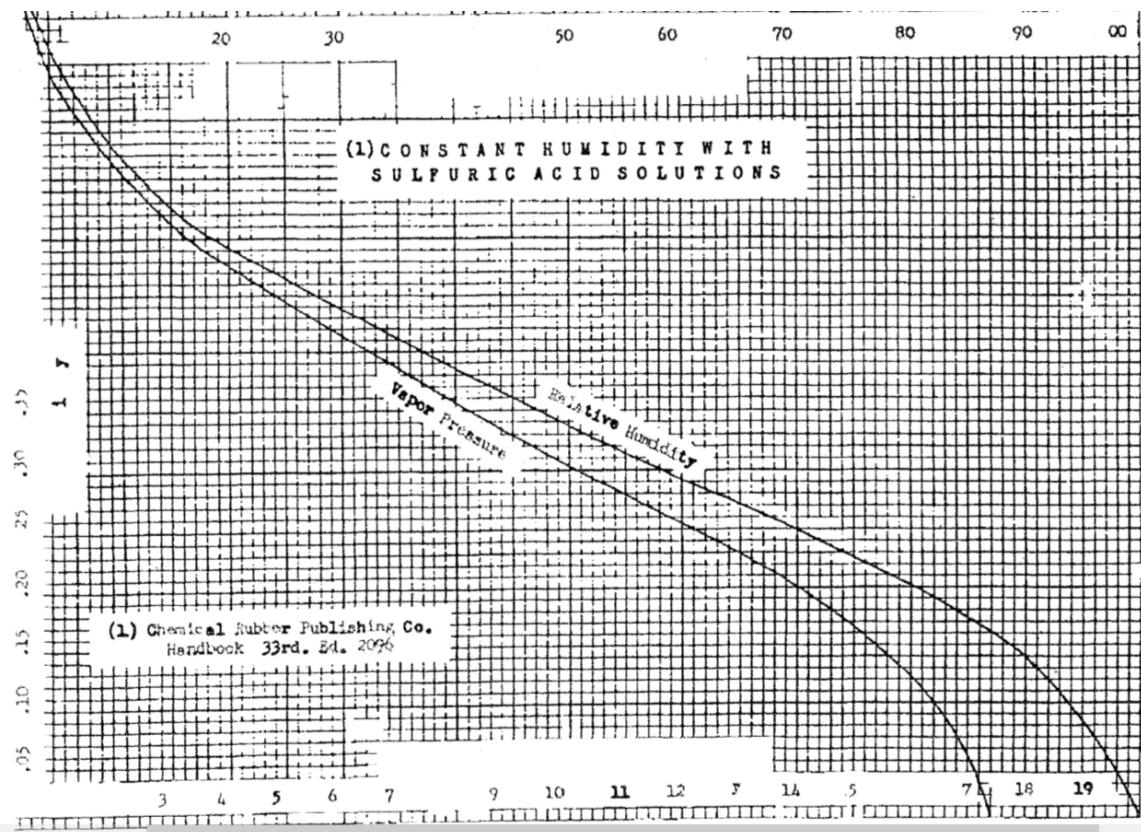
Constant Humidity with Sulfuric Acid Solutions

(1)

Relative Humidity and Pressure of Aqueous Vapor of Air in Equilibrium Conditions Above Aqueous Solutions of Sulfuric Acid.

Density of Acid <u>Solution</u>	Relative <u>Humidity</u>	Vapor Pressure at 20 C.	Density of Acid <u>Solution</u>	Relative <u>Humidity</u>	Vapor Pressure at 20 C.
1.00	100	17.4	1.30	58.3	10.1
1.05	97.5	17.0	1.35	47.2	8.3
1.10	93.9	16.3	1.40	37.1	6.5
1.15	88.8	15.4	1.50	18.8	3.3
1.20	80.5	14.0	1.60	8.5	1.5
1.25	70.4	12.2	1.70	3.2	0.6

(1)Chemical Rubber Pub. Co., 33rd. Ed. 2096 (1951)

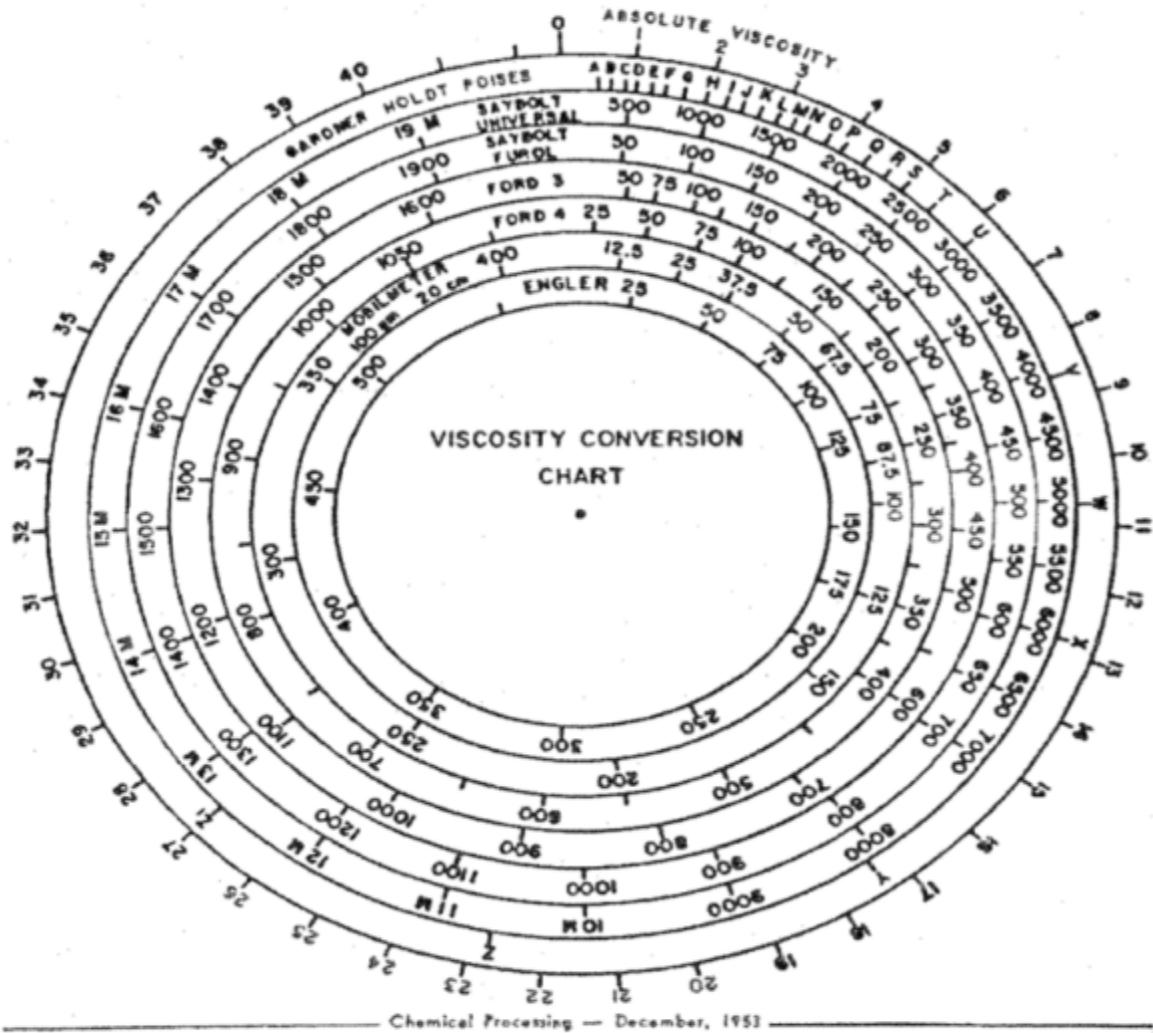


QUICK VISCOSITY CONVERSION

Courtesy of PALO LABORATORY SUPPLIES, Inc.

This novel conversion nomograph shows viscosity in any of eight standard units. In order to convert from one set of units to another, a straightedge is placed so that it passes through known viscosity and

through the chart's center. Straightedge will then intersect other equivalent readings of viscosity. Chart is intended for use in rapid estimation rather than extreme accuracy.



Chemical Processing — December, 1953

Bolting Cloth Mesh

Nylon Bolting Cloth (1)

<u>Tensile Strength</u> (g.p.d.)	<u>Regular</u>	<u>High Tenacity</u>
(Std. is 70°F. at 65% r.h.)		
Std.	4.7 to 5.6	6.4 to 7.5
Wet	4.2 to 5.0	5.7 to 6.5
Std. Loop	4.0 to 4.8	5.2 to 6.2
Std. Knot		5.3 to 6.2
Elongation %	Std.	25 to 28
	Wet	29 to 32
Elastic Recovery %		100% to 8%
Tensile Stress (psi.)		68,000 to 81,000
Average Stiffness(g.p.d.)	20	39
Average Toughness	0.56	
Specific Gravity	1.14	1.14
Regain (adsorption)	3.8% at 70 F. and 65% R. H	
Water Absorbency	6.1% at 95% R. H	
Effect of Heat	Melts at 482 F. Yellows slightly at 300 F. when held for 5 hrs.	
Effect of Age	Virtually None	
Effect of Sunlight	Loses strength on prolonged exposure. No discoloration. Bright yarn is more resistant than semi-dull.	
Effect of Acids	Boiling in 5% hydrochloric acid ultimately causes disintegration, dissolves with at least partial decomposition by cold concentrated solution of hydrochloric, sulfuric, and nitric acids.	
Effect of Alkalies	Substantially inert	
Effect of Other Chemicals	Generally good resistance	
Effect of Organic Solvents	Generally insoluble; soluble in some phenolic compounds and in concentrated formic acid.	
Resistance to Moths	Wholly	
Resistance to Mildew	Wholly	
Dielectric Strength	3,000 volts per mil (film)	

A. G. B. Monofilament (1)

<u>Quality No.</u>	<u>Aperture</u>	<u>Mesh Count</u>
9M	.0059	110 x 112
10M	.0054	118 x 120
11M	.0049	124 x 124
12M	.0042	136 x 136
13M	.0039	142 x 142
14M	.0037	145 x 145

A. G. B. Multifilament

7XX	.0067	81 x 84
8XX	.0068	85 x 89
9XX	.0063	95 x 98
10XX	.0049	106 x 109
11XX	.0045	122 x 127
12XX	.0039	121 x 124
13XX	.0040	127 x 133
14XX	.0038	131 x 143
15XX	.0035	138 x 142
16XX	.0030	147 x 152
17XX	.0028	160 x 154
20XX	.0028	172 x 184

A. G. B. NYLON - OPEN AREA

Monofilament Nylon Bolting Cloth

Quality	Open Area
8M	33%
9M	40%
10M	38%
11M	35%
12M	31%
13M	29%
14M	27%
16M	23%

A. G. B. NYLON - OPEN AREA

Multifilament Nylon Bolting Cloth

Quality	Open Area
7XX	29%
8XX	34%
9XX	36%
10XX	29%
11XX	30%
12XX	23%
13XX	27%
14XX	26%
15XX	24%
16XX	20%
17XX	19%
20XX	23%

(1) Albert Godde Bedin, Inc. New York 16, N. Y

Nylon Monofilament Bolting Cloth

<u>* "Nitex" number</u>	<u>Mesh opening in inches</u>	<u>Open area</u>	<u>Comparative number of Swiss silk bolting cloth</u>
	0.0110	55 %	4 XX
243	.0096	53 %	5 XX
215	.0085	47 %	6 XX
202	.0080	46 %	7 XX
	.0070	44 %	8 XX
	.0057	47 %	9 XX
142	.0056	48 %	10 X
	.0051	44 %	10 XX
	.0047	43 %	11 XX
	.0043	41 %	12 XX
	.0040	39 %	13 XX
93	.0037	37 %	14 XX
85	.0033	43 %	15 XX
80/66	.0030 x .0026	37 %	
64	.0025	28 %	25 Std.

(1) Data supplied by Tobler, Ernet and Traber, Inc. 71 Murray Street, New York, N. Y.

* "Nitex" is a registered Trade-Mark of Tobler, Ernst and Traber, Inc.

Genuine Dufour Bolting Cloth

(1)

SCHEDULE OF APERTURE SIZES

Standard Quality					Double Extra (XX) Quality				
	<u>Meshes</u>	<u>Dimensions of Apertures</u>				<u>Meshes</u>	<u>Dimensions of Apertures</u>		
<u>No.</u>	<u>per inch</u>	<u>Min. Ins.</u>	<u>Mode Ins.</u>	<u>Max. Ins.</u>	<u>No.</u>	<u>per inch</u>	<u>Min. Ins.</u>	<u>Mode Ins.</u>	<u>Max. Ins.</u>
0000	18	.0510	.0537	.0564	0000	18	.0492	.0520	.0546
000	23	.0370	.0403	.0420	000	23	.0358	.0385	.0412
00	29	.0268	.0296	.0313	00	29	.0268	.0286	.0304
0	38	.0206	.0224	.0242	0	38	.0197	.0206	.0233
1	48	.0151	.0164	.0170	1	48	.0138	.0157	.0170
2	54	.0125	.0144	.0157	2	54	.0125	.0138	.0151
3	58	.0118	.0131	.0144	3	58	.0111	.0125	.0144
4	62	.0105	.0125	.0131	4	62	.0098	.0111	.0125
5	66	.0098	.0111	.0125	5	66	.0092	.0105	.0118
6	74	.0085	.0094	.0100	6	74	.0085	.0092	.0100
7	82	.0082	.0088	.0097	7	82	.0073	.0082	.0088
8	86	.0073	.0080	.0091	8	86	.0067	.0076	.0082
9	97	.0059	.0066	.0074	9	97	.0052	.0059	.0069

10	109	.0052	.0062	.0066	10	109	.0047	.0054	.0062
11	116	.0049	.0057	.0064	11	116	.0039	.0049	.0054
12	125	.0039	.0047	.0052	12	125	.0037	.0042	.0052
13	129	.0039	.0044	.0049	13	129	.0034	.0039	.0047
14	139	.0034	.0039	.0047	14	139	.0032	.0037	.0044
15	150	.0032	.0037	.0044	15	150	.0030	.0036	.0042
16	157	.0030	.0034	.0042					
17	163	.0027	.0032	.0039					
18	166	.0025	.0031	.0037					
19	169	.0025	.0030	.0037					
20	173	.0022	.0030	.0034					
21	178	.0020	.0027	.0034					
25	200	.0017	.0025	.0034					

Extra (X) Quality

Triple Extra (XXX)
Quality

6	74	.0085	.0091	.0100	6	71	.0088	.0097	.0106
7	82	.0076	.0085	.0091	7	74	.0085	.0091	.0100
8	86	.0070	.0079	.0085	8	82	.0076	.0082	.0091
9	97	.0054	.0062	.0071	9	86	.0069	.0074	.0081
10	109	.0049	.0058	.0064	10	97	.0054	.0062	.0069
11	116	.0044	.0052	.0059	11	109	.0044	.0052	.0059
12	125	.0037	.0044	.0052	12	116	.0039	.0046	.0052
13	129	.0037	.0042	.0049	13	125	.0037	.0044	.0049
14	139	.0034	.0039	.0047	14	129	.0032	.0038	.0044
15	150	.0030	.0037	.0042	15	139	.0030	.0037	.0042
16	157	.0027	.0032	.0039	16	150	.0027	.0034	.0039
17	163	.0025	.0032	.0037	17	157	.0024	.0032	.0037
					18	163	.0022	.0030	.0040

(1) Data furnished by Tobler, Ernst and Traber, Inc., New York.

Genuine Dufour Bolting Cloth (1)

SCHEDULE OF APERTURE SIZES

Grit Gauze					XXX Grit Gauze				
Meshes		Dimensions of Apertures			Meshes		Dimensions of Apertures		
No.	per inch	Min. Ins.	Mode Ins.	Max. Ins.	No.	per inch	Min. Ins.	Mode Ins.	Max. Ins.
14	13 1/2	.0653	.0689	.0734	14	13 1/2	.0609	.0653	.0671
16	15 1/2	.0546	.0582	.0609	16	15 1/2	.0573	.0600	.0626
18	17 1/2	.0492	.0519	.0546	18	17 1/2			
20	19	.0439	.0456	.0483	20	19	.0430	.0456	.0475
22	21	.0403	.0420	.0447	22	21	.0376	.0394	.0421
24	23	.0358	.0376	.0403	24	23	.0344	.0367	.0394
26	25	.0304	.0322	.0344	26	25	.0304	.0322	.0340

28	27	.0278	.0304	.0322	28	27	.0278	.0296	.0313
30	29	.0268	.0286	.0304	30	29	.0260	.0278	.0296
32	31	.0242	.0260	.0286	32	31	.0242	.0251	.0278
34	33	.0215	.0242	.0260	34	33	.0224	.0233	.0260
36	35	.0206	.0224	.0242	36	35	.0206	.0224	.0242
38	37	.0197	.0215	.0233	38	37	.0188	.0206	.0224
40	39	.0179	.0197	.0215	40	39	.0188	.0197	.0215
42	40 1/2	.0169	.0188	.0215	42	40 1/2	.0161	.0179	.0197
44	42 1/2	.0170	.0184	.0200	44	42 1/2	.0151	.0170	.0184
46	44 1/2	.0157	.0170	.0190	46	44 1/2	.0151	.0164	.0177
48	46 1/2	.0144	.0157	.0177	48	46 1/2	.0144	.0157	.0170
50	48 1/2	.0131	.0148	.0164	50	48 1/2	.0125	.0138	.0151
52	50 1/2	.0131	.0144	.0164	52	50 1/2	.0124	.0134	.0151
54	52 1/2	.0125	.0138	.0151	54	52 1/2	.0118	.0131	.0144
56	54 1/2	.0118	.0131	.0144	56	54 1/2	.0111	.0125	.0138
58	56 1/2	.0111	.0128	.0138	58	56 1/2	.0105	.0118	.0131
60	58	.0111	.0118	.0138	60	58	.0098	.0115	.0125
62	60	.0105	.0118	.0131	62	60	.0096	.0112	.0121
64	62	.0098	.0111	.0125	64	62	.0097	.0109	.0115
66	64	.0094	.0103	.0109	66	64	.0091	.0097	.0106
68	66	.0091	.0097	.0106	68	66	.0082	.0091	.0097
70	68	.0085	.0094	.0103	70	68	.0079	.0085	.0094
72	72	.0082	.0088	.0097	72	72	.0076	.0083	.0091

This schedule is based upon 100 apertures measured in each number and grade.

In each instance there is indicated both minimum and maximum dimension regardless of the number of times the measurement occurs. Being the extreme figures at either end they may apply to only two or three openings in the area examined so that the MODE column, which represents the aperture of most frequent occurrence, is the controlling size of each number.

(1) Data furnished by Tobler, Ernst and Traber, Inc., New York.

Dur-loy Free-Bolting Cloth (1)

Nearest Equivalent Numbers in Silk and Gritz
Gauze

Meshes Per Lineal Inch	Opening Dec. of Inch	Wire Diameter Dec. of Inch	Open area	Gritz Gauze		
				Standard Silk	Standard	XXX
14	.0620	.009	76.4%	...	14	14
16	.0535	.009	73.3%	0000	16	16
18	.0466	.009	70.2%	...	18	...
20	.0410	.009	67.2%	...	20-22	20
22	.0380	.0075	69.7%	000	24	22
24	.0342	.0075	67.2%	...	...	24

26	.0310	.0075	64.8%	...	26-28	26
28	.0282	.0075	62.4%	00	30	28
30	.0268	.0065	64.8%	...	32	30
32	.0248	.0065	62.7%	...	34	32
34	.0229	.0065	60.7%	0	36	34
36	.0213	.0065	58.7%	0	38	36-38
38	.0198	.0065	56.7%	...	40	40
40	.0185	.0065	54.8%	...	42	40
43	.0183	.005	61.6%	...	44	...
46	.0172	.0045	62.9%	...	46	42-44
48	.0163	.0045	61.5%	1	...	46
50	.0155	.0045	60.1%	...	48	48
54	.0145	.004	61.5%	...	50	...
56	.0138	.004	60.2%	2	52-54	50
58	.0132	.004	59.0%	3	56	52
60	.0127	.004	57.8%	3	58	54
62	.0121	.004	56.5%	4	60	56-58
66	.0112	.004	54.2%	...	62	60-62
70	.0106	.0037	54.9%	5	64	64
72	.0102	.0037	53.8%	...	66	...
74	.0098	.0037	52.7%	...	68	...
76	.0095	.0037	51.7%	6	70	66
78	.0091	.0037	50.6%	6	70	68
80	.0088	.0037	49.6%	7	72	...
84	.0084	.0035	49.8%	7		70
88	.0079	.0035	47.9%	8		72
94	.0071	.0035	45.0%	...		...
105	.0065	.003	46.9%	9-10		
120	.0057	.0026	47.3%	11		
145	.0047	.0022	46.4%	12		

(1) The W. S. Tyler Company, Cleveland, Ohio

Tyler Stainless Steel Bolting Cloth (1)

Nearest Equivalent Numbers in
Silk and Gritz Gauze

Gritz Gauze

<u>Meshes Per Lineal Inch</u>	<u>Opening Dec. of Inch</u>	<u>Wire Diameter Dec. of Inch</u>	<u>Open area</u>	<u>Standard Silk</u>	<u>Standard</u>	<u>XXX</u>
16	.0535	.009	73.3%	0000	16	16
18	.0466	.009	70.2%	...	18	...
20	.0410	.009	67.2%	...	20-22	20
22	.0380	.0075	69.7%	000	24	22
24	.0342	.0075	67.2%	...	...	24
26	.0310	.0075	64.8%	...	26-28	26
28	.0282	.0075	62.4%	00	30	28
30	.0268	.0065	64.8%	...	32	30
32	.0248	.0065	62.7%	...	34	32
34	.0229	.0065	60.7%	0	36	34
36	.0213	.0065	58.7%	0	38	36-38
38	.0198	.0065	56.7%	...	40	40
40	.0185	.0065	54.8%		42	40
43	.0183	.005	61.6%		44	...
46	.0172	.0045	62.9%		46	42-44
48	.0163	.0045	61.5%	1	...	46
50	.0155	.0045	60.1%	...	48	48
54	.0145	.004	61.5%	...	50	
56	.0138	.004	60.2%	2	52-54	50
58	.0132	.004	59.0%	3	56	52
60	.0127	.004	57.8%	3	58	54
62	.0121	.004	56.5%	4	60	56-58
66	.0112	.004	54.2%	...	62	60-62
70	.0106	.0037	54.9%	5	64	64
72	.0102	.0037	53.8%	...	66	...
74	.0098	.0037	52.7%	...	68	...
76	.0095	.0037	51.7%	6	70	66
78	.0091	.0037	50.6%	6	70	68
80	.0088	.0037	49.6%	7	72	...
84	.0084	.0035	49.8%	7	...	70
88	.0079	.0035	47.9%	8		72
94	.0071	.0035	45.0%	...		...
105	.0065	.003	46.9%	9-10		...
120	.0057	.0026	47.3%	11		
135	.0051	.0023	47.4%	...		
145	.0047	.0022	46.4%	12		
165	.0042	.0019	47.1%	13		
200	.0034	.0016	46.2%	16		
230	.0029	.0014	46.0%	19-20		

(1) The W. S. Tyler Company, Cleveland, Ohio

Tuf-tex Wire Bolting Cloth (1)

Nearest Equivalent Numbers in Silk
and Gritz Gauze

<u>Meshes Per Lineal Inch</u>	<u>Opening Dec. of Inch</u>	<u>Wire Diameter Dec. of Inch</u>	<u>Open area</u>	<u>Standard Silk</u>	<u>Standard</u>	<u>Gritz Gauze</u>
14	.0620	.009	76.4%	...	14	14
16	.0535	.009	73.3%	0000	16	16
18	.0466	.009	70.2%	...	18	
20	.0410	.009	67.2%	...	20-22	20
22	.0380	.0075	69.7%	000	24	22
24	.0342	.0075	67.2%	...	...	24
26	.0310	.0075	64.8%	...	26-28	26
28	.0282	.0075	62.4%	00	30	28
30	.0268	.0065	64.8%	...	32	30
32	.0248	.0065	62.7%	...	34	32
34	.0229	.0065	60.7%	0	36	34
36	.0213	.0065	58.7%	0	38	36-38
38	.0198	.0065	56.7%		40	40
40	.0185	.0065	54.8%		42	40
42	.0183	.0055	59.1%		44	
44	.0172	.0055	57.4%	...	46	42-44
46	.0162	.0055	55.8%	1	...	46
48	.0153	.0055	54.2%	...	48	48
50	.0145	.0055	52.6%	...	50	...
52	.0137	.0055	51.0%	2	52-54	50
54	.0130	.0055	49.4%	3	56	52
58	.0127	.0045	54.6%	3	58	54
60	.0122	.0045	53.3%	4	60	56-58
64	.0111	.0045	50.7%	...	62	60-62
66	.0106	.0045	49.4%	5	64	64
70	.0103	.004	51.8%	...	66	...
72	.0099	.004	50.7%	...	68	...
74	.0095	.004	49.6%	6	70	66
76	.0095	.004	48.4%	6	70	68
78	.0088	.004	47.3%	7	72	
80	.0085	.004	46.2%	7		70
84	.0079	.004	44.1%	8		72
88	.0074	.004	42.0%			
90	.0071	.004	41.0%	...		
94	.0066	.004	38.9%	9-10		

(1) The W. S. Tyler Company, Cleveland, Ohio

Tyler Tinned Mill Screen Cloth (1)

<u>Meshes Per Lineal Inch</u>	<u>Diameter of Wire Dec. of Inch</u>	<u>Width of Opening</u>		<u>Open Area</u>
		<u>Dec. of Inch</u>	<u>M.M.</u>	
2	.054	.446	11.33	79.6%
3	.041	.292	7.42	76.7%
4	.035	.215	5.46	74.0%
5	.032	.168	4.27	70.6%
6	.028	.139	3.53	69.6%
7	.028	.115	2.92	64.8%
8	.025	.100	2.54	64.0%
9	.023	.088	2.24	62.7%
10	.020	.080	2.03	64.0%
12	.018	.065	1.65	60.8%
14	.017	.054	1.37	57.2%
16	.016	.0465	1.18	55.4%
18	.015	.0406	1.03	53.4%
20	.014	.0360	.91	51.8%
22	.0135	.0320	.81	49.6%
24	.013	.0287	.73	47.4%
26	.011	.0275	.70	51.1%
28	.010	.0257	.65	51.8%
30	.0095	.0238	.61	51.0%
32	.009	.0223	.57	50.9%
34	.009	.0204	.52	48.1%
36	.009	.0188	.48	45.8%
38	.0085	.0178	.45	45.8%
40	.0085	.0165	.42	43.6%
45	.008	.0142	.36	40.8%
50	.0075	.0125	.32	39.1%
55	.007	.0112	.28	37.9%
60	.0065	.0102	.26	37.5%

(1) The W. S. Tyler Company, Cleveland, Ohio

U.S. Sieve Series and Tyler Equivalents (1)

The 8-inch diameter full-height sieves are considered standard and are usually carried in stock. Sieves can also be made up in 6-inch, 10-inch, and 12-inch diameters.

FINE SERIES

<u>Microns</u>	<u>U. S. Number</u>	<u>Tyler Screen Scale Equivalent</u>	
		<u>Opening Inches</u>	<u>Mesh</u>
5660	No. 3 1/2	.0221	3 1/2
4760	No. 4	.185	4
4000	No. 5	.156	5
3360	No. 6	.131	6
2830	No. 7	.110	7
2380	No. 8	.093	8
2000	No. 10	.078	9
1680	No. 12	.065	10
1410	No. 14	.055	12
1190	No. 16	.046	14
1000	No. 18	.0390	16
840	No. 20	.0328	20
710	No. 25	.0276	24
590	No. 30	.0232	28
500	No. 35	.0195	32
420	No. 40	.0164	35
350	No. 45	.0138	42
297	No. 50	.0116	48
250	No. 60	.0097	60
210	No. 70	.0082	65
177	No. 80	.0069	80
149	No. 100	.0058	100
125	No. 120	.0049	115
105	No. 140	.0041	150
88	No. 170	.0035	170
74	No. 200	.0029	200
62	No. 230	.0024	250
53	No. 270	.0021	270
44	No. 325	.0017	325
37	No. 400	.0015	400

(1) The W. S. Tyler Company, Cleveland, Ohio

COARSE SERIES Sieve Equivalents

<u>Sieve Designation</u>	<u>Sieve Inches</u>	<u>U. S. Sieve Opening</u>	<u>Tyler Screen Scale Equivalent</u>	<u>Diameter of Wire Inches</u>
	<u>Opening mm.</u>	<u>Inches</u>		
(4.24)**	107.6	4.24	-	.250
4	101.6	4.00	-	.250
3 1/2	88.9	3.50	-	.225
3	76.2	3.00	-	.207
2 1/2	63.5	2.50	-	.192
(2.12)**	53.8	2.12	-	.192

2	50.8	2.00		.192
1 3/4	44.4	1.75		.192
1 1/2	38.1	1.50		.162
1 1/4	31.7	1.25	-	.162
(1.06)**	26.9	1.06	1.05	.148
1	25.4	1.00		.148
7/8	22.2	.875	.883	.135
3/4	19.1	.750	.742	.135
5/8	15.9	.625	.624	.120
(0.530)**	13.4	.530	.525	.105
1/2	12.7	.500		.105
7/16	11.1	.438	.441	.105
3/8	9.52	.375	.371	.092
5/16	7.93	.312	.312	.088
(0.265)**	6.73	.265	.263	.070
1/4 (No.3)	63.5	.250	-	.070

Note:--Where it is desired that the coarse sieves follow the 4V2:1 ratio with the fine series, the 4", 2", 1", 1/2" and 1/4" sieves should be omitted from the above series and the sieves marked with the double asterisk() in their place.

(1) The W. S. Tyler Company, Cleveland, Ohio

