

Some 1-Aroyl-4,4-dialkylsemicarbazides and Their Cyclization to Afford 5-Aryl-1,3,4-oxadiazol-2(3*H*)-ones

Short Communication

John S. Davidson

North East London Polytechnic, London, E15 4LZ, England

(Received 18 January 1988. Accepted 2 February 1988)

Some 1-aroyl-4,4-dialkylsemicarbazides have been prepared by reacting aroyl-hydrazides with dimethyl- or diethyl-carbamoyl chloride. In boiling *DMF* they lose dimethylamine or diethylamine to give 5-aryl-1,3,4-oxadiazol-2(3*H*)-ones.

(Keywords: 1-Aroyl-4,4-dialkylsemicarbazides; Oxadiazolones)

*Einige 1-Aroyl-4,4-dialkylsemicarbazide und ihre Cyclisierung
zu 5-Aryl-1,3,4-oxadiazol-2(3H)-onen (Kurze Mitteilung)*

Es wurden mittels Reaktion von Aroyl-hydraziden mit Dimethyl- oder Diethyl-carbaminsäure-chlorid einige 1-Aroyl-4,4-dialkylsemicarbazide dargestellt. Diese verlieren in kochendem *DMF* Dimethylamin bzw. Diethylamin und geben 5-Aryl-1,3,4-oxadiazol-2(3*H*)-one.

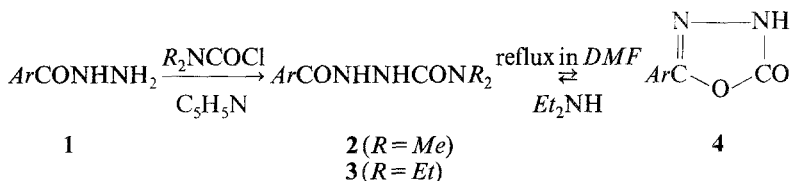
Dornow and *Lüpfert* [1] cyclized 1-benzoylsemicarbazide by heating a solution in diphenyl to 230–240 °C for a few minutes. Recently [2] it was found that 1-*o*-aminophenyl-4,4-dimethylsemicarbazide is readily cyclized in boiling dimethylformamide and this cyclization appears to be general for 1-aroyl-4,4-dialkylsemicarbazides. Previous workers [3, 4] have prepared some 5-aryl and 5-heterocyclic derivatives of 1,3,4-oxadiazol-2(3*H*)-one from the acid hydrazide and dialkylcarbamoyl chloride in pyridine without isolation (except in one case) of the intermediate semicarbazide, but yields were generally poor. The following procedure has been found useful.

The aroyl-hydrazine (0.03 mol) was dissolved in pyridine (15 cm³) with gentle warming and then the dialkylcarbamoyl chloride (0.033 mol) added. After some

Table I

<i>Ar</i>	2		3		4		Lit. m.p. (°C)
	Yield (%)	m.p. (°C)	Yield (%)	m.p. (°C)	Yield (%)	m.p. (°C)	
a <i>Ph</i>	78	212	45	163–164	82	138–139	138–139 [6]
b <i>o</i> -MeC ₆ H ₄			85*	175	84	144–145	
c <i>m</i> -MeC ₆ H ₄	74	181–182	85	158–159	85	113–114	
d <i>p</i> -MeC ₆ H ₄	50	200–201	73	172–173	98	162–163	161 [7]
e <i>o</i> -MeOC ₆ H ₄			36*	137–138	92	174–175	
f <i>m</i> -MeOC ₆ H ₄	62	177–178			92	147–148	
g <i>p</i> -MeOC ₆ H ₄	58	202–204	79	150–151	95	186–187	185 [7]
h <i>o</i> -ClC ₆ H ₄	70	182–183	78	188–189	90	163–164	165–166 [6]
i <i>m</i> -ClC ₆ H ₄	90	194–195			90	160–161	158–159 [8]
j <i>p</i> -ClC ₆ H ₄	73	195–196	93	177–178	92	228–229	234–235 [6]
k <i>o</i> -O ₂ NC ₆ H ₄	50*	197–198	81*	186–187	89	158–159	159–161 [2]
l <i>m</i> -O ₂ NC ₆ H ₄	97	198–199	44	183–184	94	194–195	190–192 [6]
m <i>p</i> -O ₂ NC ₆ H ₄	79	202–203			86	250–251	251–253 [6]
n <i>o</i> -HOC ₆ H ₄	75	177–178			75	197–198	199–200 [4]
o 2,5-HO(MeO)C ₆ H ₃	60	194–195			70	188–189	
p 2,5-HO(Cl)C ₆ H ₃	82	217–219	46	173–174	46	237–239	236–239 [4]

* These yields of **2k**, **3b**, **3e**, and **3k** were obtained when the reaction time was extended to 3–4 weeks



hours, conveniently overnight, water was added and the precipitated 1-aryl-4,4-dialkylsemicarbazide filtered off, washed with water and dried. The dried products **2** or **3** were quite pure and could be cyclized without further purification. Analytical specimens were recrystallised from ethanol. *Stempel* [5] obtained **3a** by heating **4a** with diethylamine in a sealed tube. Samples of **3e** and **3l** were also made by *Stempel's* method.

To accomplish cyclization to the oxadiazolone (**4**), the semicarbazide (**2** or **3**) was dissolved in dimethylformamide (5 to 10 parts) and heated under reflux for several hours till evolution of dialkylamine ceased. Addition of water afforded the 5-aryl-1,3,4-oxadiazol-2(3*H*)-one which was recrystallised from ethanol or aqueous ethanol. Yields of **4** obtained from **2** or **3** were so similar that it is unnecessary to quote both (Table I).

Satisfactory analyses for C, H, and N were obtained for all novel compounds. Infra-red spectra of compounds **2** and **3** showed absorption around 1640 cm^{-1} , whereas the oxadiazolones (**4**) absorbed around 1780 cm^{-1} . The mass spectrum of **4a** was similar to that in the literature [9]. For **2a**, **2d**, **2h**, **2i**, **3a**, and **3g** peaks were observed corresponding to M^+ , ArCO^+ , Ar^+ , and R_2NCO^+ .

Although 5-(2-aminophenyl)-1,3,4-oxadiazol-2(3*H*)-one readily rearranges to 3-amino-2,4(1*H*,3*H*)-quinazolinedione [2] when heated above its melting point, no analogous rearrangement of **4n** to 3-amino-2*H*-1,3-benzoxazine-2,4(3*H*)-dione [10] was observed.

The author thanks SERC for the mass spectra.

References

- [1] *Dornow A, Lüpfer S* (1955) *Arch Pharm* 288: 311
- [2] *Davidson JS* (1984) *Monatsh Chem* 115: 565
- [3] *Yale HL, Losee KA, Perry FM, Bernstein J* (1954) *J Am Chem Soc* 76: 2208
- [4] a) US 3,127,410; (1964) CA 61: 3118^g; b) *Wilder Smith AE* (1962) *Arch Pharm* 295: 455
- [5] *Stempel A, Zelauskas J, Aeschlimann JA* (1955) *J Org Chem* 20: 412
- [6] *Chau N, Saegusa Y, Iwakura Y* (1982) *J Het Chem* 19: 541
- [7] *British* 988, 974; (1964) CA 60: 4157^f
- [8] *Kamizono H, Eto M* (1983) *Agric Biol Chem* 47: 701
- [9] *Golfier M, Rene M, Guy B, Yannik H* (1976) *Org Mass Spectrom* 11: 712; *Bouchoux G, Hoppilliard Y, Golfier M, Guillerez MG* (1981) *Org Mass Spectrom* 16: 29
- [10] *Davidson JS* (1982) *Chem Ind* 1982: 660