

SYNTHESIS OF BI- AND TRICYCLIC MESOIONIC [1,2,4,6]THIATRIAZINE-1,1,3-TRIOXIDES

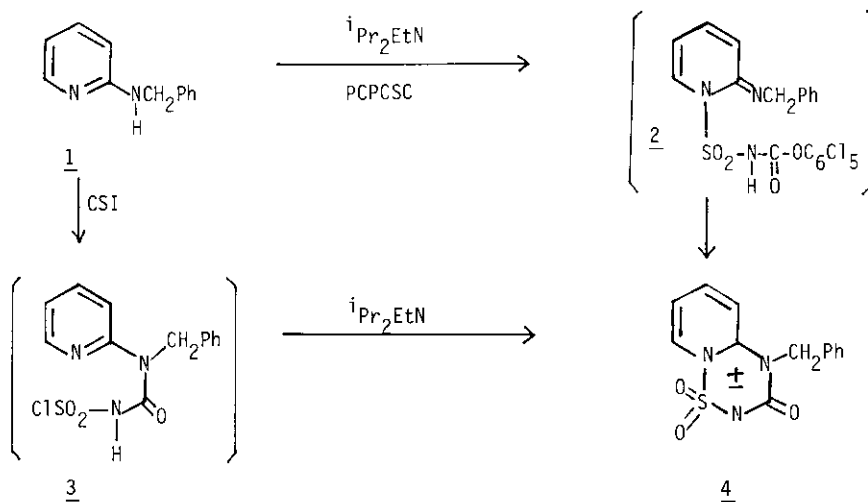
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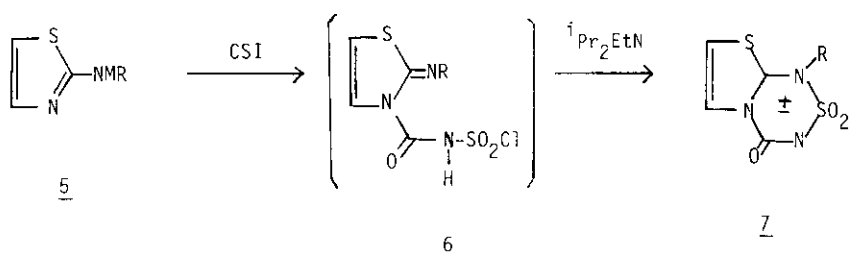
Abstract - The reaction of N-substituted aminoheterocycles with chlorosulfonyl isocyanate (CSI) or pentachlorophenyl N-chlorosulfonylcarbamate (PCPCSC) affords bi- and tricyclic mesoionic [1,2,4,6]thiatriazine-1,1,3-trioxides in the presence of ethyldiisopropylamine.

Numerous examples of six-membered mesoionic compounds are found in the literature and reviewed.¹ Malonyl dichlorides,² their ester derivatives,³ carbon suboxide,⁴ ethoxy- or phenoxy-carbonyl isocyanate and their thio derivatives⁵ are very useful reagents for the syntheses of mesoionic compounds. Since CSI has two functional groups of NCO and SO₂Cl, it can be used as cyclizing reagent for mesoionic compounds, but has received scant attention.⁶ We wish to report the syntheses of mesoionic compounds from the reaction of CSI or PCPCSC with N-substituted aminoheterocycles.



2-Benzylaminopyridine reacted with PCPCSC in chloroform at room temperature producing mesoionic 1-benzylpyrido[1,2-b][1,2,4,6]thiatriazine-2,4,4-trioxide (4). Karady and co-workers^{6a} already reported compound 4 which was synthesized from the reaction of 2-benzylaminopyridine and CSI in the presence of a tertiary amine base. Structure 4 was assigned by the comparison with authentic sample.⁷

2-Alkylaminothiazoles reacted with CSI producing the intermediate 6 which cyclized on the addition of a tertiary base to afford mesoionic 1-alkylthiazolo[2,3-c][1,2,4,6]thiatriazine-2,2,4-trioxides (7). The structure of 7 was assigned by the study of ¹H NMR and IR of intermediate 6a and ¹H NMR of intermediate 3. Presence of exocyclic imine bond was verified on the base of ¹H NMR chemical shift and imino stretching band in IR of 6a.

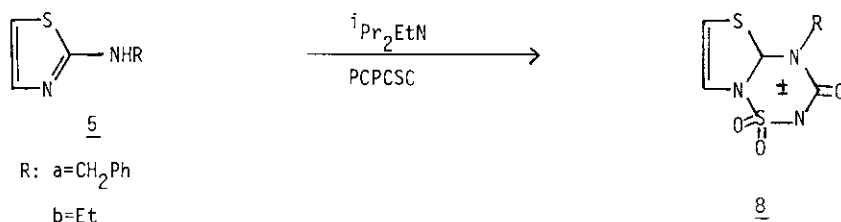


R: a=CH₂Ph
b=Et

¹H NMR data (CDCl₃, 60 MHz)

3	6a		
NCH ₂	NCH ₂	NCH	SCH
5.30 s	4.64 s, 4.74 s	7.87 d, J=5 Hz	6.68 d, J=5 Hz

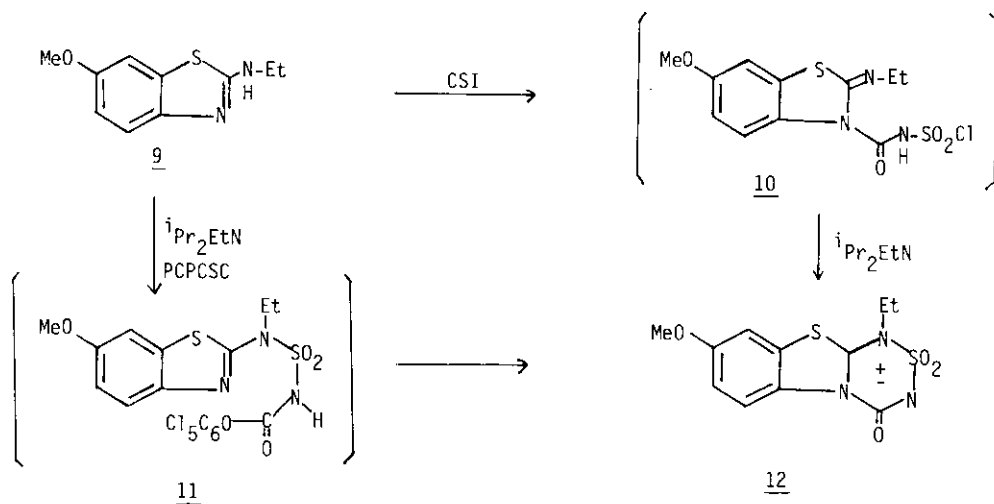
PCPCSC resulted in mesoionic compound 8, which is the regioisomer of 7, with 2-alkylaminothiazoles in the presence of a tertiary amine base. The structure of 8 are assigned by comparison with the ¹H NMR chemical shifts of 7.



^1H NMR data ($\text{CDCl}_3 + \text{CF}_3\text{COOH}$, 80 MHz)

	NCH	SCH	NCH ₂	CH ₃
7a	8.04 d, J=5 Hz	6.95 d, J=5 Hz	5.26 s	
7b	8.02 d, J=5 Hz	7.03 d, J=5 Hz	4.19 q, J=7 Hz	1.61 t, J=7 Hz
8a	7.88 d, J=5 Hz	7.20 d, J=5 Hz	5.35 s	
8b	7.90 d, J=5 Hz	7.32 d, J=5 Hz	4.18 q, J=7 Hz	1.48 t, J=7 Hz

Mesoionic compound 12 was obtained from the reaction of 2-ethylamino-6-methoxybenzothiazole with CSI or PCPCSC in the presence of a tertiary base. Product structure from A path (9-10-12) was assigned by ^1H NMR chemical shift of intermediate 10. ^1H NMR chemical shift of methylene groups in exocyclic and endocyclic imine intermediate 10 are 3.50 ppm and 4.25 ppm, respectively,⁸ but this intermediate 10 has N-CH₂ resonance at 3.50 ppm. Product structure of B path (9-11-12) was determined by comparison with the data of the product from A path.



Pentachlorophenoxy group is the good leaving group.⁹ PCPCSC cyclized with at room temperature, but ethyl- or phenyl N-chlorosulfonylcarbamate did not afford mesoionic compound at reflux condition in ethyl acetate or xylene.

EXPERIMENTAL

Melting points are uncorrected. IR and ¹H-NMR spectra were recorded on Perkin-Elmer Model 283 B grating infrared spectrometer and Varian T-60A or Varian FT-80A Spectrometer, respectively. Mass spectra were taken at an ionizing voltage of 70 eV on a Hewlett-Packard 5985 GC/MS instrument.

General Procedure (method A)

An equimolar amount of N-substituted aminoheterocycle was added to the solution of CSI in chloroform at room temperature. After 2 h an equivalent of ethyldiisopropylamine was injected and stirred at room temperature for 6 h. White solid was collected by filtration.

General Procedure (method B)

An equimolar amount of PCPCSC was added to the solution of equimolar ethyldiisopropylamine and N-substituted aminoheterocycle in chloroform and stirred for 6 h at room temperature. White solid was collected by filtration.

Mesoionic 1-Benzylpyrido[1,2-b][1,2,4,6]thiatriazine-2,4,4-trioxide(4): Method B. yield = 46%.

Mp 166-170°C (decomp.) IR(KBr): 1690, 1630, 1510, 1358, 1330, 1230, 1220, 1180, 1000, 780, 690 cm⁻¹. ¹H NMR (CDCl₃ + CF₃COOH): 5.45 (s, 2H), 7.00-8.90 (m, 9H). Ms (m/z): 289 (M⁺), 183 (M⁺-SO₂NCO)

Mesoionic 1-Benzylthiazolo[2,3-c][1,2,4,6]thiatriazine-2,2,4-trioxide (7a): Method A. Yield =

68%. Mp 200-203°C (decomp.) IR(KBr): 1740, 1575, 1555, 1340, 1205, 1180, 995, 900, 700 cm⁻¹. ¹H NMR(CDCl₃ + CF₃COOH): 5.26(s, 2H), 6.95(d, J=5 Hz, 1H), 7.46(s, 5H), 8.04(d, J=5Hz, 1H) Ms(m/z): 295(M⁺), 189(M⁺-SO₂NCO)

Mesoionic 1-Ethylthiazolo[2,3-c][1,2,4,6]thiatriazine-2,2,4-trioxide (7b) : Method A. Yield =

90%, Mp 213-216°C (decomp.) IR(KBr): 1720, 1580, 1560, 1390, 1330, 1315, 1310, 1205, 1180, 1090, 1005, 895 cm⁻¹. ¹H NMR(CDCl₃ + CF₃COOH): 1.61(t, J=7Hz, 3H), 4.19(q, J=7Hz, 2H), 7.03(d, J=5Hz, 1H), 8.02(d, J=5Hz, 1H). Ms(m/z): 233(M⁺), 205(M⁺-CO), 127(M⁺-SO₂NCO).

Mesoionic 1-Benzylthiazolo[3,2-b][1,2,4,6]thiatriazine-2,4,4-trioxide (8a): Method B. Yield =

52%. Mp 194-198°C (decomp.) IR(KBr): 1700, 1545, 1370, 1215, 995 cm⁻¹. ¹H NMR(CDCl₃ + CF₃COOH):

5.35(s, 2H), 7.20(d, J=5Hz, 1H), 7.41(s, 5H), 7.88(d, J=5Hz, 1H). Ms(m/z): 295(M⁺), 189(M⁺-SO₂NCO).

Mesoionic 1-Ethylthiazolo[3,2-b][1,2,4,6]thiatriazine-2,4,4-trioxide (8b): Method B. Yield = 65%, Mp 225-227°C (decomp.) IR(KBr): 1710, 1570, 1380, 1355, 1290, 1205, 1015, 755 cm⁻¹. ¹H NMR (CDCl₃ + CF₃COOH): 1.48(t, J=7Hz, 3H), 4.18(q, J=7Hz, 2H), 7.32(d, J=5Hz, 1H), 7.90(d, J=5Hz, 1H). Ms(m/z): 233(M⁺), 127(M⁺-SO₂NCO).

Mesoionic 4-Ethyl-7-methoxybenzothiazolo[2,3-c][1,2,4,6]thiatriazine-1,3,3-trioxide(12): Method A. Yield = 60%. Mp 241-245°C (decomp.) IR(KBr): 1710, 1570, 1500, 1200, 1010 cm⁻¹. ¹H NMR (CDCl₃ + CF₃COOH): 1.50(t, J=7Hz, 3H), 4.00(s, 3H), 4.26(q, J=7Hz, 2H), 7.25-8.30(m, 3H). Anal. Calcd for C₁₁H₁₁N₃O₄S₂: C, 42.17; H, 3.54; N, 13.42. Found: C, 41.8; H, 3.30; N, 13.8. Method B. Yield = 58%. Anal. Calcd for C₁₁H₁₁N₃O₄S₂: C, 42.17; H, 3.54; N, 13.42. Found: C, 41.9; H, 3.25; N, 13.9.

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