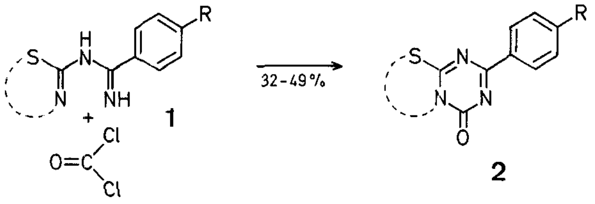
Synthesis of Heterocyclic-Condensed *s*-Triazines*

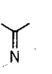
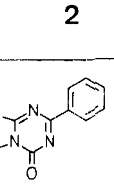
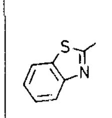
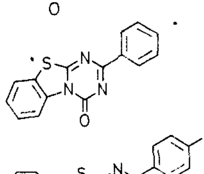
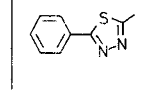
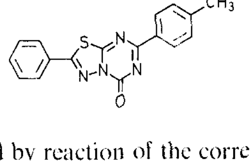
T. GEORGE and R. TAHILRAMANI

CIBA Research Center, CIBA of India Ltd., Goregaon Bombay 400063, India

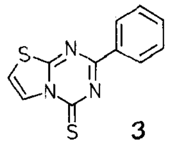
Only a few heterocyclic-condensed triazines are described in literature. Derivatives of 3*H*-thiazolo[3,2-*c*]-*v*-triazine-carboxylic acid[1] and 7-oxo-7*H*-thiazolo[3,2-*b*]-*as*-triazine[2] are known. The present communication outlines a facile synthesis of the 4-oxo derivatives of the following fused 1,3,5-triazine systems: 4*H*-thiazolo[3,2-*a*]-*s*-triazine (**2a**), 4*H*-benzothiazolo[3,2-*a*]-*s*-triazine (**2b**), and 4*H*-[1,3,4]thiadiazolo[3,2-*a*]-*s*-triazine (**2c**).

N-Chlorocarbonylation of *imines* with carbonyl chloride has been reported[3]. The above synthesis involves the *N*-chlorocarbonylation of *amidines* (**1**), followed by intramolecular cyclization.



		R	**2**
a		H	
b		H	
c		CH₃	

Amidines **1** were obtained by reaction of the corresponding 2-aminoheteroarenes with benzonitriles in the presence of aluminum chloride by the method of Oxley et al.[4]. An attempt to prepare the thio analogue (**3**) of **2a** using thiocarbonyl chloride failed, presumably on account of hydrolysis of **3** during the work-up under alkaline conditions.



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The I.R. spectra of compounds **2a**–**c** show the carbonyl band at 1698 cm⁻¹. This is in agreement with the values reported for fused lactams[5]. The U.V. spectra of **2** exhibit a bathochromic shift relative to the spectra of **1**.

The mass spectra of compounds **2a**–**c** display an intense $(M-1)^+$ species. An important fragmentation process common to all of them involves the loss of ·NCO radial ($m/e = 42$). In case of **2a**, a peak corresponding to a further loss of thiirene radical cation ($m/e = 58$) is observed. This is in agreement with the fragmentation observed for thiazoles[6]. The mass spectrum of **2b** showed peaks corresponding to the loss of CN radical from M and M-1 species. Compound

2c showed a peak corresponding to loss of CN and an intense peak corresponding to loss of elements of C_6H_5NCS ($m/e = 135$).

***N*-(1,3-Thiazol-2-yl)-benzamidine (1a):**
An intimate mixture of 2-amino-1,3-thiazole (20 g, 0.2 mol) and benzonitrile (20.8 g, 0.21 mol) was stirred in an oil bath and anhydrous aluminum chloride (27.6 g, 0.2 mol) was added in several portions so that the temperature of the reaction did not exceed 80°. After the last portion of aluminum chloride had been added, the temperature of the oil bath was raised to 120° and maintained for 1 h. Thereafter, the mixture was poured onto crushed ice and treated with 10% aqueous sodium hydroxide. The precipitate obtained was filtered, washed with water, and dried. It was recrystallised from isopropanol/hexane; yield: 10.5 g (25%); colourless crystals, m.p. 92°.

$C_{10}H_9N_3S$	calc.	C 59.10	H 4.46	N 20.68
(203.3)	found	59.18	4.62	20.54

I.R. (Nujol): $\nu_{NH} = 3250$, $\nu_{C=C}$ 1620 cm^{-1}.

U.V. (ethanol): $\lambda_{max} = 232$ (log $\varepsilon = 4.01$), 318 nm (4.17).

***N*-(1,3-Benzothiazol-2-yl)-benzamidine (1b):**
This compound was obtained in a similar way from 2-amino-1,3-benzothiazole; yield: 29%; pale yellow crystals, m.p. 160° (from ethanol).

$C_{14}H_{11}N_3S$	calc.	C 66.39	H 4.38	N 16.59
(253.3)	found	66.74	4.50	16.42

I.R. (Nujol): $\nu_{NH} = 3250$, $\nu_{C=C} = 1620$ cm^{-1}.

U.V. (ethanol): $\lambda_{max} = 230$ (log $\varepsilon = 4.30$), 328 nm (4.38).

***N*-(5-Phenyl-1,3,4-thiadiazol-2-yl)-4-methylbenzamidine (1c):**
This compound was obtained in a similar way from 2-amino-5-phenyl-1,3,4-thiadiazole; yield: 32%; pale yellow crystals, m.p. 202° (from isopropanol).

$C_{16}H_{14}N_4S$	calc.	C 65.29	H 4.80	N 10.87
(294.6)	found	65.49	4.92	10.76

I.R. and U.V. spectra were analogous to those of **1a** and **1b**.

4-Oxo-2-phenyl-4*H*-thiazolo[3,2-*a*]-*s*-triazine (2a):
To a stirred suspension of **1a** (4.06 g, 0.02 mol) in toluene (50 ml) was added a solution of carbonyl chloride in toluene (100 ml, excess). The solution was brought to reflux gradually and maintained at reflux temperature for 6 h. The gummy product was filtered, washed with cold dilute sodium hydrogen carbonate solution, and dissolved in dichloromethane. The solution was washed with water, dried with sodium sulfate, and evaporated. The residue was treated with a mixture of isopropanol and ether and filtered. It was recrystallized from methanol; yield: 2.11 g (49%); pale yellow crystals, m.p. 265°.

$C_{11}H_7N_3OS$	calc.	C 57.64	H 3.08	N 18.34
(229.3)	found	57.43	2.96	18.46

I.R. (Nujol): $\nu_{C=O} = 1695$ cm^{-1}.

U.V. (ethanol): $\lambda_{max} = 273$ (log $\varepsilon = 4.21$), 330 nm (4.18).

Reaction of *N*-(1,3-Thiazol-2-yl)-benzamidine (1a) with Thiocarbonyl Chloride:
Compound **1a** (4.06 g, 0.02 mol) was treated with thiocarbonyl chloride (2.53 g, 0.022 mol) under the same conditions as described above. Upon work-up of the reaction mixture, **2a** was obtained; yield: 1.36 g (32%).

4-Oxo-2-phenyl-4*H*-benzothiazolo[3,2-*a*]-*s*-triazine (2b):
This compound was obtained as described above for **1a**; yield: 42%; pale-yellow crystals; m.p. 287° (from methanol).

$C_{15}H_9N_3OS$	calc.	C 64.51	H 3.25	N 15.05
(279.3)	found	64.71	3.42	14.90

I.R. (Nujol): $\nu_{C=O}$ 1700 cm^{-1}.

*U.V. (ethanol): $\lambda_{max} = 280$ and 337 nm

*Only qualitative assay because of low solubility of the compound.

2-(4-Methylphenyl)-4-oxo-7-phenyl-4*H*-[1,3,4]thiadiazolo[3,2-*a*]-*s*-triazine (2c):
This compound was obtained as described above for **1a**; yield: 38%; yellow crystals, m.p. 298° (from dichloromethane/hexane).

$C_{17}H_{12}N_4OS$	calc.	C 63.74	H 3.78	N 17.49
(320.4)	found	63.54	3.86	17.19

I.R. (Nujol): $\nu_{C=O}$ 1700 cm^{-1}.

U.V. (ethanol): $\lambda_{infl} = 228$ (log $\varepsilon = 4.29$), 300 (4.40), $\lambda_{max} = 328$ nm (log $\varepsilon = 4.49$).

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[1] H. M. Crooks, in *Chemistry of Penicillins*, Ed. H. T. Clarke et al., Princeton University Press, Princeton, N.L., 1949, p. 455.

[2] C. F. H. Allen et al., *J. Org. Chem.* **24**, 779 (1959).

[3] H. Kiefer, *Synthesis* **1972**, 39.

[4] P. Oxley, M. W. Partridge, W. F. Short, *J. Chem. Soc.* **1947**, 1110.

[5] T. George, R. Tahilramani, *J. Org. Chem.* **36**, 2190 (1971).

[6] N. Porter, J. Baldas, *Mass Spectrometry of Heterocyclic Compounds*, Wiley-Interscience, New York, 1971, p. 532.