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PUBLICATIONS ON POLARIMETRY
AND ITS APPLICATION TO THE SUGARS AND THEIR DERIVATIVES
by Members of the Staff of the National Bureau of Standards

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GENERAL INFORMATION

This Letter Circular is a list of publications on polarimetry and its application to the sugars and their derivatives by members of the staff of the National Bureau of Standards. Most of these papers have been printed in the regular series of publications of the Bureau and others in the various scientific and technical journals. Copies can usually be consulted at the leading libraries of the larger cities.

For ready reference and convenience in ordering the separate papers of the Bureau, these have been listed with the serial letter and number in one column, and the price in the second column. "O.P." indicates that the paper is out of print but may be consulted in libraries, as stated above. A complete list of the Bureau's publications (Circular No. 24 and supplements) is also generally available at such libraries.

Where the price is noted, the publication may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D.C. (stamps not accepted). The prices quoted are for delivery in the United States and its possessions, and to Canada, Cuba, Mexico, Newfoundland, the Philippines, and the Republic of Panama. Remittances for delivery to other countries must include one-third of the total cost of publications, in addition, to cover postage. Remittances should be made payable to the "Superintendent of Documents, Government Printing Office, Washington, D.C.", and sent to him with the order.

Serial letters are used to designate Bureau publications:

- S = "Scientific Paper". From S1 to S329, inclusive, the separate papers of this series were known as reprints from the "Bulletin of the Bureau of Standards" (Bul. BS). Subsequently, from S330 to S572, the separates were known as reprints from the "Scientific Papers of the Bureau of Standards" (Sci. Pap. BS). This series was superseded by the "Bureau of Standards Journal of Research" in 1928.
- T = "Technologic Paper". T1 to T202 were issued each independent of the other with individual pagination. Later they were assembled to make the first 15 volumes of this series, and subsequent separates were given volume pagination (Tech. Pap. BS). This series was superseded by the "Bureau of Standards Journal of Research" in 1928.
- RF = "Research Paper". These are reprints of articles appearing in the "Bureau of Standards Journal of Research" (BSJ: Research) and the "Journal of Research of the National Bureau of Standards" (J. Research NBS), the latter being the title of this periodical since July 1934 (volume 13, number 1).

C = "Circular" of the National Bureau of Standards.

LC = "Letter Circular", distributed free on application directly to the National Bureau of Standards.

For papers in other scientific or technical journals, the name of the journal or of the organization publishing the article is given in abbreviated form, with address in parentheses, together with the volume number (underscored), page, and year of publication, in the order named. The Bureau cannot supply copies of these journals, or reprints from them, and it is unable to furnish information as to their availability or price.

To avoid repetition, the addresses of several of the journals are given below:

Journal of the American Chemical Society, Mills Building,
Washington, D.C.

Facts About Sugar, 56 West 45th St., New York, N.Y.

Journal of the Optical Society of America, American Institute of Physics, 175 Fifth Ave., New York, N.Y.

Journal of Biological Chemistry, 1280 York Ave., New York, N.Y.

Journal of the Association of Official Agricultural Chemists, Box 540 Benjamin Franklin Station, Washington, D.C.

International Sugar Journal, 7 & 8 Idol Lane, London, E.C.3, England.

Zeitschrift des Verein der Deutschen Zucker-Industrie, Institut für Zucker-Industrie, Amrumerstrasse 32, Berlin N. 65, Germany.

POLARIMETRIC MEASUREMENTS

<u>Series</u>	<u>Price</u>	
S 34	O.P.	Spectrum lines as light sources in polariscopic measurements. Frederick Bates. Bul. BS <u>2</u> , 239 (1906).
S 86	O.P.	A quartz compensating polariscope with adjustable sensibility. Frederick Bates. Bul. BS <u>4</u> , 461 (1908). Also in Z. Ver. Deut. Zuckerind. <u>58</u> , 105 (1908); International Sugar J. <u>9</u> , 588 (1907); Am. Sugar Ind. <u>13</u> , 254 (1911).
S 98	5¢	Remarks on the quartz compensating polariscope with adjustable sensibility. Frederick Bates. Bul. BS <u>5</u> , 193 (1908).
S 268	O.P.	Constants of the quartz-wedge saccharimeter and the specific rotation of sucrose. 1. The constants for the 26-gram normal weight. Frederick Bates and Richard F. Jackson. Bul. BS <u>13</u> , 67 (1916). Also in Z. Ver. Deut. Zuckerind. <u>67</u> , 347 (1917); Sugar <u>18</u> , pp. 242, 305, 365, 419 (1916); Sugar (Spanish section) <u>18</u> , pp. 279, 343, 456, 507, 552 (1916); Record of Hawaiian Chemists Assoc. (1917); J. Wash. Acad. Sci. (450 Ahnaip St., Menasha, Wis.) <u>6</u> , 25 (1916).
C 44	O.P.	Polarimetry: Cir. BS 44 [2nd ed.] (1918).
-	-	Report of committee on quartz plate standardization and normal weight. Frederick Bates and C.A. Browne and F.W. Zerban. J. Assoc. Offic. Agric. Chem. <u>16</u> , 39 (1933).

PREPARATION, STRUCTURE, AND OPTICAL ROTATION OF:

SUCROSE

S 52	O.P.	The influence of basic lead acetate on the optical rotation of sucrose in water solution. Frederick Bates and J.C. Blake. Bul. BS <u>3</u> , 105 (1907). Also in J. Am. Chem. Soc. <u>29</u> , 286 (1907).
-	-	The crystallography of sucrose. Francis P. Phelps. Proceedings of the Fourth Congress of the International Soc. of Sugar Cane Tech., Bul. 104, San Juan, P.R. (1932).

DEXTROSE

<u>Series</u>	<u>Price</u>	
S 293	10¢	The saccharimetric normal weight and specific rotation of dextrose. Richard F. Jackson. Bul. BS <u>13</u> , 633 (1916).
S 437	5¢	The solubility of dextrose in water. Richard F. Jackson and Clara Gillis Silsbee. Sci. Pap. BS <u>17</u> , 715 (1922).
-	-	Research work at the Bureau of Standards on the establishing of dextrose and levulose industries. Frederick Bates. Facts About Sugar <u>21</u> , 250 (1926); Planter and Sugar Manuf. <u>76</u> , 228 (1926); Sugar <u>28</u> , 167 (1926); Z. Ver. Deut. Zuckerind. <u>76</u> , 316 (1926); International Sugar J. <u>28</u> , 330 (1926).
-	-	Sugar standards researches. Levulose and dextrose. Frederick Bates. The United States Daily (Washington, D.C.), April 9 and 10, 1928.
LC 500	-	The National Bureau of Standards and the establishment of hard refined dextrose and levulose industries. Frederick Bates. Letter Circular 500.

LEVULOSE

-	-	A method for the manufacture of levulose. R.F. Jackson, C.G. Silsbee, and M.J. Proffitt. Ind. Eng. Chem. (American Chemical Society, Mills Bldg., Washington, D.C.) <u>16</u> , 1250 (1924); Facts About Sugar <u>19</u> , 586 (1924); Sugar <u>27</u> , 9 (1925); Planter and Sugar Manuf. <u>73</u> , 469 (1924).
S 519	10¢	The preparation of levulose. Richard F. Jackson, Clara Gillis Silsbee, and Max J. Proffitt. Sci. Pap. BS <u>20</u> , 587 (1926). Also in Planter and Sugar Manuf. <u>76</u> , pp. 230, 248, 268, 289 (1926); Facts About Sugar <u>21</u> , 326 (1926), a review; Sugar <u>28</u> , pp. 170, 222, 326, 380 (1926); J. Fabricants de Sucre (42, Rue du Louvre, Paris 1 ^{er} , France), May 15, 1926 (translation of above review from Facts About Sugar).
-	-	Research work at the Bureau of Standards on the establishing of dextrose and levulose industries. Frederick Bates. Facts About Sugar <u>21</u> , 250 (1926); Planter and Sugar Manuf. <u>76</u> , 228 (1926); Sugar <u>28</u> , 167 (1926); Z. Ver. Deut. Zuckerind. <u>76</u> , 316 (1926); International Sugar J. <u>28</u> , 330 (1926).

<u>Series</u>	<u>Price</u>	
-	-	Sugar standards researches. Levulose and Dextrose. Frederick Bates. The United States Daily (Washington, D.C.), April 9 and 10, 1928.
LC 500	-	The National Bureau of Standards and the establishment of hard refined dextrose and levulose industries. Frederick Bates. Letter Circular 500.
RP 840	5¢	Design and construction of an experimental diffusion battery. Max J. Proffitt. J. Research NBS <u>15</u> , 441 (1935). Also Ind. Eng. Chem. <u>27</u> , 1266 (1935).
RP 931	5¢	Dimensions of Jerusalem-artichoke cossettes. Max J. Proffitt, John A. Bogan, and Richard F. Jackson. J. Research NBS <u>17</u> , 615 (1936).
RP1025	5¢	Extraction of levulose from Jerusalem artichokes. Max J. Proffitt, John A. Bogan, and Richard F. Jackson. J. Research NBS <u>19</u> , 263 (1937).
RP 426	10¢	Some physical properties of levulose and its estimation by copper reduction methods. Richard F. Jackson and Joseph A. Mathews. BS J. Research <u>8</u> , 403 (1932).
RP 495	5¢	Analytical methods for the determination of levulose in crude products. R.F. Jackson, J.A. Mathews, and W.D. Chase. BS J. Research <u>9</u> , 597 (1932).
RP 611	5¢	The stability of levulose in aqueous solutions of varying pH. Joseph A. Mathews and Richard F. Jackson. BS J. Research <u>11</u> , 619 (1933).
RP 832	5¢	Yield and purity of levulose derived from the calcium levulate process. Richard F. Jackson and Joseph A. Mathews. J. Research NBS <u>15</u> , 341 (1935).
RP 79	5¢	A crystalline difructose anhydride from hydrolyzed inulin. Richard F. Jackson and Sylvia M. Goergen. BS J. Research <u>3</u> , 27 (1929).
RP 224	5¢	Note on the individualities of anhydrofructose and difructose anhydride. R.F. Jackson and S.M. Goergen. BS J. Research <u>5</u> , 733 (1930).
RP 251	5¢	The constant occurrence of nonreducing disaccharides in hydrolyzed inulin. Richard F. Jackson and Emma McDonald. BS J. Research <u>5</u> , 1151 (1930).
RP 299	5¢	Two new crystalline difructose anhydrides from hydrolyzed inulin. Richard F. Jackson and Emma McDonald. BS J. Research <u>6</u> , 709 (1931).

OTHER SUGARS

<u>Series</u>	<u>Price</u>	
S 416	5¢	Preparation of galactose. E.P. Clark. Sci. Pap. BS <u>17</u> , 227 (1921). Also in J. Biol. Chem. <u>47</u> , 1 (1921).
S 429	O.P.	Note on the preparation of mannose. E.P. Clark. Sci. Pap. BS <u>17</u> , 567 (1922). Also in J. Biol. Chem. <u>51</u> , 1 (1922).
S 432	5¢	An improved method for preparing raffinose. E.P. Clark. Sci. Pap. BS <u>17</u> , 607 (1922). Also in J. Am. Chem. Soc. <u>44</u> , 210 (1922).
S 459	5¢	The structure of fucose. E.P. Clark. Sci. Pap. BS <u>18</u> , 527 (1922). Also in J. Biol. Chem. <u>54</u> , 65 (1922).
RP 723	5¢	A note on the purification of α -D-xylose and its mutarotation. Horace S. Isbell. J. Research NBS <u>13</u> , 515 (1934).
-	-	A convenient modification of the Kiliani synthesis of higher carbon acids (or their lactones) from reducing sugars. C.S. Hudson, Olive Hartley, and Clifford B. Furves. J. Am. Chem. Soc. <u>56</u> , 1248 (1934).
-	-	Communication to the Editor. Preparation of crystalline β -D-allose. Francis P. Phelps and Frederick Bates. J. Am. Chem. Soc. <u>56</u> , 1250 (1934).
-	-	Communication to the Editor. Crystalline β -glucoheptose and its mutarotation. Horace S. Isbell. J. Am. Chem. Soc. <u>56</u> , 2789 (1934).
-	-	Relations between rotatory power and structure in the sugar group. XV. Conversion of lactose to another disaccharide, neolactose. The chlorohepta-acetate and two octa-acetates of neolactose. Alfons Kunz and C.S. Hudson. J. Am. Chem. Soc. <u>48</u> , 1978 (1926).
-	-	Relations between rotatory power and structure in the sugar group. XVII. The structure of neolactose. Alfons Kunz and C.S. Hudson. J. Am. Chem. Soc. <u>48</u> , 2435 (1926).

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- - Relations between rotatory power and structure in the sugar group. XVI. Conversion of cellobiose to another disaccharide, celtrobiose, by the aluminum chloride reaction. Chloro-acetyl celtrobiose. C.S. Hudson. J. Am. Chem. Soc. 48, 2002 (1926).
- - Relations between rotatory power and structure in the sugar group. XXVII. Synthesis of a new disaccharide ketose (lactulose) from lactose. Edna M. Montgomery and C.S. Hudson. J. Am. Chem. Soc. 52, 2101 (1930).
- - Relations between rotatory power and structure in the sugar group. XXVIII. The conversion of d-alpha-glucoheptose to a new ketose, d-glucoheptulose. W.C. Austin. J. Am. Chem. Soc. 52, 2106 (1930).
- RP 106 5¢ Two isomeric crystalline compounds of d-mannose with calcium chloride. J.K. Dale. BS J. Research 3, 459 (1929). Also in J. Am. Chem. Soc. 51, 2788 (1929).
- RP 226 10¢ A new crystalline calcium chloride compound of alpha-d-gulose and its rotation and mutarotation in aqueous solution. Horace S. Isbell. BS J. Research 5, 741 (1930).
- - The occurrence of gentiobiose in the products of the commercial hydrolysis of corn starch. Henry Berlin. J. Am. Chem. Soc. 48, 2627 (1926).
- - The identity of isomaltose with gentiobiose. Henry Berlin. J. Am. Chem. Soc. 48, 1107 (1926).
- - Relations between rotatory power and structure in the sugar group. III. The biose of amygdalin (gentiobiose) and its configuration. C.S. Hudson. J. Am. Chem. Soc. 46, 483 (1924).
- - Communication to the Editor. Mutarotation of beta-d-ribose and beta-l-ribose. Francis P. Phelps, Horace S. Isbell, and Ward Pigman. J. Am. Chem. Soc. 56, 747 (1934).
- RP 892 5¢ Note on the thermal mutarotation of d-galactose, l-arabinose, and d-talose. Horace S. Isbell and W.W. Pigman. J. Research NBS 16, 553 (1936).
- RP1035 5¢ Mutarotation of l-sorbose. W.W. Pigman and H.S. Isbell. J. Research NBS 19, 443 (1937).

SUGAR DERIVATIVES

<u>Series</u>	<u>Price</u>	
S 533	35¢	Relations between rotatory power and structure in the sugar group. Part 1 (1-10). C.S. Hudson. Sci. Pap. BS <u>21</u> , 241 (1926).
-	-	Relations between rotatory power and structure in the sugar group. I. The halogen-acyl and nitro-acyl derivatives of the aldose sugars. C.S. Hudson. J. Am. Chem. Soc. <u>46</u> , 462 (1924).
-	-	Relations between rotatory power and structure in the sugar group. II. The halogen-acetyl derivatives of a ketose sugar (d-fructose). C.S. Hudson. J. Am. Chem. Soc. <u>46</u> , 477 (1924).
-	-	Relations between rotatory power and structure in the sugar group. V. The chloro- and bromo-acetyl derivatives of arabinose. The nomenclature of alpha and beta forms in the sugar group. Some derivatives of 1,6-bromo-acetyl glucose, gentiobiose and maltose. C.S. Hudson and F.P. Phelps. J. Am. Chem. Soc. <u>46</u> , 2591 (1924).
-	-	Relations between rotatory power and structure in the sugar group. X. The chloro-, bromo-, and iodo-acetyl derivatives of lactose. C.S. Hudson and Alfons Kunz. J. Am. Chem. Soc. <u>47</u> , 2052 (1925).
-	-	Studies on salicin. Part 1. Exceptional rotations of the halogeno-tetra-acetyl derivatives of salicin. A new synthesis of salicin. Alfons Kunz. J. Am. Chem. Soc. <u>48</u> , 262 (1926).
-	-	Relations between rotatory power and structure in the sugar group. XI. The related rotations of amylobiose, amylotriose and glucose. C.S. Hudson, H. Pringsheim, and J. Leibowitz. J. Am. Chem. Soc. <u>48</u> , 288 (1926).
-	-	Relations between rotatory power and structure in the sugar group. VII. The methyl glycosidic derivatives of the sugars. C.S. Hudson. J. Am. Chem. Soc. <u>47</u> , 268 (1925).
-	-	Relations between rotatory power and structure in the sugar group. VIII. Some terpene alcohol glycosides of glucose, glucuronic acid, maltose and lactose. C.S. Hudson. J. Am. Chem. Soc. <u>47</u> , 537 (1925).

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- - Relations between rotatory power and structure in the sugar group. IX. The rotation of the alpha form of methyl gentiobioside recently synthesized by Helferich and Becker. C.S. Hudson. J. Am. Chem. Soc. 47, 872 (1925).
- - Relations between rotatory power and structure in the sugar group. XII. The preparation and properties of pure alpha-methyl d-lyxoside. F.P. Phelps and C.S. Hudson. J. Am. Chem. Soc. 48, 503 (1926).
- - Relations between rotatory power and structure in the sugar group. XIII. A classification of various substances of the mannose and rhamnose series according to ring types. C.S. Hudson. J. Am. Chem. Soc. 48, 1424 (1926).
- - Relations between rotatory power and structure in the sugar group. XIV. The determination of ring structures in the glucose, mannose and rhamnose series. C.S. Hudson. J. Am. Chem. Soc. 48, 1434 (1926).
- - Relations between rotatory power and structure in the sugar group. XVIII. Alpha-methyl d-lyxoside triacetate. F.P. Phelps and C.S. Hudson. J. Am. Chem. Soc. 50, 2049 (1928).
- RP 93 5¢ The structure of alpha methylxyloside. F.P. Phelps and C.B. Purves. BS J. Research 3, 247 (1929).
- - Relations between rotatory power and structure in the sugar group. XXX. The alpha and beta methyl-d-galactosides and their tetra-acetates. J.K. Dale and C.S. Hudson. J. Am. Chem. Soc. 52, 2534 (1930).
- RP 396 5¢ The preparation of crystalline methyl-d-gulosides by means of coordination compounds with calcium chloride. Horace S. Isbell. BS J. Research 8, 1 (1932). Also in Proc. Nat. Acad. Sci. 16, 699 (1930).
- - Relations between rotatory power and structure in the sugar group. XXI. Beta-thiophenol glycosides of glucose, xylose, lactose and cellobiose. Clifford B. Purves. J. Am. Chem. Soc. 51, 3619 (1929).
- - Relations between rotatory power and structure in the sugar group. XXII. Evidence concerning the ringed structure of beta-thiophenol cellobioside and of beta-thiophenol lactoside. Clifford B. Purves. J. Am. Chem. Soc. 51, 3627 (1929).

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- - Relations between rotatory power and structure in the sugar group. XXIII. The preparation and the structure of beta-thiophenol maltoside and of its hepta-acetate. Clifford B. Purves. J. Am. Chem. Soc. 51, 3631 (1929).
- - Action of titanium tetrachloride on derivatives of sugars. II. Preparation of tetra-acetyl-beta-normal hexylglucoside and its transformation to the alpha form. Eugen Pacsu. J. Am. Chem. Soc. 52, 2563 (1930).
- - Action of titanium tetrachloride on derivatives of sugars. III. Transformation of tetra-acetyl-beta-cyclohexylglucoside to the alpha form and the preparation of alpha-cyclohexylglucoside. Eugen Pacsu. J. Am. Chem. Soc. 52, 2568 (1930).
- - Action of titanium tetrachloride on derivatives of sugars. IV. Transformation of hepta-acetyl-beta methylcellobioside to the alpha form and the preparation of alpha-methylcellobioside. Eugen Pacsu. J. Am. Chem. Soc. 52, 2571 (1930).
- RP 287 5¢ Application of the fluorating process to fructose. D.H. Brauns and Harriet L. Frush. BS J. Research 6, 449 (1931).
- - Note on optical rotation and atomic dimension. IX. Halogeno-tetra-acetyl derivatives of mannose. Their configurational peculiarities. D.H. Brauns. J. Am. Chem. Soc. 53, 2004 (1931).
- RP 358 10¢ Optical rotation and atomic dimension - Halogeno-tetra-acetyl derivatives of mannose. D.H. Brauns. BS J. Research 7, 573 (1931).
- - Communication to the Editor. Optical rotation and atomic dimension. D.H. Brauns. J. Am. Chem. Soc. 56, 1421 (1934).
- RP 915 5¢ Empirical relation between the atomic dimensions and the melting and sublimation points of the noble gases, halogens, and elements of the sulphur group. D.H. Brauns. J. Research NBS 17, 337 (1936).
- RP 978 5¢ Optical rotation and atomic dimension for the four optically active 1-halogeno-2-methylbutanes. Dirk H. Brauns. J. Research NBS 18, 315 (1937).

<u>Series</u>	<u>Price</u>	
RP 128	5¢	Optical rotation and ring structure in the sugar group. The optical rotation of the various asymmetric carbon atoms in the hexose and pentose sugars. H.S. Isbell. BS J. Research <u>3</u> , 1041 (1929).
RP 253	5¢	The ring structure of mannose. The optical rotation of 4-glucosido- α -mannose. Horace S. Isbell. BS J. Research <u>5</u> , 1179 (1930). Also in Proc. Nat. Acad. Sci. <u>16</u> , 704 (1930).
-	-	Note on the structure of the acetyl-methylmannosides. H.S. Isbell. J. Am. Chem. Soc. <u>52</u> , 5298 (1930).
RP 392	10¢	Derivatives of 4-glucosido-mannose. Horace S. Isbell. BS J. Research <u>7</u> , 1115 (1931).
RP1021	5¢	β -d-Talose and d-talose acetates and orthoesters. William Ward Pigman and Horace S. Isbell. J. Research NBS <u>19</u> , 189 (1937).

ALDONIC ACIDS AND OXIDATION PRODUCTS

RP 328	5¢	The oxidation of sugars. I. The electrolytic oxidation of aldose sugars in the presence of a bromide and calcium carbonate. Horace S. Isbell and Harriet L. Frush. BS J. Research <u>6</u> , 1145 (1931).
RP 436	5¢	Manufacture of calcium gluconate by the electrolytic oxidation of dextrose. Horace S. Isbell, Harriet L. Frush, and F.J. Bates. BS J. Research <u>8</u> , 571 (1932). Also in Ind. Eng. Chem., Analytical Edition (American Chemical Society, Mills Bldg., Washington, D.C.) <u>24</u> , 375 (1932).
RP 773	5¢	Electrolytic oxidation of xylose in the presence of alkaline earth bromides and carbonates. Horace S. Isbell and Harriet L. Frush. J. Research NBS <u>14</u> , 359 (1935).
RP 914	5¢	Preparation and properties of calcium lactobionate-calcium bromide. Horace S. Isbell. J. Research NBS <u>17</u> , 331 (1936).
RP 82	5¢	Improvements in the preparation of aldonic acids. C.S. Hudson and H.S. Isbell. BS J. Research <u>3</u> , 57 (1929). Also in J. Am. Chem. Soc. <u>51</u> , 2225 (1929).

<u>Series</u>	<u>Price</u>	
RP 418	5¢	The course of the oxidation of the aldose sugars by bromine water. H.S. Isbell and C.S. Hudson. BS J. Research <u>8</u> , 327 (1932).
RP 441	5¢	A study of the delta lactones formed by the oxidation of aldoses with bromine water. Horace S. Isbell. BS J. Research <u>8</u> , 615 (1932).
-	-	Communication to the Editor. The calcium chloride modifications of mannose and gulose. H.S. Isbell. J. Am. Chem. Chem. Soc. <u>55</u> , 2166 (1933).
-	-	Note on oxidation of the alpha and beta forms of the sugars. Horace S. Isbell. J. Am. Chem. Soc. <u>54</u> , 1692 (1932).
-	-	Nomenclature of the alpha and beta sugars. (Note). Horace S. Isbell. J. Chem. Education (Williams and Wilkins, Baltimore, Md.) <u>12</u> , 96 (1935).
RP 534	5¢	The oxidation of alpha and beta glucose and a study of the isomeric forms of the sugar in solutions. Horace S. Isbell and Ward Pigman. BS J. Research <u>10</u> , 337 (1933).
RP 969	10¢	Bromine oxidation and mutarotation measurements of the alpha- and beta-aldoses. Horace S. Isbell and William W. Pigman. J. Research NBS <u>18</u> , 141 (1937). Also in J. Organic Chem. <u>1</u> , 505 (1937).
RP 990	10¢	Configuration of the pyranoses in relation to their properties and nomenclature. Horace S. Isbell. J. Research NBS <u>18</u> , 505 (1937).
RP 613	5¢	Preparation and properties of aldonic acids and their lactones and basic calcium salts. Horace S. Isbell and Harriet L. Frush. BS J. Research <u>11</u> , 649 (1933).
RP 618	5¢	Preparation of calcium lactobionate and lactobionic delta-lactone. Horace S. Isbell. BS J. Research <u>11</u> , 713 (1933).
RP 770	5¢	Optical rotations and other properties of the lead and calcium aldonates. Horace S. Isbell. J. Research NBS <u>14</u> , 305 (1935).

METHODS OF ANALYSIS

<u>Series</u>	<u>Price</u>	
S 375	O.P.	The double-polarization method for estimation of sucrose and the evaluation of the Clerget divisor. Richard F. Jackson and Clara L. Gillis. Sci. Pap. BS <u>16</u> , 125 (1920). Also in Z. Ver. Deut. Zucker-ind. <u>70</u> , 521 (1920); International Sugar J. <u>22</u> , pp. 509, 570, 538 (1920); abridged in Sugar <u>22</u> , pp. 604, 643 (1920).
-	-	The applicability of the Clerget method to dilute sucrose solutions. R.F. Jackson and C.L. Gillis. Louisiana Planter and Sugar Manuf. <u>66</u> , 141 (1921); Facts About Sugar <u>12</u> , 190 (1921); International Sugar J. <u>23</u> , 217 (1921).
-	-	The complete applicability of the modified Clerget method. R.F. Jackson and C.L. Gillis. Louisiana Planter and Sugar Manuf. <u>66</u> , 380 (1921); Facts About Sugar <u>13</u> , 10 (1921); International Sugar J. <u>23</u> , 445 (1921).
-	-	Note on the evaluation of the Clerget divisor in the analysis of sugar mixtures. Richard F. Jackson and Clara Gillis Silsbee. International Sugar J. <u>24</u> , 313 (1922).
-	-	Report on chemical methods for reducing sugars. R.F. Jackson. J. Assoc. Offic. Agric. Chem. <u>8</u> , 402 (1925).
-	-	Report on chemical methods for reducing sugars. R.F. Jackson. J. Assoc. Offic. Agric. Chem. <u>9</u> , 178 (1926).
-	-	Report on chemical methods for reducing sugars. R.F. Jackson. J. Assoc. Offic. Agric. Chem. <u>11</u> , 175 (1928).
-	-	Report on chemical methods for reducing sugars. R.F. Jackson. J. Assoc. Offic. Agric. Chem. <u>12</u> , 166 (1929).
-	-	Report on drying, densimetric and refractometric methods. J.F. Brewster. J. Assoc. Offic. Agric. Chem. <u>12</u> , 156 (1929).
-	-	Report on chemical methods for reducing sugars. R.F. Jackson. J. Assoc. Offic. Agric. Chem. <u>13</u> , 197 (1930).

Series Price

- - Report on chemical methods for reducing sugars. R.F. Jackson. J. Assoc. Offic. Agric. Chem. 14, 181 (1931).
- - Report on chemical methods for reducing sugars. Biourge and Nyns' selective determination of levulose. R.F. Jackson and J.A. Mathews. J. Assoc. Offic. Agric. Chem. 15, 198 (1932).
- - Report on drying, densimetric and refractometric methods. Carl F. Snyder. J. Assoc. Offic. Agric. Chem. 15, 194 (1932).
- - Report on drying, densimetric, and refractometric methods. Carl F. Snyder. J. Assoc. Offic. Agric. Chem. 16, 173 (1933).
- - A critical study of the Munson-Walker method for reducing sugars. R.F. Jackson. J. Assoc. Offic. Agric. Chem. 17, 293 (1934).
- - Report on chemical methods for reducing sugars. R.F. Jackson and Emma J. McDonald. J. Assoc. Offic. Agric. Chem. 18, 172 (1935).
- - Report on drying, densimetric, and refractometric methods. C.F. Snyder. J. Assoc. Offic. Agric. Chem. 19, 399 (1936).

MOLASSES AND SIRUPS

- T 161 5¢ A picnometer for the determination of density of molasses. W.B. Newkirk. Tech. Pap. BS 13 (1920).
- - Regulations governing the weighing, taring, sampling, classification, and polarization of imported sugars and molasses. U.S. Customs Regulations, 1923, 1931, and 1937, Treasury Department. Printed as a separate by the Bureau of Customs for general distribution.
- C 145 15¢ Summary of technical methods for the utilization of molasses. Collated from patent literature. Cir. BS 145 (1924).
- - Possibilities of beet molasses. W.J. Geldard. Chem. & Met. Eng. (McGraw-Hill Book Co., Inc., New York, N.Y.) 30, 394 (1924).

<u>Series</u>	<u>Price</u>	
T 345	5¢	Determination of weight per gallon of blackstrap molasses. Carl F. Snyder and L.D. Hammond. Tech. Pap. BS <u>21</u> , 409 (1927).
C 375	5¢	Weights per United States gallon and weights per cubic foot of sugar solutions. Cir. BS 375 (1929). Also in Facts About Sugar <u>24</u> , 714 (1929); Planter and Sugar Manuf. <u>82</u> , 501 (1929).

SUGAR COLORIMETRY

T 338	20¢	Color in the sugar industry. I. Color nomenclature in the sugar industry. II. Colorimetric clarification of turbid sugar solutions. H.H. Peters and F.P. Phelps. Tech. Pap. BS <u>21</u> , 261 (1927). Part I published in Facts About Sugar <u>20</u> , 353 (1925); Planter and Sugar Manuf. <u>74</u> , 288 (1925); Sugar <u>27</u> , 223 (1925); Z. Ver. Deut. Zuckerind. <u>75</u> , 448 (1925).
RP 38	5¢	A technical method of using the mercury arc to obtain data at wave length 560 μ in the spectrophotometric analysis of sugar products. H.H. Peters and F.P. Phelps. BS J. Research <u>2</u> , 335 (1928).
-	-	Color in the sugar industry. III. Preparation of asbestos for use as a filter aid. J.F. Brewster and F.P. Phelps. Ind. Eng. Chem., Analytical Edition (American Chemical Society, Mills Bldg., Washington, D.C.) <u>2</u> , 373 (1930).
RP 536	5¢	The preparation of optically stable sugar solutions for colorimetric analysis. J.F. Brewster and F.P. Phelps. BS J. Research <u>10</u> , 365 (1933).
RP 878	5¢	Simplified apparatus for technical sugar colorimetry. Joseph F. Brewster. J. Research NBS <u>16</u> , 349 (1936).

GLASS

S 358	10¢	Concerning the annealing and characteristics of glass. A.Q. Tool and J. Valasek. Sci. Pap. BS <u>15</u> , 537 (1920).
-	-	The absorption of heat in glass. A.Q. Tool and C.G. Eichlin. J. Opt. Soc. Am. <u>4</u> , 340 (1920).

<u>Series</u>	<u>Price</u>	
-	-	Certain effects produced by chilling glass. A.Q. Tool and C.G. Eichlin. J. Opt. Soc. Am. & Rev. Sci. Insts. <u>8</u> , 419 (1924).
-	-	Variations in glass caused by heat treatment. A.Q. Tool and C.G. Eichlin. J. Am. Ceramic Soc. (2525 N. High St., Columbus, Ohio) <u>8</u> , 1 (1925).
-	-	On the constitution and density of glass. A.Q. Tool and E.E. Hill. Transactions Soc. Glass Tech. (Sheffield, England) <u>9</u> , 185 (1925).
S 572	10¢	Cause and removal of certain heterogeneities in glass. L.W. Tilton, A.N. Finn, and A.Q. Tool. Sci. Pap. BS <u>22</u> , 719 (1928).
-	-	The effect of heat treatment on the physical properties of glass. A.Q. Tool and D.B. Lloyd. Fuels and Furnaces (F.C. Andersen and Associates, Inc., Pittsburgh, Pa) <u>6</u> , 353 (1928).
-	-	Some effects of carefully annealing optical glass. L.W. Tilton, A.N. Finn, and A.Q. Tool. J. Am. Ceramic Soc. <u>11</u> , 292 (1928).
RP 112	5¢	Optical heterogeneity of a fused quartz disk. L.W. Tilton and A.Q. Tool. BS J. Research <u>3</u> , 619 (1929).
RP 219	10¢	Dimensional changes caused in glass by heating cycles. A.Q. Tool, D.B. Lloyd, and G.E. Merritt. BS J. Research <u>5</u> , 627 (1930). Also in J. Am. Ceramic Soc. <u>13</u> , 632 (1930).
RP 292	10¢	Variations caused in heating curves of glass by heat treatment. A.Q. Tool and C.G. Eichlin. BS J. Research <u>6</u> , 523 (1931). Also in J. Am. Ceramic Soc. <u>14</u> , 276 (1931).
RP 345	10¢	The restoration of solarized ultra-violet transmitting glasses by heat treatment. A.Q. Tool and R. Stair. BS J. Research <u>7</u> , 357 (1931).
RP 626	5¢	Effect of heat treatment on the expansivity of a pyrex glass. J.B. Saunders and A.Q. Tool. BS J. Research <u>11</u> , 799 (1933).

MISCELLANEOUS RELATED SUBJECTS

<u>Series</u>	<u>Price</u>	
S 221	O.P.	Influence of atmospheric conditions in the testing of sugars. Frederick Bates and Francis P. Phelps. Bul. BS <u>10</u> , 537 (1914). Also in International Sugar J. <u>16</u> , 265 (1914); Z. Ver: Deut. Zuckerind. <u>64</u> , 579 (1914).
S 232	O.P.	Equilibrium in the system; lead acetate, lead oxide, and water, at 25°. Richard F. Jackson. Bul. BS <u>11</u> , 331 (1914). Also in J. Am. Chem. Soc. <u>36</u> , 2346 (1914).
S 298	O.P.	Standard substances for the calibration of viscometers. Eugene C. Bingham and Richard F. Jackson. Bul. BS <u>14</u> , 59 (1917).
T 115	5¢	New Baume scale for sugar solutions. Frederick J. Bates and H.W. Bearce. Tech. Pap. BS <u>11</u> , (1918).
-	-	Shall America adopt a new normal sugar weight? Frederick Bates. Louisiana Planter and Sugar Manuf. <u>62</u> , 217 (1919); Sugar <u>21</u> , 187 (1919); Facts About Sugar <u>8</u> , 312 (1919); El Mundo Azucararo, p. 305 (1919).
RP 916	5¢	The French Sugar Scale. Frederick Bates and Francis P. Phelps. J. Research NBS <u>17</u> , 347 (1936).
S 371	5¢	A new cadmium-vapor arc lamp. Frederick Bates. Sci. Pap. BS <u>16</u> , 45 (1920). Also in Phil. Mag. (Taylor and Francis, London, England) <u>39</u> , 353 (1920).
-	-	Densimetric and polariscopic standardization in reference to the Associate Referee's report on sugar. Frederick Bates and R.F. Jackson. J. Assoc. Offic. Agric. Chem. <u>4</u> , 330 (1921).
T 259	10¢	Saturation relations in mixtures of sucrose, dextrose, and levulose. Richard F. Jackson and Clara Gillis Silsbee. Tech. Pap. BS <u>18</u> , 277 (1924)
-	-	A lesson in waste recovery. Walter J. Geldard and William D. Chase. Chem. & Met. Eng. (McGraw-Hill Book Co., Inc., New York, N.Y.) <u>32</u> (Feb. 2, 1925).
C 207	5¢	Recommended specification for limestone, quicklime, lime powder, and hydrated lime for use in the manufacture of sugar. Cir. BS 207 (1925).

<u>Series</u>	<u>Price</u>	
C 295	5¢	Temperature corrections to readings of Baume hydrometers, Bureau of Standards Baume scale for sugar solutions (standard at 20°C). Cir. BS 295 (1926).
S 557	5¢	A suggested new base point on the thermometric scale and the $\alpha \rightleftharpoons \beta$ inversion of quartz. Frederick Bates and Francis P. Phelps. Sci. Pap. BS 22, 315 (1927).

UNITED STATES PATENTS

- Crystalline magnesium xylonate and process for the preparation of magnesium salts of aldonic acids. Horace S. Isbell. No. 1,964,734. July 3, 1934.
- Process of oxidizing aldose sugars and products resulting therefrom. Horace S. Isbell. No. 1,976,731. October 16, 1934.
- Process for the preparation of calcium lactobionate. Horace S. Isbell. No. 1,980,996. November 20, 1934.
- Process for the preparation of crystalline gluconic acid. Horace S. Isbell. No. 1,985,255. December 25, 1934.
- Process for crystallizing calcium salts of aldonic acids and resulting products. Horace S. Isbell. No. 2,044,793. June 23, 1936.
- Crystalline calcium lactobionate-calcium bromide and process for making the same. Horace S. Isbell. Patent pending.
- Process of making sugar products. Richard F. Jackson. No. 2,007,971. July 16, 1935.
- Process of extracting levulose or polysaccharides from organic tissues or like materials. Max J. Proffitt. Patent pending.
- The application of reagents in processes of countercurrent extraction. Max J. Proffitt. Patent pending.
- Process for the preparation of ribose. F.P. Phelps. Patent pending.

