and all attempts to convert this form into the metastable form were unsuccessful.

Experimental

In a 2-liter flask fitted with mercury-seal mechanical stirrer and reflux condenser, were placed 150 g. (0.8 mole) of *p*-chlorodiphenyl (Eastman Kodak Co. Techn.), 145 g. (0.8 mole) of *p*-benzophenone, and 525 cc. of anhydrous benzene. The mixture was heated until all of the solid had dissolved. Forty-five grams (0.2 mole) of sodium sand was then added, in small portions, through the top of the condenser, each portion being washed down with a little dry benzene. Just enough heat was applied to keep the reaction mixture refluxing gently. The time required for the addition of the sodium was two hours. The reaction mixture was then refluxed for two hours longer. After cooling, the unreacted sodium was destroyed by the addition of methanol. The mixture was then hydrolyzed with dilute hydrochloric acid, the benzene layer separated, and the carbinol isolated by removal of the benzene. After repeated recrystallization from ligroin (b. p. 90–120°) 180 g. of the carbinol was obtained, m. p. 135–136°; yield 67%.

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A Calcium Chloride Compound of α-*d*-Galactose[1]

BY RAYMOND M. HANN AND C. S. HUDSON

Although crystalline calcium chloride addition compounds of several aldose sugars have been obtained, one containing *d*-galactose as a component does not appear to have been described. The present note summarizes the experimental details leading to the isolation of α-*d*-galactose calcium chloride trihydrate.

Ten grams of α-*d*-galactose was dissolved in 16 cc. of water and 16 g. of calcium chloride dihydrate (2 moles) was added. Upon slowly concentrating the thin sirup in a desiccator, spontaneous crystallization occurred in seven months in a yield of 15 g. The substance may be recrystallized by solution in three parts of 90% alcohol containing 10% of calcium chloride dihydrate, separating in groups of clear colorless elongated prisms which melt at 129–130° (corr.). It must be preserved in a dry atmosphere to prevent deliquescence. Analysis and the course of mutarotation indicate that the compound is α-*d*-galactose calcium chloride trihydrate.

Anal. Calcd. for $C_6H_{12}O_6{\cdot}CaCl_2{\cdot}3H_2O$: Ca, 11.6; Cl, 20.5; galactose, 52.2. Found: Ca, 11.7; Cl, 20.4; galactose (by hypoiodite) 52.2.

MUTAROTATION OF α-*d*-GALACTOSE·$CaCl_2{\cdot}3H_2O$ IN WATER

Concentration 2.0173 g. in 25 cc. solution; tube length, 2 dm.; $T = 20 \pm 0.5°$.

Time after making soln., min.	$[\alpha]^{20}_D$	$[\alpha]^{20}_D$ based on galactose	$k_1 + k_2$	$k_1 + k_2$ pure galactose
2.7	+75.82°	+145.3°	....	....
3.8	74.65°	143.0°	0.0143	....
5.8	72.82°	139.5°	.0133	0.0127
7.8	71.43°	136.9°	.0121	.0117
8.9	70.57°	135.2°	.0121	.0118
10.9	69.28°	132.7°	.0116	.0107
14.1	67.67°	129.7°	.0108	.0105
25.0	62.42°	119.6°	.0101	.0096
38.4	57.92°	114.9°	.0094	.0092
48.0	56.13°	107.5°	.0094	.0089
73.0	50.19°	96.2°	.0092	.0086
∞	42.68°	81.8°	....	....

The extrapolated initial rotation of the galactose in each case was about +151° and the change in rate as mutarotation progressed was quite similar. The somewhat high equilibrium rotation, based on galactose, is probably due to the presence of calcium chloride.

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[1] Publication authorized by the Surgeon General, U. S. Public Health Service.

Monolayers and Multilayers of Chlorophyll

BY IRVING LANGMUIR AND VINCENT J. SCHAEFER

Monolayers of chlorophyll[1] spread on a water surface from a benzene solution may be deposited in successive layers on a solid plate to form multilayers.

A benzene solution of chlorophyll illuminated by blue light shows red fluorescence. During the spreading of a drop of the solution on a water surface fluorescence disappears as soon as the benzene has evaporated.

Chlorophyll monolayers on water behave as two-dimensional liquids until subjected to a pressure of more than 20 dynes cm.$^{-1}$, when they become quite viscous. The *p*H of the water has apparently no effect on the viscosity below this pressure.

The absolute viscosities[2] of chlorophyll mono-

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[1] Made by Dr. A. Stoll of Basel and obtained from Dr. J. Franck of the Physics Department of Johns Hopkins University.

[2] Irving Langmuir and Vincent J. Schaefer, THIS JOURNAL, not yet published.