1,2,4-Triazines. III. A Convenient and General Synthesis of 4*H*-[1,3,4]Thiadiazolo[2,3-*c*][1,2,4]triazin-4-ones (1)

Masato Mizutani and Yuzuru Sanemitsu (2)

Pesticide Division, Institute for Biological Science, Sumitomo Chemical Co. Ltd., 4-2-1, Takatsukasa, Takarazuka, Hyogo 665, Japan

Received April 16, 1982

4*H*-[1,3,4]Thiadiazolo[2,3-*c*][1,2,4]triazin-4-ones were prepared by cyclization of 3-thio-4-amino-1,2,4-triazine-3,5(2*H*,4*H*)-diones with a variety of acids in the presence of concentrated sulfuric acid. The synthesis appears to be general.

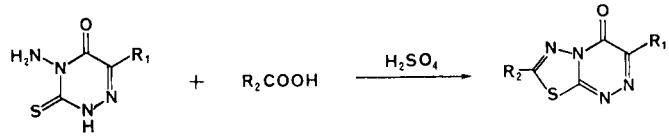
J. Heterocyclic Chem., **19**, 1577 (1982).

The synthetic route to 4*H*-[1,3,4]thiadiazolo[2,3-*c*][1,2,4]-triazin-4-ones was achieved through ring closure of 3-thio-4-amino-1,2,4-triazine-3,5(2*H*,4*H*)-diones with a number of acids. Phosphorus oxychloride as a dehydrating agent has been used when the acids employed are conjugated or aromatic, but the reaction fails when the acids are aliphatic (3). In contrast to this procedure which requires only conjugated or aromatic acids, we wish to report a convenient and general synthesis of 4*H*-[1,3,4]thiadiazolo[2,3-*c*][1,2,4]-triazin-4-ones (**3a-f**) which involves ring closure of 3-thio-4-amino-1,2,4-triazine-3,5(2*H*,4*H*)-diones (**1a-f**) (4) with either aliphatic or aromatic acid in the presence of concentrated sulfuric acid.

Thus, treatment of 3-thio-4-amino-1,2,4-triazine-3,5(2*H*,-4*H*)-diones (**1a-f**) with an excess of acids (**2a-f**) in concentrated sulfuric acid at 120° for 3 hours afforded the desired 4*H*-[1,3,4]thiadiazolo[2,3-*c*][1,2,4]triazin-4-ones (**3a-f**) in 59-94% yield (Equation I).

Other dehydrating agents were examined to achieve the cyclization reaction. Methanesulfonic acid gave the same cyclized products, but in low yield (**1a**, 45%). Consequently, concentrated sulfuric acid was the reagent of choice based on yield, handling and treatment.

Equation I



1 2 3

The structures of 4*H*-[1,3,4]thiadiazolo[2,3-*c*][1,2,4]triazin-4-ones (**3a-f**) were confirmed on the basis of spectroscopic data. The ir spectra gave an absorption at 1680-1725 cm^{-1}, indicating the existence of a carbonyl group. The pmr spectra of these products (**3a-b,g**) exhibit a sharp singlet signal at δ 8.84-9.42 due to H-7 proton, leading to the conclusion that ring closure occurred.

In conclusion, this reaction appears to be general for the preparation of 4*H*-[1,3,4]thiadiazolo[2,3-*c*][1,2,4]triazin-4-ones.

EXPERIMENTAL

Melting points are uncorrected. The pmr spectra were obtained on a

Table I

Synthesis of 4*H*-[1,3,4]Thiadiazolo[2,3-*c*][1,2,4]triazin-4-ones (**3a-f**)

Compound	R_1	R_2	mp (°C) (a)	Isolated yield (%)	Formula	Calcd./Found C%	H%	N%	S%
3a	*t*-Bu	H	186.5-187.5	76	$C_8H_{10}N_4OS$	45.69	4.79	26.64	15.25
						45.87	4.81	26.84	14.84
3b	1-methyl-cyclopentyl	H	131.6	94	$C_{10}H_{12}N_4OS$	50.83	5.12	23.71	13.57
						50.69	4.91	23.60	13.31
3c	*t*-Bu	Me	139.1	59	$C_9H_{12}N_4OS$	48.19	5.39	24.98	14.30
						48.07	5.47	24.85	14.07
3d	*t*-Bu	Et	154.0	75	$C_{10}H_{14}N_4OS$	50.40	5.92	23.51	13.46
						50.42	5.91	23.50	13.40
3e	*t*-Bu	Ph	238.6 (b)	84	$C_{14}H_{14}N_4OS$	58.73	4.93	19.57	11.20
						58.69	4.99	19.44	11.00
3f	Ph	H	206.0-208.0 (c)	83	$C_{10}H_6N_4OS$	52.17	2.63	24.34	13.93
						51.95	2.63	24.02	13.85

(a) Recrystallized from *n*-hexane-acetone, unless otherwise noted. (b) Recrystallized from acetone. (c) Recrystallized from ethanol.

Table II

Physical Data for Compounds **3a-f**

Compound	Mass (M^+)	IR (nujol) cm^{-1}	PMR (δ) (a)
3a	210	3070, 1680	1.48 s 9H, 8.48 s 1H
3b	236	3070, 1710	1.45 s 3H, 1.50-2.60 m 8H, 8.78 s 1H
3c	224	1690	1.50 s 9H, 2.72 s 3H
3d	238	1725	1.42 t (J = 7.5 Hz), 3H, 1.47 s 9H, 3.00 q (J = 7.5 Hz) 2H
3e (b)	286	1705	1.47 s 9H, 7.45-7.82 m 3H, 7.96-8.24 m 2H
3f (c)	230	3060, 1690	7.37-7.86 m 3H, 8.03-8.40 m 2H, 9.42 s 1H

(a) Measured in deuteriochloroform unless otherwise noted. (b) Measured in DMSO-d_6-perdeuterioacetone. (c) Measured in perdeuterioacetone.

Hitachi R-900 spectrometer operating at 60 MHz using TMS as an internal standard. The ir spectra were recorded on a Hitachi 260-10 spectrometer. Mass spectra were run on a Shimadzu LKB-9000B instrument.

General Procedure for the Synthesis of Compounds **3a-f**.

A mixture of compound **1** (2 mmoles) and acid (6 mmoles) in concentrated sulfuric acid (3 mmoles) was stirred at 120° for 3 hours. After cooling, cold water was added. The product was extracted with chloroform, washed with water and then dried over anhydrous sodium sulfate. The crystalline product obtained by removal of chloroform *in vacuo* was recrystallized from *n*-hexane-acetone in **3a-d**, acetone in **3e** and ethanol in **3f** yielding pure product **3**. Physical data and yield are summarized in Table I and II.

REFERENCES AND NOTES

(1) For part II see Y. Sanemitsu, Y. Nakayama and M. Shiroshita, *J. Heterocyclic Chem.*, **18**, 1053 (1981).

(2) To Whom inquiries should be addressed.

(3) H. Golgolab, I. Lalezari and L. Hosseini-Gohari, *J. Heterocyclic Chem.*, **10**, 387 (1973). See another synthetic method of [1,3,4]-thiadiazolo[2,3-*c*][1,2,4]triazinones, A. Dornow and P. Marx, *Chem. Ber.*, **97**, 2640 (1964); K. Zauer, J. Puskas, J. Nyitrai, G. Hornyak, A. Wolfner, G. Doleschall and K. Lempert, *Period. Polytech., Chem. Eng. (Budapest)*, **12**, 259 (1968); A. Shafiee, I. Lalezari and M. Mirrashed, *J. Heterocyclic Chem.*, **13**, 117 (1976).

(4) J. Manfred, German Patent Application, 2,165,554 (1973); *Chem. Abstr.*, **79**, 92295g (1973).