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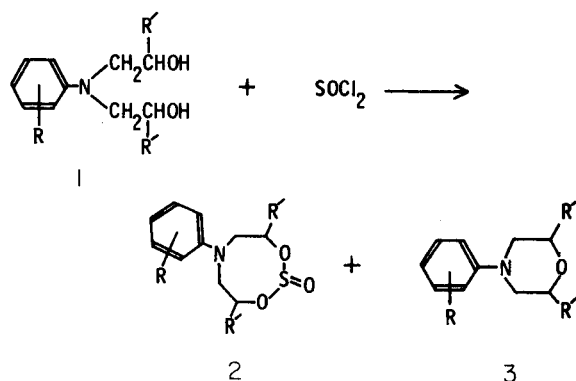
Four 6-phenyl-5,6,7,8-tetrahydro-4H-1,3,2,6-dioxathiazocine 2-oxides were synthesized by the reaction of the corresponding *N,N*-bis(2-hydroxyethyl)aniline with thionyl chloride in the presence of triethylamine.

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Reaction of diols with thionyl chloride has been known to give cyclic sulfites (1-3). In a similar manner 1,2,5-thiadiazolidine 1-oxides have prepared by the reaction of alkanediamines with thionyl chloride (4). In recent years the configurational analysis of cyclic sulfites by means of nmr spectroscopy has been reported. Thus we are interested in the reaction of *N,N*-bis(2-hydroxyethyl)anilines (1) with thionyl chloride giving 6-phenyl-5,6,7,8-tetrahydro-4H-1,3,2,6-dioxathiazocine 2-oxides (2), which information has not appeared in the literature.

The transformation of 1 to 2 was accomplished by adding dropwise a benzene solution of thionyl chloride (ice bath) to a benzene solution of 1 and triethylamine.

6-Phenyl-5,6,7,8-tetrahydro-4H-1,3,2,6-dioxathiazocine 2-oxide (2a) was obtained and the structure is supported by analytical and spectral data. Additional support for the general structure 2 for these compounds was obtained by the base catalyzed hydrolysis of 2 to yield the precursor amino alcohol 1.



a, R = H, R' = H, b, R = *p*-CH₃, R' = H, c, R = *p*-Cl, R' = H, d, R = *p*-CH₃, R' = Cl

In addition an oily product was obtained purified chromatographically. The compound was identified by *N*-phenylmorpholine (6), (3a), by comparing its ir spectrum with that of an authentic sample and mass spectral data (*m/e* 163). The above yields and properties of the products are listed in Table I.

The nmr spectra (Figure 1) of 2a, 2b, and 2c gave complicated multiplets due to the 8-membered ring

Figure 1
Nmr spectra of the compounds of 2a, 2b, and 2c

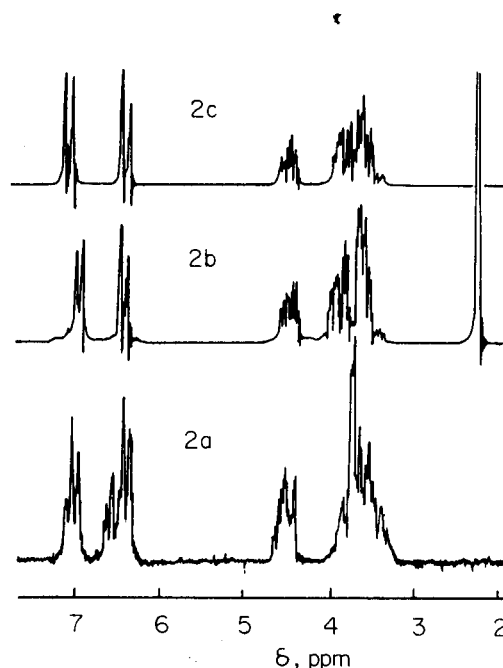


Table I

Data for the 1,3,2,6-Dioxathiazocine 2-Oxides

Com- pound	Yield %	M.p. °C	Analysis %		
			C	H	N
2a	48	89.2-90.6	52.66 (52.84)	5.70 (5.76)	6.12 (6.16)
2b	41	99.5-101.0	54.68 (54.74)	6.21 (6.26)	5.60 (5.80)
2c	35	107.2-107.6	45.83 (45.89)	4.62 (4.62)	5.35 (5.35)
2d	50	182.0-182.9	57.74 (57.96)	7.07 (7.11)	5.18 (5.20)

protons and are not easily analyzed. The four protons attached to C-4 (C-8) and C-5 (C-7) carbons in the ring are not all magnetically equivalent. The introduction of two methyl groups on two carbon atoms in an 8-membered ring to give **2d**, lead to relatively simple signals. Signals appeared at 3.06 (q), 3.81 (d), and 4.57-4.98 (m), respectively. The signal at δ 4.57-4.98 ppm is considered to be due to the methine protons attached to C-4 carbon or C-8 carbon. The two protons attached to the C-5 (C-7) carbon are not equivalent. The resonance signal appearing at higher field (a quartet centered at δ 3.06) may be assigned to the *trans* proton to the sulfoxide bond, taking the anisotropy effect of the S=O group into account (5,7).

EXPERIMENTAL

All the melting points are uncorrected. The ir spectra were recorded on a Shimadzu Model ir-27G spectrophotometer. The nmr and mass spectra were taken on JEOL-PS-100 at 100 MHz and JEOL-JMS-01SG Spectrometers, respectively. The chemical shifts are in ppm downfield from internal TMS (δ). The compounds, *N,N*-bis(2-hydroxyethyl)anilines **1a**, **1b**, **1c**, and **1d** were prepared by the reaction of the corresponding aniline with ethylene oxide or propylene oxide, respectively (8).

6-Phenyl-5,6,7,8-tetrahydro-4H-1,3,2,6-dioxathiazocine 2-Oxide (**2a**).

A solution of thionyl chloride (2.0 g., 17 mmoles) in benzene (18 ml.) was added dropwise to a cooled solution of **1a** (1.8 g., 10 mmoles) and triethylamine (2.2 g., 22 mmoles) in benzene (50 ml.). After stirring for 40 minutes in an ice bath, the reaction mixture was then washed with water, dried over sodium sulfate and evaporated *in vacuo* to give 1.8 g. of the crude products. Recrystallization from a mixture of hexane and carbon tetrachloride and evaporated *in vacuo* afforded 1.08 g. (48%) of **2a**; ir (potassium bromide): 1598 (s), 1575 (m), 1504 (s), 1460 (m), 1355 (s), 1272 (m), 1201 (s), 1050 (m), 1022 (m), and 1005 cm^{-1} (s); nmr (carbon tetrachloride): δ = 3.29-3.97 (6H, m), 4.45-4.74 (2H, m), 6.38-6.76 (3H, m), and 7.00-7.25 (2H, m); ms (75 eV, relative intensity): 227 (M^+ , 22), 197 (17), 133 (10), 106 (13), 105 (100), 104 (23), 91 (11), and 77 (27). The filtrate was evaporated *in vacuo* to give a yellow oil, from which was separated through an alumina column with benzene-dichloromethane to afford 0.15 g. (9%) of **3a**; ms: m/e 163 M^+ .

6-(*p*-Tolyl)-5,6,7,8-tetrahydro-4H-1,3,2,6-dioxathiazocine 2-Oxide (**2b**).

2-(*p*-Tolyl)-5,6,7,8-tetrahydro-4H-1,3,2,6-dioxathiazocine 2-oxide (**2b**) (41%) and **3b** (19%) were obtained by stirring a mixture of benzene and hexane solution (4:1, 50 ml.) of **1b** (2.0 g., 10 mmoles) with benzene solution (20 ml.) of thionyl chloride (2.2 g.) in the presence of triethylamine (2.3 g.). Recrystallization of **2b** from a mixture of hexane and benzene afforded white crystals; ir (potassium bromide): 1611 (s), 1555 (m), 1512 (s), 1455 (m), 1385 (m), 1354 (s), 1265 (m), 1230 (m), 1170 (s), 1030 (m), and 1000 (s) cm^{-1} ; nmr (deuteriochloroform): δ = 2.22 (3H, s), 3.36-3.69 (4H, m), 3.81-4.05 (2H, m), 4.35-4.62 (2H, m), 6.48 (2H, d, J = 8.0 Hz), and 7.01 (2H, d, J = 8.0 Hz); ms m/e (75 eV, relative intensity): 241 (M^+ , 36), 211 (16), 120 (12), 119 (100), 118 (15), and 91 (20).

6-(*p*-Chlorophenyl)-5,6,7,8-tetrahydro-4H-1,3,2,6-dioxathiazocine 2-Oxide (**2c**).

A benzene solution (20 ml.) of thionyl chloride (2.6 g., 22 mmoles) was added dropwise to a mixture of benzene-hexane solution (4:1, 50 ml.) of **1c** (2.0 g., 9 mmoles) and triethylamine (2.4 g.) in an ice bath for 55 minutes. The reaction mixture was washed with water, dried over sodium sulfate and evaporated *in vacuo* to give crude products **2c** and **3c** (8%). Recrystallization of **2c** from mixture of benzene and carbon tetrachloride afforded white needles (0.85 g., 35%); ir (potassium bromide): 1584 (s), 1490 (s), 1384 (m), 1350 (s), 1268 (m), 1225 (m), 1173 (s), 1025 (m), and 998 (s) cm^{-1} ; nmr (deuteriochloroform): δ = 3.36-4.01 (6H, m), 4.41-4.68 (2H, m), 6.47 (2H, d, J = 9.8 Hz), and 7.15 (2H, d, J = 9.8 Hz); ms, m/e (75 eV, relative intensity): 263 (M^+ , 13), 261 (M^+ , 28), 231 (18), 141 (35), 140 (17), 139 (100), 138 (20), and 111 (15).

4,8-Dimethyl-6-(*p*-tolyl)-5,6,7,8-tetrahydro-1,3,2,6-dioxathiazocine 2-Oxide (**2d**).

A benzene solution (5 ml.) of thionyl chloride (200 mg., 1.7 mmoles) was added dropwise to a mixture of benzene-hexane (4:1, 15 ml.) solution of **1d** (100 mg., 0.45 mmoles) and triethylamine (300 mg.) in an ice bath for 30 minutes. The reaction mixture was then washed with water, the organic layer was dried, filtered, and evaporated to give crude products **2d** and **3d** (8%). The resulting mixture was recrystallized from mixture of hexane-benzene to give a 60 mg. (50%) of a colorless crystalline solid, m.p. 182.0-182.9° (**2d**); ir (potassium bromide): 1612 (s), 1510 (s), 1452 (m), 1372 (s), 1350 (s), 1230 (m), 1190 (s), 1125 (s), 1072 (s), 1044 (s), and 995 (m) cm^{-1} ; nmr (deuteriochloroform): δ = 1.38 (6H, d, J = 7.0 Hz), 2.31 (3H, s), 3.06 (2H, q, J = 15.7 and 9.2 Hz), 3.81 (2H, d, J = 15.7 Hz), 4.57-4.98 (2H, m), 6.42 (2H, d, J = 9.8 Hz), and 7.06 (2H, d, J = 9.8 Hz); ms, m/e , (75 eV, relative intensity): 269 (M^+ , 13), 120 (12), 119 (100), 118 (13), and 91 (20).

Base Hydrolysis of **2a**.

A solution of **2a** (740 mg., 32.6 mmoles), 30 ml. of ethanol, 10 ml. of water and 0.6 g. of sodium hydroxide was refluxed for 2 hours. After adding 50 ml. of water, the reaction mixture was extracted with 200 ml. of diethyl ether. The ether layer was dried (sodium sulfate) and evaporated to yield a pale yellow solid (672 mg.). This solid was recrystallized from carbon tetrachloride to give 482 mg. (82%) of a colorless crystalline solid which was identified as *N,N*-bis(2-hydroxyethyl)aniline (**1a**) by comparing the melting point and the ir and nmr spectra with those of an authentic sample.

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