lating this compound, and because future experiments with substituted dibenzoselenophenes are expected to yield substituted biphenyls.

Experimental

Raney Nickel.—The Raney nickel was prepared according to the directions of Pavlic and Adkins.[6]

Deselenization.—A typical experiment follows: In a 3-necked r.b. flask equipped with a mechanical stirrer and reflux condenser, was placed 100 ml. of benzene, 20 ml. of ethanol, 35 g. of Raney nickel and 1.5 g. of dibenzoselenophene oxide. Refluxed in oil-bath for 5 hr. The unreacted solid was filtered and washed with 40 ml. of benzene (nickel burst into flames on drying). Combined solvents were washed twice with 30 ml. of concentrated H_2SO_4 and twice with water. Benzene was removed, and residue recrystallized from ethanol–water; yield 0.67 g. of biphenyl (72%), m.p. 67–68°. One further recrystallization brought m.p. to 71° (reported 70°[7]); no depression on admixture with authentic sample.

Acknowledgment.—It is a pleasure to acknowledge the assistance of Dr. J. R. McCormick who suggested the method some years ago.

(6) A. A. Pavlic and H. Adkins, THIS JOURNAL, **68**, 1471 (1946).

(7) R. L. Shriner and R. C. Fuson, "The Systematic Identification of Organic Compounds," Second Edition, John Wiley and Sons, N. Y., 1940, p. 218.

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The Isolation of Bufotenine from *Piptadenia peregrina*

BY VERNER L. STROMBERG

RECEIVED NOVEMBER 18, 1953

The inhalation of a narcotic snuff by the natives of Haiti was a common practice at the time of the discovery of the West Indies. This snuff, called cohoba, was used by the necromancers or priests in their ceremonies and was supposed to enable them to communicate with unseen powers.

The ceremonial use of cohoba was described as early as 1496 by Ramon Pane who was with Columbus on his second voyage, but in later years cohoba was confused with tobacco.

The chemistry of this snuff has never been studied although the leguminous shrub *Piptadenia peregrina* is now known to be its source.[1]

In the present work there was isolated from the seeds of this plant a crystalline organic base, m.p. 146–147°, with empirical formula $C_{12}H_{16}N_2O$ in 0.94% yield.

The ultraviolet absorption spectrum in 0.1 *N* hydrochloric acid showed a maximum at 277 mμ, a shoulder with a second maximum at 295 mμ and a minimum at 247 mμ. In 0.1 *N* sodium hydroxide the absorption spectrum shows a shift of the second maximum to 322 mμ. This shift is similar to that observed for the vasoconstrictor 5-hydroxytryptamine (serotonin).[2]

A methiodide, picrate, oxalate and *m*-nitrobenzoate were prepared. The melting points were in good agreement with the literature values for bufotenine

	Bufotenine m.p., °C.	Piptadenia alkaloid m.p., °C.
Base	147[3]	146–147
Red picrate	178[3]	176–177
Methiodide	210[3]	213–214
Oxalate	84–88[4]	82–84
m-Nitrobenzoate	258[3]	255–257

The infrared absorption spectrum of the picrate was identical with that of a picrate of a synthetic sample kindly supplied by Dr. M. E. Speeter of the Upjohn Company.

The seeds of *Piptadenia peregrina* evidently constitute an excellent source of bufotenine. The leaves and branches do not give an alkaloid test with Meyer's or silicotungstic acid reagents. The seed pods give only a slight positive test.

Experimental

Isolation of Bufotenine.—*Piptadenia peregrina* seeds, 891 g., secured from Las Mesas, Puerto Rico,[5] were ground in a Waring blendor and extracted twice with 4 l. of 1% ethanolic tartaric acid solution for 2 hours at 55°. The resulting 8 l. of solution was filtered, concentrated to a volume of 1 l. and diluted with 2.5 l. of water. It was acidified with 200 ml. of 2 *N* hydrochloric acid. The solution was filtered and extracted six times with 200-ml. portions of chloroform. The chloroform solution was discarded. The acid solution was neutralized with solid sodium carbonate. This was divided into two parts and each part was extracted seven times with 200-ml. portions of chloroform. The combined chloroform solutions were extracted with 2 *N* hydrochloric acid. This acid solution was made basic with solid sodium carbonate and the base was re-extracted with chloroform. After drying, the solvent was removed to provide 20.95 g. (2.45%) of mixed organic bases.

A crude alkaloid fraction, 10.11 g., was subjected to chromatographic separation on alumina (Merck Reagent). An ethyl acetate fraction contained 0.12 g. of a brown oil. The bufotenine fraction was eluted with 3:1 ethyl acetate–ethanol to give 7.66 g. of material. Several recrystallizations from ethyl acetate gave 4.09 g. (40% of the alkaloid fraction), m.p. 146–147°. Bufotenine represents 0.94% of the Piptadenia seed. The material remaining on the column was eluted with ethanol to give 2.31 g. of residue.

(3) H. Wieland, W. Kanz and H. Mittasch, *Ann.*, **513**, 1 (1934).

(4) T. Wieland and W. Motzel, *ibid.*, **581**, 10 (1953). The oxalate as originally prepared by H. Wieland had a melting point of 96.5° and was a monohydrate. The oxalate prepared here is a half-hydrate (*Anal.* Calcd. for $2C_{12}H_{16}N_2O \cdot 2C_2H_2O_4 \cdot H_2O$: C, 55.44; H, 6.31; N, 9.24. Found: C, 55.58; H, 6.41; N, 9.05) and is apparently the same as the material reported by T. Wieland without analytical data.

(5) Through the Agricultural Research Service, Plant Exploration and Introduction, United States Department of Agriculture

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The Specific Rotation of Isocolchicine[1]

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RECEIVED NOVEMBER 13, 1953

During the course of our work on the chemistry of colchicine derivatives we observed that the specific rotation of solutions of isocolchicine changed with time. To our knowledge, this is the first recorded instance of this phenomenon in the col-

(1) This investigation was supported (in part) by a grant from the National Cancer Institute of the National Institutes of Health, Department of Health, Education and Welfare.

(1) W. E. Safford, *J. Wash. Acad. Sci.*, **6**, 15, 547 (1916).

(2) V. Erspamer and B. Asero, *Nature*, **169**, 800 (1952).

chicine series[2] although other workers have noted the change in specific rotation of colchicine and desmethylcolchicine with solvent and concentration.[3,4]

Experimental

The specific rotation[5] of a sample of isocolchicine (m.p. 219–221°; calcd. for $C_{22}H_{25}NO_6$: C, 66.15; H, 6.31. Found: C, 65.94; H, 6.38), taken five minutes after preparation of a solution in pure chloroform (*c* 0.997), was −319°. This value decreased numerically with time as shown in Table I. With solutions of isocolchicine in chloroform containing 0.5–2.0% alcohol, a similar effect was observed but *not* with solution in alcohol nor with alcohol containing up to 0.5% chloroform. Colchicine did not show this behavior. This is in agreement with the findings of Bellet.[4]

A solution which had reached an equilibrium value (Sample 2, Table I) was evaporated to dryness on the steam-bath at atmospheric pressure. The residue was reconstituted in chloroform and the rotation was redetermined, $[\alpha]_D$ −260°. When the residue was dried for seven hours at 100° *in vacuo*, or heated with alcohol and water and then dried *in vacuo*, the rotation returned to −305°. However, when the residue was dissolved in ethyl acetate and evaporated to dryness three times,[6] the rotation of the reconstituted chloroform solution rose to the original value and again decreased numerically to the equilibrium value after standing 4.5 hours (sample 4, Table I). A plot of the log % change in specific rotation against time, using the average values given in Table I, is a straight line (Fig. 1).

These data suggest that the change is due to the formation of a stable complex between isocolchicine and chloroform. The nature of this complex is under investigation elsewhere.[3]

The infrared spectrum (*c* 10 mg./cc. in chloroform) exhibited no characteristics which could be associated with changes in the specific rotation of isocolchicine samples which had stood for 0, 1, 2 and 5 hours after solution in chloroform.

TABLE I

SPECIFIC ROTATION OF ISOCOLCHICINE IN CHLOROFORM

Sample →	1	2	3	Ave.	4
c →	0.997	1.000	1.000		1.000
t, min.			$[\alpha]^{22}D$		
0[a]	−319°	−317°	−321°	−319°	−322°
15	310	308	...	309	...
30	300	...	298	299	...
60	286	281	288	285	283
120	269	265	273	269	266
240	260	254	262	259	259
360	259	253	260	257	...

[a] Initial readings were taken within the first five minutes after solution was effected.

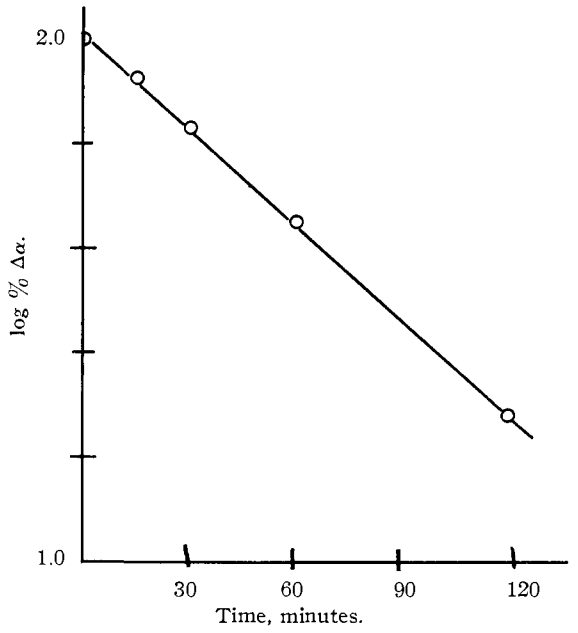

Fig. 1.—Change in specific rotation of isocolchicine with time.

(2) In a personal communication Dr. Henry Rapoport has informed us that he has observed similar variations in the specific rotation of a number of isocolchicine derivatives and will report his findings in greater detail at a later date.

(3) P. Bellet and P. Regnier, *Ann. pharm. franç.*, **10**, 340 (1952).

(4) R. M. Horowitz and G. E. Ullyot, unpublished data from these laboratories.

(5) Readings were taken on a Rudolph Precision Polarimeter in a 1-dm. tube at 24–26° with an estimated error of ±1.5°.

(6) The use of ethyl acetate was suggested by Dr. Rapoport.

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The Preparation of L-, D- and DL-Kynurenine[1]

BY J. L. WARNELL AND CLARENCE P. BERG

RECEIVED NOVEMBER 5, 1953

The purpose of this communication is to present a convenient procedure for the preparation of kynurenine from N-acetyltryptophan. The method is based on the ozonolysis procedure outlined by Witkop,[2] who used free DL-tryptophan. Protection of the amino group by acetylation prevents the extensive decomposition which otherwise occurs and permits the isolation of an initially purer and more efficiently recrystallizable kynurenine sulfate. The method has been found preferable to other procedures which we have tested. Isolation of kynurenine from the urine of rabbits fed tryptophan affords relatively low yields of a product difficult to purify.[3,4] The synthesis of kynurenine from *o*-nitrophenacyl bromide by Dalgliesh's modification[5] of the method of Butenandt and others,[6] yields an excellent product, but the method becomes highly involved if the starting material must also be prepared. The procedure outlined is adaptable to the preparation of L-, D- or DL-kynurenine in good yield from the corresponding isomer of acetyltryptophan.

Experimental

N-Acetyl-L- and N-acetyl-D-tryptophan were obtained by resolution of the DL-form with brucine.[7] Access of moisture to the solvent used was avoided. From anhydrous ethanol the brucine salt of N-acetyl-D-tryptophan separated in rosettes, $[\alpha]^{25}D$ −18.0°, *c* 1% in water; from anhydrous methanol its diastereoisomer crystallized in rectangular prisms, $[\alpha]^{25}D$ +0.5°. Removal of the brucine yielded N-acetyltryptophans which showed $[\alpha]^{25}D$ −29.0° and $[\alpha]^{25}D$ +30.1°, *c* 1% in water +1 equivalent of NaOH, in good agreement with recorded values.[8,9]

(1) From a thesis submitted by J. L. Warnell in partial fulfillment of the requirements for the degree of Master of Science in the Graduate College of the State University of Iowa.

(2) B. Witkop and G. Graser, *Ann. Chem.*, **556**, 103 (1944).

(3) Y. Kotake and J. Iwao, *Z. physiol. Chem.*, **195**, 139 (1931).

(4) R. E. Kallio and C. P. Berg, *J. Biol. Chem.*, **181**, 333 (1949).

(5) C. E. Dalgliesh, *J. Chem. Soc.*, 137 (1952).

(6) A. Butenandt, W. Weidel, R. Weichert and W. von Derjugin, *Z. physiol. Chem.*, **279**, 27 (1943).

(7) A. C. Shabica and M. Tishler, THIS JOURNAL, **71**, 3251 (1949). The N-acetyl-DL-tryptophan used was kindly provided by The Dow Chemical Company.

(8) V. du Vigneaud and R. R. Sealock, *J. Biol. Chem.*, **96**, 511 (1932).

(9) C. P. Berg, *ibid.*, **100**, 79 (1933).