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Condensation of 1,2-dialkylhydrazines with epichlorohydrin affords 1,2-dialkyl-4-pyrazolidinols in moderate yield.

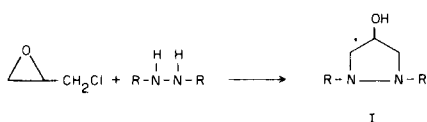
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In connection with other work (1) we required a series of 1,2-dialkyl-4-pyrazolidinols (Ia-f). A survey of the literature revealed that a related compound was obtained by Gerhardt (2) in 1891. In that early work, treatment of epichlorohydrin with phenylhydrazine in ether afforded 1-phenyl-4-pyrazolidinol. Modification of this method by the use of benzene in place of ether permitted the use of a shorter reaction time (3). These workers (3) also described the preparation of the *p*-tolyl homolog.

We have found that epichlorohydrin reacts readily with 1,2-dialkylhydrazines and affords 1,2-dialkyl-4-pyrazolidinols (Ia-f) in yields of 31-53% (Table I) (Scheme I). The structure of these compounds was confirmed by infrared spectral data and elemental analyses. Hydroxyl absorption occurs in the range of 3140-3445 cm^{-1} in chloroform.

An attempt to prepare 1,2-diphenyl-4-pyrazolidinol from epichlorohydrin and hydrazobenzene was unsuccessful. 1-Methyl-2-phenyl-4-pyrazolidinol (4) can be obtained in low yield from 1-methyl-2-phenylhydrazine and the above chlorohydrin.

Scheme I



EXPERIMENTAL (5)

Preparation of Hydrazines.

1,2-Dimethylhydrazine (6), 1,2-diethylhydrazine (7), 1,2-dipropylhydrazine (7), 1,2-diisopropylhydrazine (7) and 1,2-di-

benzylhydrazine (8) were prepared by reported methods. 1,2-Diisobutylhydrazine was obtained by the lithium aluminum hydride reduction of isobutylideneazine (9) according to the method of Renaud and Leitch (7). A 71% yield of a colorless product was obtained, b.p. 64° (11 mm), n_D^{24} 1.4312 [lit (10) b.p. 169.5-170°; 70.5° (16 mm) and 63.5° (10 mm)].

Preparation of the 1,2-Dialkyl-4-pyrazolidinols (Ia-f).

A typical reaction is described, that for the preparation of 1,2-diethyl-4-pyrazolidinol (Ib) (Table I).

A solution of 16.1 g. (0.183 mole) of 1,2-diethylhydrazine and 11.3 g. (0.122 mole) of epichlorohydrin in 90 ml. of anhydrous ether was stored at room temperature for one week. The mixture was filtered to remove the precipitated salt, and the ether was evaporated under reduced pressure. The residue was distilled and gave 9.3 g. (53%) of a colorless oil, b.p. 54° (0.03 mm), n_D^{24} 1.4737. A picrate was prepared and recrystallized from absolute ethanol, m.p. 116-116.5°.

REFERENCES AND NOTES

- (1) Abstracted in part from the Ph.D. dissertation submitted by M. J. Kornet to the Graduate College of the University of Illinois at the Medical Center, 1963.
- (2) F. Gerhardt, *Ber.*, **24**, 352 (1891).
- (3) I. L. Finar and K. E. Godfrey, *J. Chem. Soc.*, 2295 (1954).
- (4) P. Bouchet and C. Coquelet, *Bull. Soc. Chim. France*, 3159 (1973).
- (5) The melting points and boiling points are uncorrected. The analyses were performed by Dr. Kurt Eder, Geneva, Switzerland and Drs. Weiler and Strauss, Oxford, England. The infrared spectra were determined on a Beckman IR-4 spectrophotometer using sodium chloride optics.
- (6) R. L. Hinman, *J. Am. Chem. Soc.*, **78**, 1645 (1956).
- (7) R. Renaud and L. C. Leitch, *Can. J. Chem.*, **32**, 545 (1954).
- (8) K. A. Taipale, *Chem. Zentralbl.*, **1**, 902 (1924).
- (9) A. Franke, *Monatsh. Chem.*, **19**, 531 (1898).
- (10) K. A. Taipale, *J. Russ. Phys. Chem. Soc.*, **56**, 81 (1925).

Table I
Physical Properties of 1,2-Dialkyl-4-pyrazolidinols (Ia-f)

Compound	R	Reaction Time (Days)	Boiling Point, °C (mm) or Melting Point	n_D^{20} (°C)	Yield %	Recrystallization Solvent (a)	Formula	C		H		N	
								Calcd.	Found	Calcd.	Found	Calcd.	Found
Ia	CH ₃	10 (b)	56 (0.1)	1.4750 (26)	36		C ₅ H ₁₂ N ₂ O	51.70	51.92	10.41	10.53	24.12	23.84
Ia-picrate			175-176			A	C ₁₁ H ₁₅ N ₅ O ₈	38.26	38.77	4.38	4.59	20.29	20.20
Ib	CH ₃ CH ₂	7	54 (0.03)	1.4737 (24)	53		C ₇ H ₁₆ N ₂ O	58.43	58.18	11.18	11.61	19.43	19.18
Ib-picrate			116-116.5			A	C ₁₃ H ₁₉ N ₅ O ₈	41.82	42.27	5.13	5.19	18.76	19.15
Ic	CH ₃ (CH ₂) ₂	7	60-62 (0.05)	1.4679 (25)	42		C ₉ H ₂₀ N ₂ O	62.75	63.22	11.70	12.18	16.26	15.90
Ic-picrate			91.5-93.5			A	C ₁₅ H ₂₃ N ₅ O ₈	44.88	44.78	5.78	5.54	17.45	17.35
Id	(CH ₃) ₂ CH	73	54 (0.09)	1.4718 (21.5)	40		C ₉ H ₂₀ N ₂ O	62.75	63.26	11.70	11.78	16.26	16.20
Id-picrate			122-123			A	C ₁₅ H ₂₃ N ₅ O ₈	44.88	44.67	5.78	5.56	17.45	17.68
Ie	(CH ₃) ₂ CHCH ₂	(c)	66 (0.05)	1.4512 (26)	31		C ₁₁ H ₂₄ N ₂ O	65.95	65.87	12.08	11.96	13.99	14.05
Ie (d)			97.5-98.5			B	C ₁₈ H ₂₆ N ₄ O ₆	54.81	54.65	6.64	6.88	14.21	14.03
If	C ₆ H ₅ CH ₂	18	91.5-92		41		C ₁₇ H ₂₀ N ₂ O	76.08	76.42	7.51	7.67	10.44	9.99
If (c)			66.5-67			A	C ₂₄ H ₂₃ N ₃ O ₄	69.05	69.37	5.55	5.61	10.07	10.23

(a) A = absolute ethanol, B = 95% ethanol, C = ligroin (b.p. 60-90°), then benzene. (b) Stored in refrigerator at 4°. (c) Reaction effected by refluxing for 7 hours in benzene. (d) 3,4-Dinitrobenzoate. (e) *p*-nitrobenzoate.