carbon at the 4-position. Therefore, trichloroacetonitrile chemistry based on the low electronic density on the carbon in the nitrile may not be used as a basis on which to predict the reactions of I.

It was reported that the higher the electronic density on a carbon atom carrying a nitrile function, the greater is the intensity of the infrared absorption resulting from vibration of the nitrile bond.[11a] There are many exceptions to this generality[11b] but the correlation is sometimes true in a closely related class of compounds and perhaps is valid in a comparison of isonicotinonitrile and its methiodide (I). Whereas isonicotinonitrile exhibited characteristic nitrile absorption, no absorption appeared in the same spectral region of I. This further reflects the strong electrophilic character of the 4-position ring carbon of I.

Experimental[12]

4-Cyano-1-methylpyridinium iodide (I) was obtained as bright orange needles, m.p. 200–202° dec., reported,[13] 197–198.5°. Infrared absorption maxima in potassium bromide using a Perkin–Elmer Infracord, μ (s, strong; m, medium; w, weak) 3.75 w, 3.25 s, 6.10 m, 6.85 m, 6.95 m shoulder, 7.5 w, 7.8 m shoulder, 7.9 s, 8.18 w, 8.31 w, 8.5 m, 8.7 w, 9.5 w, 11.66 s, 11.89 w, 13.98 w.

Anal. Calcd. for $C_7H_7IN_2$: C, 34.2; H, 2.9; I, 51.6. Found: C, 34.4; H, 3.0; I, 51.6.

4-Amino-1-methylpyridinium Iodide (II).—To 1.8 g. (0.0193 mole) of 4-aminopyridine in 20 ml. of acetone was added 3.0 ml. of methyl iodide. Within 5 min. a crystalline solid precipitated. The mixture was allowed to stand overnight, then filtered to give 3.0 g. (65%) of a colorless solid, m.p. 179–82°.

Anal. Calcd. for $C_6H_9IN_2$: C, 30.5; H, 3.8; I, 53.8. Found: C, 30.2; H, 3.9; I, 53.0.

Ammonolysis of 4-Cyano-1-methylpyridinium Iodide.—A solution of 2.5 g. of 4-cyano-1-methylpyridinium iodide in 12 ml. of concentrated ammonium hydroxide was heated overnight at 70° in a 200-ml. capped bottle. The reaction mixture was added to a 3 ft. × 5/8 in. column of Woelm basic aluminum oxide prepared using *n*-butyl alcohol. The chromatogram was developed using methanol. The main band was purple; remaining colored zones were red and orange-brown. The purple zone was collected, ether was added to precipitate 1.0 g. of a purple solid, m.p. 185–189°, whose infrared absorption spectrum corresponded exactly to that of an authentic sample of 4-amino-1-methylpyridinium iodide. It was found later that repeated treatment with charcoal in methanol will remove the color.

Isonicotinimidic acid ethyl ester dihydrochloride was obtained as colorless crystalline solid, m.p. 240–250° dec.; reported,[14] 252–253°. A potentiometric titration of this crude material indicated the presence of equivalent amounts of a strong and weak acids, approximate pK_a values, 3.3 and 9.0.

Isonicotinimidic Acid Ethyl Ester.—Crude isonicotinimidic acid ethyl ester dihydrochloride (60 g.) was added to 1.0 l. of 10% potassium carbonate at 0°. The cold solution was extracted with three 160-ml. portions of ethyl ether. The etherates were combined, dried over potassium carbonate, and evaporated on a rotating evaporator to give 28 g. of a colorless liquid, b.p. 67° (0.28 mm.).

Anal. Calcd. for $C_8H_{10}N_2O$: C, 64.0; H, 6.7; N, 18.7. Found: C, 64.4; H, 6.8; N, 18.3.

Isonicotinimidic Acid Ethyl Ester Methiodide.—A solution of isonicotinimidic acid ethyl ester (6.5 g., 0.043 mole), methyl iodide, (6.0 g., 0.043 mole), and 25 ml. of acetone was allowed to stand at room temperature for 3 hr., then filtered to give 5.6 g. of a yellow crystalline solid. The product was recrystallized from absolute ethanol to give 4.4 g. (35.1%) of yellow needles, m.p. 193–194° dec.

Anal. Calcd. for $C_9H_{13}IN_2O$: C, 37.1; H, 4.5; I, 43.4. Found: C, 37.1; H, 4.5; I, 43.6.

Isonicotinamidine Hydrochloride Hydrate.—The method described by Gardner, Wenis, and Lee[15] was followed in that 3.5 g. (0.023 mole) of isonicotinimidic acid ethyl ester, 15 ml. of ethanol, 5 ml. of water, and 1.2 g. of ammonium chloride were combined and allowed to reflux for 4 hr. The solution was cooled to room temperature and filtered to give 2.6 g. (56%) of a colorless crystalline solid, m.p. 246–248°; reported,[15] 242–243°; reported,[16] 230–232°.

Anal. Calcd. for $C_6H_8N_3Cl \cdot 2\ 1/2\ H_2O$: C, 35.7; H, 6.5; neut. equiv., 202. Found: C, 35.7; H, 6.2; neut. equiv., 200; pK_a 9.9.

4-Amidino-1-methylpyridinium Iodide Hydroiodide.—A methanolic solution (10 ml.) of isonicotinamidine hydrochloride (0.5 g., 0.0025 mole) and methyl iodide (2 g.) was refluxed for 18 hr. Ether was added to precipitate 0.7 g. (72%) of an orange solid decomposing over 206°. The conversion of a chloride salt to the corresponding iodide by the addition of methyl iodide was noted previously.[17]

Anal. Calcd. for $C_7H_{11}I_2N_3$: C, 21.5; H, 2.8; neut. equiv., 391. Found: C, 21.7; H, 2.9; neut. equiv., 394; pK_a 8.5.

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(12) All melting points are uncorrected. The pK_a values were determined at room temperature (25–27°) from potentiometric titration data, assuming pK_a to be the pH of half neutralization. In each case approximately 100 mg. of compound dissolved in 10 ml. of water was titrated with 0.1 *N* sodium hydroxide or hydrogen chloride.

(13) E. M. Kosower, *J. Am. Chem. Soc.*, **80**, 3253 (1958).

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(16) H. L. Yale, K. Losee, J. Martins, M. Holsing, F. M. Perry, and J. Bernstein, *J. Am. Chem. Soc.*, **75**, 1933 (1953).

(17) B. E. Hackley, Jr., E. J. Poziomek, G. M. Steinberg, and W. A. Mosher, submitted to the *J. Org. Chem.*, **27**, 4220 (1962).

Vincaminyl Alcohol and Vincamine Nitrite

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Plat, Manh, Le Men, Janot, Budzikiewicz, Wilson, Durham, and Djerassi have recently reported the conversion of vincamine into eburnamonine by means of lithium aluminum hydride.[1]

In the course of our investigations of the structures of vincamine and other alkaloids of *Vinca minor*, prior to the publication of the structure of vincamine by Trojanek, *et al.*,[2] we also studied the reduction of vincamine by lithium aluminum hydride. By means of lithium aluminum hydride vincamine was reduced to an amino alcohol which we have named vincaminyl alcohol. Reduction of the carbomethoxy group in vincamine[3] to a primary alcoholic group was quite evident from the anal-

(1) M. Plat, D. D. Manh, J. Le Men, M. M. Janot, H. Budzikiewicz, J. M. Wilson, L. J. Durham, and C. Djerassi, *Bull. soc. chim. France*, 1082 (1962). Details of the methods used in achieving this unusual conversion were not given.

(2) J. Trojánek, O. Štrouf, F. Holubek, and Z. Čekan, *Tetrahedron Letters*, **20**, 702 (1961).

(3) E. Schlittler and A. Furlenmeier, *Helv. Chim. Acta*, **36**, 2017 (1953).

ysis and from the infrared spectrum. While the ester band present in the spectrum of vincamine at 1755 cm.$^{-1}$ disappeared, a new band at 3510 cm.$^{-1}$ appeared which was assigned to a primary alcoholic group. There was no absorption in the region between 5 and 6 μ which would be expected if a keto group were present in the molecule as is the case with eburnamonine.[4] The ultraviolet spectrum of vincaminyl alcohol was quite similar to that of vincamine and many 2,3-substituted indole derivatives.[4]

A mononitrite of vincamine which could be reconverted into vincamine by treatment with hydrochloric acid has been made. Similarily, a mononitrite of yohimbine has been prepared.

Experimental

Vincaminyl Alcohol.—A solution of 200 mg. of vincamine[5] in 25 ml. of tetrahydrofuran which had been dried by sodium, was added dropwise in 15 min. with stirring to a suspension of 100 mg. of lithium aluminum hydride in 20 ml. of dry ether. Stirring was continued, while the reaction mixture was gently refluxed for 1 hr. After cooling in an ice bath, 5 ml. of water was gradually added to decompose the excess of lithium aluminum hydride. After addition of 40 ml. of 10% sodium hydroxide solution, the mixture was extracted three times with ether (50 ml. each). The ether extract was washed with water, dried over anhydrous sodium sulfate, and distilled. The yellowish, amorphous solid which remained (180 mg.), was crystallized from benzene in needles; m.p. 180° (dec.). For analysis the compound was dried at 100° *in vacuo* over phosphorus pentoxide.

Anal. Calcd. for $C_{20}H_{26}N_2O_2$: C, 73.60; H, 8.03; N, 8.59; 3 active H, 0.93. Found: C, 73.41; H, 7.99; N, 8.80; active H, 0.88.

Ultraviolet Spectrum.—Maxima at 232 mμ (ϵ 27300); 280 mμ (ϵ 7200); minimum at 250 mμ (ϵ 1670).

Infrared Spectrum.—Sharp band at 3510 cm.$^{-1}$ (due, apparently, to the primary alcohol group resulting from reduction of the carbomethoxy group), broad band at 3325 cm.$^{-1}$ (apparently the original associated OH), strong band at 738 cm.$^{-1}$, no ester nor amide band in the region 1650 cm.$^{-1}$ to 1900 cm.$^{-1}$.

Vincamine Nitrite.—To an ice-cooled solution of 100 mg. of vincamine in 7.0 ml. of 70% acetic acid was gradually added within 0.5 hr. a cold solution of 400 mg. of sodium nitrite in 10 ml. of water. The reaction mixture from which yellowish needles began to separate was kept in the refrigerator for 24 hr. The yellowish solid (50 mg.) was separated by filtration; an additional 20 mg. were obtained from the mother liquor on standing for a few days. Vincamine nitrite was recrystallized from methanol–ether as needles, m.p. 224–225° (dec.). For analysis the compound was dried at 100° *in vacuo* over phosphorus pentoxide.

Anal. Calcd. for $C_{21}H_{27}N_3O_5 \cdot H_2O$: C, 60.13; H, 6.97; N, 10.02. Found: C, 60.75, 60.46; H, 6.58, 6.44; N, 9.89.

Ultraviolet Spectrum.—Maxima found at 223 mμ (ϵ 29500), 275 mμ (ϵ = 7370); minimum at 243 mμ (ϵ 2060).

Infrared Spectrum.—Strong ester band at about 1725 cm.$^{-1}$, and strong band at about 1380 cm.$^{-1}$.

When vincamine nitrite was dissolved in dilute hydrochloric acid and then the solution made alkaline with ammonia, vincamine was obtained. It was characterized by its melting point, mixed melting point, and infrared spectrum.

Yohimbine Nitrite.—Yohimbine (100 mg.) was dissolved in 2 ml. of acetic acid; 2 ml. of water was then added, and the solution was cooled in an ice bath. A solution of 200 mg. of sodium nitrite in 2 ml. of water was gradually added in the course of about 30 min. The yellow solution was then kept in the refrigerator, when a yellow precipitate slowly separated. After 24 hr., the precipitate (25 mg.) was filtered. It crystallized from methanol in yellowish elongated plates, m.p. 290° (dec.). For analysis the compound was dried at 100° over P_2O_5 *in vacuo*.

Anal. Calcd. for $C_{21}H_{27}N_3O_5 \cdot H_2O$: C, 60.13; H, 6.97; N, 10.02. Found: C, 60.71; H, 6.31; N, 9.96.

Infrared Spectrum.—Strong ester band at about 1725 cm.$^{-1}$ and a strong band at about 1380 cm.$^{-1}$.

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(4) N. Neuss, "Physical Data of Indole and Dihydroindole Alkaloids," 4th ed., Lilly Research Laboratories, Indianapolis, Ind., 1960.

(5) Prepared by a method for the isolation of vincamine from *Vinca minor* which was developed in this laboratory by Dr. Friedrich Dursch. Final separation of the alkaloid depended upon a 950 stage Craig distribution between ether and a buffer solution at pH 5.5.

A Convenient Synthesis of Phenyldiazomethane

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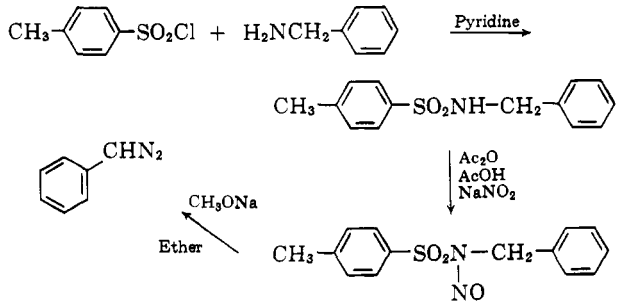
In connection with some other work, a convenient method for the preparation of phenyldiazomethane was desired. The available methods[1–3] are good but all require the use of somewhat unstable intermediates and long periods of time. We have therefore extended the procedure of de Boer and Backer[4] for diazomethane to phenyldiazomethane according to the following sequence of reactions. This procedure will supplement the already existing methods.



N-Benzyl-*p*-toluenesulfonamide was prepared essentially according to the procedure of Holmes and Ingold.[5] An 81% yield of the desired *N*-nitroso-*N*-benzyl-*p*-toluenesulfonamide[6] was achieved following a general procedure of White,[7] using a large excess of sodium nitrite. The nitrosoamide is indefinitely stable at room temperature; after six months, there was no change in its infrared spectrum or its melting point. Kirmse and Horner[8] had obtained the characteristic red color of phenyldiazomethane upon reaction of this nitrosamide with sodium methoxide. Indeed, by a modification of their procedure, an ethereal solution of phenyldiazomethane was obtained. The yield of the benzyl ester of 3,5-dinitrobenzoic acid formed from the reaction of this solution with a slight excess of the acid was 60%.

Experimental

***N*-Benzyl-*p*-toluenesulfonamide.**—An 87% yield of this compound was obtained by the procedure of Holmes and Ingold.[5]

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(2) C. D. Gutsche and E. F. Jason, *J. Am. Chem. Soc.*, **78**, 1184 (1956).
(3) P. Yates and B. L. Shapiro, *J. Org. Chem.*, **23**, 759 (1958).
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(5) E. L. Holmes and C. K. Ingold, *J. Chem. Soc.*, **127**, 1800 (1925).
(6) T. Takizawa, *J. Pharm. Soc. Japan*, **70**, 490 (1950).
(7) E. H. White, *J. Am. Chem. Soc.*, **77**, 6008 (1955).
(8) W. Kirmse and L. Horner, *Chem. Ber.*, **89**, 1674 (1956).