NOTES

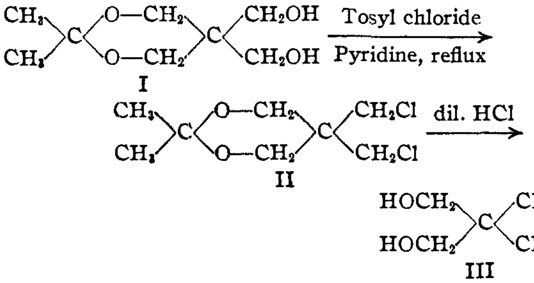
Pentaerythritol Dichloride

By H. Rapoport[1]

Previous workers have prepared pentaerythritol dichlorohydrin (III) from pentaerythritol, with the mono-, tri- and tetra-analogs and other products, by the action of sulfur monochloride,[2] concentrated hydrochloric acid in a sealed tube,[3] and thionyl chloride and pyridine.[4]

During the course of some work on the chlorine substitution products of pentaerythritol, we prepared the dichlorohydrin (III) by a method which prevented the formation of any mono-, tri- or tetrachloro compound, and found that (III) melted at 79–80°, uncor. This is in close agreement with the value reported by Mooradian and Cloke[4] (83° cor.) but differs significantly from those of Bougault[2] (65°) and Fecht[3] (95°), who probably did not have the pure compound.

In our preparation of (III) 2,2-dimethyl-5,5-bis-(hydroxymethyl)-1,3-dioxane[5] (I) was refluxed in pyridine with *p*-toluenesulfonyl chloride to give 2,2-dimethyl-5,5-bis-(chloromethyl)-1,3-dioxane (II), which on warming with dilute hydrochloric acid gave (III).



Experimental[6]

2,2-Dimethyl-5,5-bis-(chloromethyl)-1,3-dioxane (II).—To a cooled solution of 13.4 g. (0.07 mole) of *p*-toluenesulfonyl chloride (purified) in 30 ml. of pyridine (dried over potassium hydroxide) was added slowly with shaking 6.2 g. (0.035 mole) of 2,2-dimethyl-5,5-bis-(hydroxymethyl)-1,3-dioxane (I), m. p. 126–127°,[5] so that the internal temperature did not rise above 35°. After the addition was completed, the solution was refluxed for sixteen hours, cooled, the precipitated pyridinium *p*-toluenesulfonate filtered with suction and washed with 5 ml. of dry pyridine, and the combined filtrate and washings evaporated under reduced pressure. The residual magma was dissolved in 100 ml. of chloroform, and the chloroform solution was washed with dilute sulfuric acid, saturated aqueous sodium bicarbonate, and distilled water. The crystalline solid remaining after evaporation of the chloroform was recrystallized from methanol–water using decolorizing carbon and dried over sulfuric acid. The yield was 3 g. of II, 40%. A sample, after sublimation at 35–40° at 1 mm., had a m. p. of 48–49°.

Anal.[7] Calcd. for $C_8H_{14}O_2Cl_2$: Cl, 33.30; mol. wt., 213. Found: Cl, 33.42, 33.36; mol. wt., 203, 210 (Rast).

Pentaerythritol Dichlorohydrin (III).—A suspension of 1.5 g. (0.007 mole) of 2,2-dimethyl-5,5-bis-(chloromethyl)-1,3-dioxane (II) in 25 ml. of 0.5 *N* hydrochloric acid was heated on the steam-bath, and the effluent was bubbled through a solution of iodine in 10% sodium hydroxide in order to observe the evolution of acetone (by iodoform formation). After fifteen minutes, a heavy cloudiness appeared in the iodine solution, and after fifty minutes (total time on steam-bath) the hydrolysis appeared to be complete. The acid solution was now evaporated under reduced pressure to a sirupy residue which crystallized on cooling. Recrystallization first from water and then from benzene gave 0.5 g., 41%, of pentaerythritol dichlorohydrin (III). A sample after sublimation in high vacuum melted at 79–80°.

Anal.[7] Calcd. for $C_5H_{10}O_2Cl_2$: Cl, 41.00; OH, 19.65. Found: Cl, 41.36, 41.10; OH, 19.5.

Purification of Pyridinium *p*-Toluenesulfonate.—The pyridinium *p*-toluenesulfonate isolated from the reaction of 2,2-dimethyl-5,5-bis-(hydroxymethyl)-1,3-dioxane (I) with *p*-toluenesulfonyl chloride in pyridine was twice recrystallized from an ethanol–ether mixture and, after drying *in vacuo* at 65°, had a m. p. of 118–119°.[8]

Anal. Calcd. for $C_{12}H_{13}O_3SN$: S, 12.75; neut. equiv., 251. Found: S, 12.62, 12.53, neut. equiv., 253 (by titration with 0.1 *N* sodium hydroxide).

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(1) Present address: National Institute of Health, Bethesda, Md.

(2) Bougault, *Compt. rend.*, **123**, 187 (1896).

(3) Fecht, *Ber.*, **40**, 3888 (1907).

(4) Mooradian and Cloke, This Journal, **67**, 942 (1945).

(5) Orthner, *Ber.*, **61**, 116 (1928).

(6) All melting points are uncorrected.

(7) Microanalyses by Dr. Carl Tiedcke, 366 Fifth Ave., New York, N. Y.

(8) Gebauer-Fülnegg and Riesenfeld, *Monatsh.*, **47**, 185 (1926), reported m. p. 113–115° for this compound obtained by heating *p*-toluenesulfonyl chloride and pyridine in a sealed tube at 140–150°.

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The Heparin of Pig Tissue

By William C. Risser

Heparin, the blood anticoagulant, has been found in most tissues and organs of the animal body.[1] Highly vascular tissues and organs such as lung and liver contain this substance in greatest quantity. Charles and Scott[2] first isolated crystalline barium acid heparinate from ox lung. Jaques, Waters and Charles[3] have isolated the crystalline barium acid salt of heparin from the lungs of the pig and sheep and from the liver of dogs. They found that the biological activity of the heparin salts from the different species varied widely; the potencies of the acid barium salts expressed in Toronto units per mg. were reported to be: dog 240, beef 100, pig 44 and sheep 23. No significant differences in chemical analy-

(1) A. F. Charles and D. A. Scott, *J. Biol. Chem.*, **102**, 431 (1933).

(2) A. F. Charles and D. A. Scott, *Biochem. J.*, **30**, 1927 (1936).

(3) L. B. Jaques and E. T. Waters, *J. Physiol.*, **99**, 454 (1941); L. B. Jaques, *Science*, **92**, 488 (1940); L. B. Jaques, E. T. Waters and A. F. Charles, *J. Biol. Chem.*, **144**, 229 (1942).