SYNTHESES IN THE PYRIDINE SERIES

VIII. Quaternary Salts of Some β-Dialkylaminoethyl Pyrid-4-yl Sulfide N^1-Oxides*

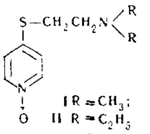
A. V. Voropaeva and L. V. Fedulova

Khimiya Geterotsiklicheskikh Soedinenii, Vol. 5, No. 2, pp. 285–287, 1969

UDC 547.824.825.07:543.422.6

The conditions for obtaining some β-dialkylaminoethyl pyrid-4-yl sulfide N^1-oxides and their quaternary salts have been studied. It has been shown that the addition of alkyl iodides to the bases obtained takes place in a similar manner to their addition to pyrid-4-yl sulfides not containing a N-oxide group.

It has been established previously that dialkylaminoethyl pyrid-2-yl sulfides, in contrast to pyrid-4-yl sulfides, react with only one molecule of alkyl iodides [1, 2]. In this work we have obtained a number of quaternary salts of some dialkylaminoethyl pyrid-4-yl sulfides containing a N-oxide group.



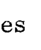
The sulfides were synthesized (Table 1) from 4-chloropyridine N-oxide and the appropriate dialkylaminoethanethiols. The reaction was carried out in ethanol in the presence of caustic soda. The best yields of the bases were obtained with a twofold excess of thiol.

The bases obtained readily form salts. Base I forms a dipicrate and a dihydrochloride and adds two molecules of alkyl iodides, while base II forms a dihydrochloride and a dimethiodide but reacts with only one molecule of ethyl iodide and one molecule of picric acid (Table 2), like diethylaminoethyl pyrid-2-yl sulfide [2].

The dihydrochlorides of both bases give a positive reaction for a N-oxide group with dimethylaniline and concentrated hydrochloric acid [3]. This confirms that no reduction of the N-oxide group, as is observed when N-oxides are heated with compounds containing sulfur [4], takes place under the experimental conditions. In the formation by the base II of a monopicrate and monoethiodide, the nitrogen of the N-oxide group apparently takes part. The low reactivity in salt formation of a tertiary nitrogen connected with ethyl groups has been reported in the literature repeatedly [5] and has also been observed previously by us [1].

On considering the UV spectra (Fig. 1), the sulfide II (curve a) is found to have an absorption band with a single maximum at 265 nm. The nature of the spectrum is similar to that both of pyridine N-oxide and of 4-chloropyridine N-oxide [6]. However, the second maximum observed in the UV spectrum of pyridine N-oxide in nonpolar solvents has disappeared here, apparently because of the formation of a hydrogen bond by the solvent with the oxygen of the N-oxide. The bathochromic effect, as compared with the base, observed in the spectra of the dimethiodide and ethiodide (curves b and c) is in agreement with literature data [7–9].

The IR spectrum of the base II (Fig. 2, curve 1) has strong bands at 1580, 1300–1240, and 1000–1060 cm^{-1} which are undoubtedly due to $\nu_{C=N}$ of pyridine, ν^{+}_{N-O} [10–13] and $\nu_{C-N<}$ of the aliphatic chain [14], respectively. The considerable lowering of the absorption maxima relating to the N-oxide group in the IR spectrum (curve 2) can be explained by the change in the nature of the N → O bond in the transition from



The UV spectra were recorded with an SF-4 spectrophotometer and the IR spectra on an IKS-14 double-beam spectrophotometer with an NaCl prism.

Table 1

β-Dialkylaminoethyl Pyrid-4-yl Sulfide N^1-Oxides

Compound	Bp, °C (pressure, nm)	d_4^{20}	n_D^{20}	M found	M calculated	Empirical formula	Found, % N	Found, % S	Calculated, % N	Calculated, % S
I	84—85 (3)	0.8689	1.5082	—	—	$C_9H_{14}N_2OS$	14.26 14.42	16.03 16.27	14.14	16.16
II	121—122 (2)	0.8913	1.5253	219 231	226	$C_{11}H_{18}N_2OS$	12.35 12.62	14.21 14.37	12.39	14.16

---

*For part VII see [1]

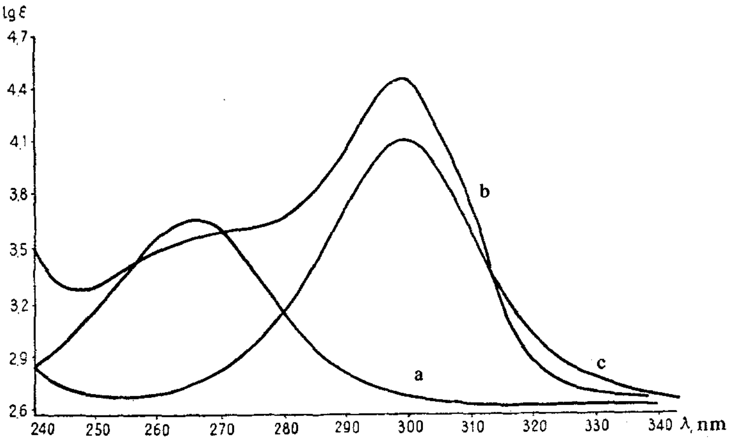


Fig. 1. UV absorption spectra in ethanol: a (β-diethylaminoethyl 4-pyridyl sulfide N^1-oxide (II); b) dimethiodide of II; c) ethiodide of II.

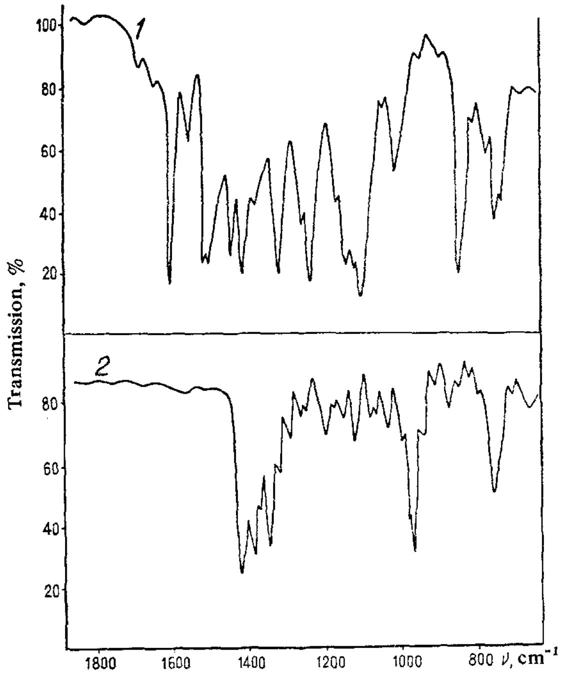


Fig. 2. IR absorption spectra in carbon tetrachloride: 1) β-diethylaminoethyl pyrid-4-yl sulfide N^1-oxide (II); 2) ethiodide of II.

Table 2

Quaternary Salts of β-Dialkylaminoethyl Pyrid-4-yl Sulfide N^1-Oxides

Initial compound	Mp of the picrate, °C	Mp of the hydrochloride, °C	Mp of the methiodide, °C	Empirical formula	Found, %			Calculated, %			Mp of the ethiodide, °C	Empirical formula	Found, %		Calculated, %	
					N	I	S	N	I	S			N	I	N	I
I	183—184	267—268	266—268 (decomp.)	$C_{11}H_{20}I_2N_2OS$	5.95 5.60	52.55 53.10	—	5.81	52.60	—	255—256 (decomp.)	$C_{13}H_{24}I_2N_2OS$	5.68 5.41	46.31 47.72	5.32	48.29
II	150—151	162—164	182—183.5	$C_{13}H_{24}I_2N_2OS$	5.18 5.29	46.80 46.90	6,17 6,37	5.49	49.80	6,29	183—185	$C_{13}H_{23}IN_2OS$	7.42 7.62	33.90 34.01	7.33	33.20

EXPERIMENTAL

Synthesis of the sulfides. Bases I and II were obtained by heating an ethanolic solution of 4-chloropyridine N-oxide with a twofold excess of the appropriate dialkylaminoethanethiols and caustic soda for 1 hr 30 min to 2 hr at 70° C. After the end of the reaction, the sodium chloride was filtered off and the ethanol was evaporated. The residue was treated with dry chloroform and the mixture filtered again from sodium mercaptide. After the evaporation of the chloroform, the residue was distilled in vacuum. The yields of the sulfides were 70–75%.

Preparation of quaternary salts. Sulfides I and II were treated with a threefold excess of alkyl iodide in chloroform or benzene solution at room temperature or with heating to 60–70° C. From chloroform, the salts precipitated in crystalline form. In the case of methyl iodide, the reaction took place vigorously. The yield of methiodides was close to quantitative. With ethyl iodide, the reaction was complete at room temperature after a day, and on heating to 60–70° C after 1 hr 30 min–2 hr. The yield of ethiodides was 85–90%.

In benzene, the reaction was accompanied by the formation of a viscous mass which crystallized slowly on standing and more rapidly on the addition of ether. The yield of salts was 60–65%. All the quaternary salts crystallize well from absolute ethanol.

REFERENCES

1. A. V. Voropaeva and I. Kh. Fel'dman, KhGS [Chemistry of Heterocyclic Compounds], 1, 275, 1965.
2. C. Musante and L. Fabbrini, Gazz. chim. ital., 84, 583, 1954.
3. N. A. Coats and A. R. Katritzky, J. Org. Chem., 24, 1836, 1959.
4. F. A. Pratt, J. Org. Chem., 27, 477, 1962.
5. E. Eliel, in the collection: Steric Effects in Organic Chemistry [Russian translation], IL, Moscow, p. 74, 1960.
6. Harisuke Hata, Bull. Chem. Soc. Japan., 29, 1, 1956.
7. H. H. Jaffe, J. Am. Chem. Soc., 85, 1085, 1956.
8. G. Costa and P. Blassina, Gazz. chim. ital., 77, 4441, 1955.
9. R. A. Jones and A. R. Katritzky, J. Chem. Soc., 3610, 1958.
10. J. K. Gardner and A. R. Katritzky, J. Chem. Soc., 4373, 1957.
11. A. R. Katritzky and J. N. Gardner, J. Chem. Soc., 2193, 1958.
12. A. R. Katritzky, I. A. T. Beard, and N. A. Coats, J. Chem. Soc., 3680, 1959.
13. R. A. Jones and A. R. Katritzky, J. Chem. Soc., 2937, 1960.
14. L. Bellamy, Infrared Spectra of Complex Molecules [Russian translation], IL, Moscow, p. 298, 1957.

10 November 1966

Leningrad Chemical and
Pharmaceutical Institute