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A CONVENIENT SYNTHESIS OF NOVEL 3-AMIDINO-2-OXO-1,2-DIHYDROQUINOXALINE

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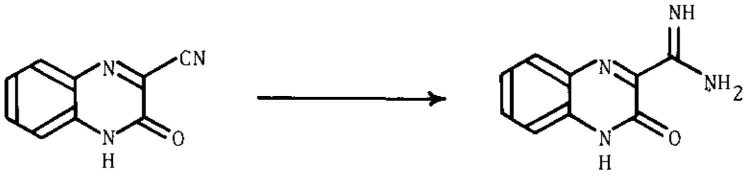
Abstract —— The reactions of 3-(5-oxo-1,2,4-oxadiazolin-3-yl)-2-oxo-1,2-dihydroquinoxaline (2) and 2-oxo-1,2-dihydroquinoxaline-3-amidoxime (3), derived from 3-cyano-2-oxo-1,2-dihydroquinoxaline (1), with $FeSO_4$-HCl and Fe-HCl afforded Fe(II) complexes of 3-amidino-2-oxo-1,2-dihydroquinoxaline (4), whose treatment with NaOH gave the free ligand 4.

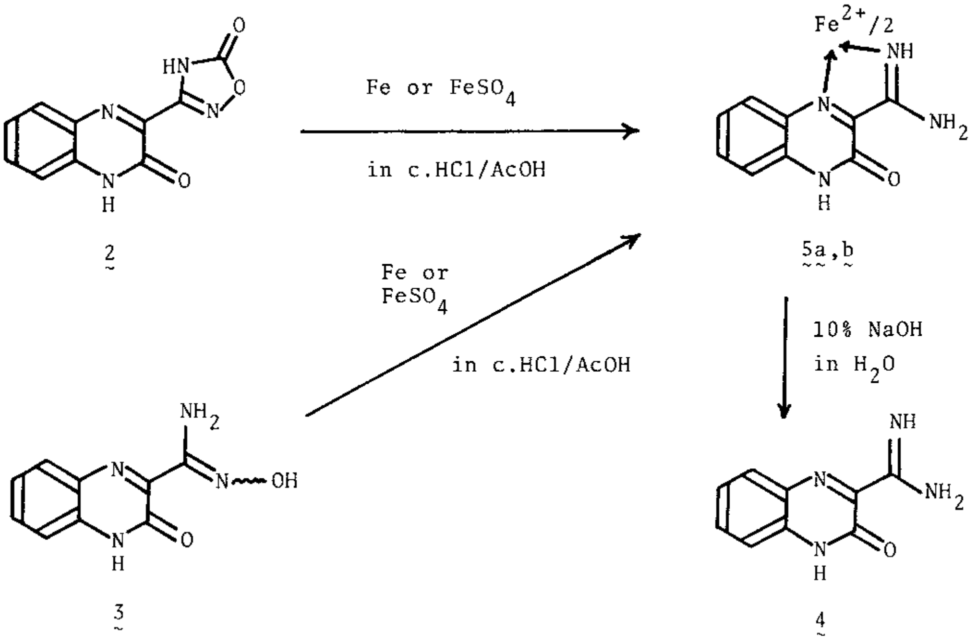
In a previous paper,[1] we reported the conversion of 3-cyano-2-oxo-1,2-dihydroquinoxaline (1) into 3-(5-oxo-1,2,4-oxadiazolin-3-yl)-2-oxo-1,2-dihydroquinoxaline (2) via 2-oxo-1,2-dihydroquinoxaline-3-amidoxime (3). However, there have been no reports on the conversion of 1 into 3-amidino-2-oxo-1,2-dihydroquinoxaline (4) (Scheme 1). Since further reduction of N-O bond of 2 or 3 would result in the formation of 4, accomplishment of this process would provide an access to a route of nitrile to amidine, presumably bearing comparison with the Pinner's amidine synthesis.[2] In



1

4

Scheme 1



Scheme 2

Table I. IR and ^{1}H-NMR Spectral Data for 4, 5a, and 5b.

Compound	IR ν(KBr) (cm^{-1})		^{1}H-NMR (solvent) δ(ppm)
3-AQ (4)	3420	1700	(CF_3COOH): 9.28(s, 1H, NH),[a] 8.40-7.33 (m, 4H, aromatic)
Fe(3-AQ)$_2$Cl$_2$·H$_2$O (5a)	3570 3400 3300	1700	(DMSO-d_6): 9.64(br.s, 4H, NH), 8.00-7.17(m, 4H, aromatic), 3.50(br.)[b]
Fe(3-AQ)$_2$SO$_4$·H$_2$O (5b)	3450 3320 3170	1705 1685	(DMSO-d_6): 9.57(br.s, 4H, NH), 8.00-7.33(m, 4H, aromatic), 4.23(br.)[b]

a: Three other NH protons disappeared, presumably due to CF_3COOH. b: A signal due to H_2O.

Table II. Mass Spectral Data for **4**, **5a**, and **5b**.

Compound	m/z	Ion species	Formula	Calcd.	Found	Relat. abundance
4	188	$[M]^+$	$C_9H_8N_4O$	188.070	188.068	100
	171	$[M-NH_3]^+$	$C_9H_5N_3O$	171.043	171.044	24.0
	160	$[M-CO]^+$	$C_8H_8N_4$	160.075	160.073	46.8
5a	same as **4***				188.071	100
					171.042	15.7
					160.073	32.0
5b	same as **4***				188.068	100
					171.043	37.9
					160.073	32.1

* **5a** and **5b** exhibited M^+ of the free ligand **4** due to thermal dissociation in the inlet system of the mass spectrometer.

this paper, we describe a facile synthesis of **4** via **2** or **3** from **1**. Although the methods have already been reported for the conversion of 1,2,4-oxadiazoline ring and amidoxime into amidine using reducing agents such as P-HI[3] and $Fe(CO)_5$,[4] respectively, we have found that the reduction of N-O bond of **2** and **3** is conveniently achieved with an inexpensive and easily available agent $FeSO_4$-HCl[5] and Fe-HCl to give **4** (3-AQ).

Refluxing of **3** (4 g) with Fe (2 g) in c.HCl (50 ml) and AcOH (150 ml) provided the $Fe(3\text{-}AQ)_2Cl_2\cdot H_2O$ complex (**5a**) (4 g, 88.3%) as yellow needles (from H_2O-EtOH) of mp 269-270 °C (dec.) [Anal. Calcd for $C_{18}H_{18}Cl_2FeN_8O_3$ (**5a**): C, 41.48; H, 3.48; Cl, 13.61; N, 21.50. Found: C, 41.62; H, 3.83; Cl, 13.65; N, 21.71.]. The reaction of **3** (1 g) with $FeSO_4$ (5 g) in c.HCl (10 ml) and AcOH (90 ml) produced the $Fe(3\text{-}AQ)_2\text{-}SO_4\cdot H_2O$ complex (**5b**) (600 mg, 50.4%) as yellow needles (from H_2O-EtOH) of mp 190-193 °C [Anal. Calcd for $C_{18}H_{18}FeN_8O_7S$ (**5b**): C, 39.57; H, 3.32; N, 20.51; S, 5.87. Found: C, 39.83; H, 3.75; N, 20.44; S, 5.82.]. Moreover, similar reactions of 2-oxo-1,2-dihydroquinoxaline-3-amidoxime (**6**) (1 g) with Fe (1 g) and $FeSO_4$ (5 g) in c. HCl (10 ml) and AcOH (90 ml) gave **5a** (720 mg, 56.3%) and **5b** (850 mg, 63.4%), respectively. Treatment of **5a** and **5b** (1 g) with 10% NaOH (10 ml) in H_2O (100 ml) furnished the free ligand 3-AQ (**4**) (640 mg, 83.3% from **5a**; 480 mg, 69.7% from **5b**) as yellow needles (trituration with $EtOH-H_2O$) of mp 310-312 °C [*Anal*. Calcd for $C_9H_8N_4O$ (**4**): C, 57.44; H, 4.29; N, 29.77. Found: C, 57.21; H, 4.29; N, 29.47.].

The structural assignment of **4**, **5a**, and **5b** (Scheme 2) was based on the microanalytical and spectral data (Tables I and II). Especially, the IR spetcral data indicated that the NH absorption bands are quite different among **4**, **5a**, and **5b**, presumably due to the presence or absence of a chelation, while the chelation hardly exerts an influence on the C=O absorption bands of **4**, **5a**, and **5b**, suggesting no participation of the C=O group in the chelation.[6] Mass spectra of **4**, **5a**, and **5b** showed similar fragmentations.

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