2-(2,6-Xyloyl)-4-methylphenol (II, R = H).—The procedure followed for Fries rearrangement was that described for *o*- and *p*-propiophenol in "Organic Syntheses."[3] To a suspension of 7.3 g. (0.055 mole) of aluminum chloride in 75 cc. of carbon disulfide was added 4.4 g. (0.018 mole) of *p*-tolyl 2,6-dimethylbenzoate. The mixture was heated under reflux with stirring for two hours. Then the carbon disulfide was removed and the mixture was heated, with stirring, to 150° and kept at this temperature for one hour. When cooled to room temperature, the reaction mixture formed a hard cake. It was decomposed by heating with dilute hydrochloric acid on the steam-cone. The aqueous mixture was extracted with benzene, and the benzene layer was washed repeatedly with dilute sodium hydroxide solution and finally with water. The benzene solution was treated several times with norite, then evaporated to dryness. The light brown residue separated from methanol as slightly yellow crystals; yield 1 g.; m. p. 89.7–90.7° (cor.).

Anal. Calcd. for $C_{16}H_{16}O_2$: C, 79.96; H, 6.72. Found: C, 79.90; H, 6.88.

The phenol was insoluble in aqueous sodium hydroxide; it reacted readily with bromine in carbon tetrachloride, with the evolution of hydrogen bromide.

2-Mesitoyl-4-methylphenol (II, R = CH_3).—A mixture of 12.7 g. (0.05 mole) of *p*-tolyl mesitoate and 15 g. (0.1 mole) of anhydrous aluminum chloride was heated for two hours at 150°. The mixture was decomposed with hydrochloric acid and the 2-mesitoyl-4-methylphenol purified by treatment with norite and recrystallization from aqueous alcohol; m. p. 86°; yield 8 g.

Anal. Calcd. for $C_{17}H_{18}O_2$: C, 80.29; H, 7.13. Found: C, 80.36; H, 7.15.

The phenol was slightly soluble in aqueous sodium hydroxide solution and gave a blue color with ferric chloride solution.

(3) "Organic Syntheses," Vol. XIII, John Wiley and Sons, Inc., New York, N. Y., 1933, p. 90.

DEPARTMENT OF CHEMISTRY
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Crystalline Calcium Pantothenate

BY HAROLD LEVY, JOHN WEIJLARD AND ERIC T. STILLER

The calcium salts of (+)-, (−)- and *dl*-pantothenic acid have been described in a recent paper from this Laboratory,[1] as microcrystalline, hygroscopic powders which were readily soluble in water and the lower alcohols. The macrocrystalline sodium[2] and other salts[3–5] have been described.

The present paper describes the method of obtaining the macrocrystalline calcium salts, which are non-hygroscopic and much less soluble in water and the lower alcohols.

(1) Stiller, Harris, Finkelstein, Keresztesy and Folkers, THIS JOURNAL, **62**, 1785 (1940).

(2) Gätzi-Fichter, Reich and Reichstein, *Helv. Chim. Acta*, **24**, 185 (1941).

(3) Kuhn and Weiland, *Ber.*, **73**, 971 (1940); **73**, 1134 (1940).

(4) Grüssner, Gätzi-Fichter and Reichstein, *Helv. Chim. Acta*, **23**, 1276 (1940).

(5) Stiller and Wiley, THIS JOURNAL, **63**, 1237 (1941).

Calcium (+)-Pantothenate

Crystallization from Methanol.—Microcrystalline calcium (+)-pantothenate was dissolved in 10 volumes of 99.5% methanol and allowed to stand for several days at room temperature with frequent stirring. Fine needles were gradually deposited and finally a mass of matted fine needles was obtained. The product was filtered, washed with methanol and dried at 80° *in vacuo*. The solvent of crystallization was readily removed at that temperature: $[\alpha]^{24}D$ +28.2° (*C*, 1% in H_2O); biological potency 108%; m. p. 195–196°. The crystalline salt was recrystallized twice from methanol and showed no change in physical properties.

Anal. Calcd. for $Ca(C_9H_{16}O_5N)_2$: C, 45.35; H, 6.77. Found: C, 45.21; H, 6.69.

Crystallization from Ethanol.—The salt was crystallized from absolute ethanol as above and dried at 100° *in vacuo;* m. p. 195–196°; $[\alpha]^{25}D$ +25.8 (*C*, 1% H_2O).

Anal. Calcd. for $Ca(C_9H_{16}O_5N)_2$: C, 45.35; H, 6.77. Found: C, 45.40; H, 6.70.

Crystallization from Isopropanol.—The salt crystallized well in clusters of fine needles, which contained 1/2 molecule of isopropanol of crystallization. This alcohol of crystallization could not be removed by drying at 80° (1 mm.); m. p. 200–201°; $[\alpha]^{25}D$ +25.5° (*C*, 0.4% in H_2O).

Anal. Calcd. for $Ca(C_9H_{16}O_5N)_2 \cdot 0.5C_3H_8O$: C, 46.23; H, 7.16; N, 5.53. Found: C, 46.04; H, 7.18; N, 5.57.

When this material was recrystallized from methanol or ethanol it crystallized with isopropanol of crystallization which could not be removed by drying at 100° *in vacuo*. In order to obtain anhydrous calcium (+)-pantothenate from the isopropanol solvated salt, it was dissolved in water and concentrated to a sirup. This treatment was repeated in order to remove all of the isopropanol. The residual water was removed by distillation with methanol and the residue was crystallized from methanol as above. The product was dried at 100° *in vacuo* and had m. p. 195–196°; $[\alpha]^{23.5}D$ +27.6° (*C*, 1% in H_2O); biological potency 106%.

Anal. Calcd. for $Ca(C_9H_{16}O_5N)_2$: C, 45.35; H, 6.77. Found: C, 45.48; H, 6.89.

Recrystallization of the Anhydrous Crystalline Salt.—Because of its slight solubility in alcohols, the crystalline salt was first dissolved in water and concentrated to a sirup *in vacuo*. The sirup was then dissolved in methanol and evaporated to dryness in order to remove the water; the methanol treatment was repeated. The residue was dissolved in 10 parts of methanol and allowed to crystallize as above; $[\alpha]^{23.5}D$ +27.7° (*C*, 1% in H_2O). For analysis and assay the sample was dried *in vacuo* at 100°. It showed a biological potency of 110% and m. p. 195–196°.

Anal. Calcd. for $Ca(C_9H_{16}O_5N)_2$: C, 45.35; H, 6.77. Found: C, 45.25; H, 6.75.

Calcium (−)-Pantothenate

One-half gram of the microcrystalline calcium (−)-pantothenate was moistened with 0.2 cc. of water,

10 cc. of methanol was added and the solution was diluted with 10 cc. of acetone. After standing for two weeks, small wart-like clusters of crystals appeared. By using these as seeds, calcium (−)-pantothenate could be crystallized readily from 10% solution in 99.5% methanol. The crystals were washed with methanol and dried *in vacuo* at 100°; m. p. 187.5–189°; $[\alpha]^{25}D$ −27.8° (*C*, 1% in H_2O). The biological potency was practically zero.

Anal. Calcd. for $Ca(C_9H_{16}O_5N)_2$: C, 45.35; H, 6.77. Found: C, 45.30; H, 6.55.

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The Preparation of 2-Bromonaphthalene

BY MELVIN S. NEWMAN AND PAUL H. WISE

Since the replacement of amino groups on the naphthalene nucleus by bromine according to the usual Sandmeyer technique often results in poor yields, we were interested in using the procedure of Schwechten[1] wherein the diazonium salt is treated with mercuric bromide and the solid complex thus produced is dried and heated with sodium bromide. Although Schwechten gave no details concerning the amount of mercuric bromide used, he represented the complex in the case of diazotized 2-naphthylamine as $(C_{10}H_7N_2Br)_2 \cdot HgBr_2$. A search of the literature revealed that investigators who have followed this procedure generally have used mercuric halides far in excess of that required by the formula.[2] In this communication we show that when the amount of mercuric bromide is reduced to that required for the formation of the complex $(C_{10}H_7N_2Br)_2 \cdot HgBr_2$ it is possible to obtain from 53 to 59% of pure 2-bromonaphthalene. Doubling the amount of mercuric bromide used raised the yield to 61–65%, and further increases had no effect.

Experimental

As the result of many experiments, we recommend the following procedure for the preparation of 2-bromonaphthalene. To the cold diazonium solution, prepared as usual from 50 g. (0.35 mole) of 2-naphthylamine, 670 cc. of water, 140 cc. of concentrated hydrochloric acid and 20% sodium nitrite solution, is added with stirring a cold suspension of mercuric bromide formed by treating 57 g. (0.175 mole) of mercuric nitrate with 83 g. of sodium bromide in a total volume of 250 cc. of water. The yellow insoluble complex which separates immediately is collected by filtration, washed with water and acetone, and air dried. The air-dried complex weighs from 137 to 149 g. (94–103% calculated on the basis of the formula $(C_{10}H_7N_2Br)_2 \cdot HgBr_2$). For decomposition, the complex is well mixed with 300 g. of finely ground sodium bromide and added in several portions through a wide rubber tube to a flask heated in a glycerol bath at 90° and fitted with a reflux condenser.[3] After each addition of complex a vigorous gas evolution occurs but no tendency to explode was ever noticed.

After the decomposition is complete, the organic matter is taken into benzene and washed with dilute acid and alkali. The 2-bromonaphthalene is twice vacuum distilled, b. p. 103–104° at 4 mm., and crystallized from 110 cc. of hot alcohol after addition of 4 cc. of hot water. In two crops, there is obtained 38.4–43.1 g. (53–59%) of almost colorless plates of 2-bromonaphthalene, m. p. 55.0–56.4°, cor. The remainder of the organic material is mostly accounted for as dark tar and high-boiling matter. Very little if any naphthol is produced.

Using a similar procedure, 1-chloro-2-bromonaphthalene, m. p. 55.0–56.5°, was obtained in 46% over-all yield from 1-chloro-2-acetylaminonaphthalene.[4]

(1) Schwechten, *Ber.*, **65**, 1605 (1932).

(2) For example, see Ruzicka and Mörgeli, *Helv. Chim. Acta*, **19**, 377 (1936); and Bachmann and Boatner, THIS JOURNAL, **58**, 2194 (1936).

(3) See sketch in Fieser, "Experiments in Organic Chemistry," D. C. Heath and Co., New York, N. Y., 1935, p. 287.

(4) Hodgson and Leigh, *J. Chem. Soc.*, 1352 (1937).

CHEMICAL LABORATORIES
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The Action of *t*-Butylmagnesium Chloride on Propylene Oxide

BY PHILIP G. STEVENS[1] AND JAMES A. MCCOUBREY[2]

In view of the recent paper by Huston and Agett[3] on the reaction of the Grignard reagent with ethylene oxide, we wish to report briefly our work in the same field. As we were interested primarily in a stereochemical problem, we used propylene oxide and *t*-butylmagnesium chloride, hoping to obtain 4,4-dimethylpentanol-2.[4]

Our best results were obtained by allowing the oxide (220 g.) and the Grignard reagent (from 150 g. of magnesium) to stand at about 25° for seven weeks. The mixture was decomposed with ammonium sulfate, and most of the ether (5 liters) from the extractions, supernatant on one liter of 10% caustic, was removed by fractional distillation. To destroy the chlorhydrin, the residual liquor was refluxed with excess caustic for five hours and then steam-distilled. Thus a chlorine-free product was obtained. Fractional distillation yielded the following fractions boiling above 130° at 762 mm.: 1, 130–134, 0.5 g.; 2, 134–137, 11 g.; 3, 137–138, 39 g.; or a combined yield of 11%, and a residue of 42 g. Two grams of fraction 3 gave 4 g. of crude 3,5-dinitrobenzoate, which after repeated crystalliza-

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(3) Huston and Agett, *J. Org. Chem.*, **6**, 123 (1941).

(4) Levene and Walti, *J. Biol. Chem.*, **94**, 367 (1931).