

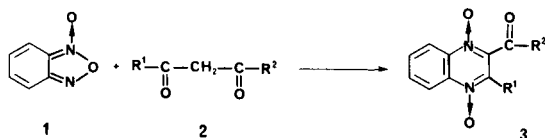
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The syntheses of 2,3-disubstituted quinoxaline 1,4-dioxides are smoothly and efficiently carried out by the adsorption of the components on molecular sieve 3A (powder) from benzofuroxan **1** and 1,3-diketones, 3-oxoalkanoic esters, or 3-oxoalkanamides **2**.

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It is well known that quinoxaline di-*N*-oxide derivatives **3** are synthesized from benzofuroxan **1** and enolate anions of 1,3-diketones or β -ketoesters **2** in a basic medium [1,2] (Scheme). In a previous paper [3], we reported that silica gel provides a versatile synthetic tool for these reactions. However, in the above method, the reaction times are long, 1-2 weeks. In continuation of the above work, we found that molecular sieve also is a more effective catalyst for these reactions.



Scheme

A solution of compound **1** and carbonyl compound **2** in methanol is evaporated in the presence of molecular sieve; both reagents are adsorbed on the molecular sieve which is then allowed to stand for 1-3 days without drying at room temperature. The mixture is chromatographed on silica gel to give the corresponding quinoxaline di-*N*-oxide derivative **3**. The reactions used molecular sieve for 1-3 days will be enough to expect good yields (with silica gel: 1-2 weeks).

The efficacy of the reactions varies considerably with the type of molecular sieve used. The most convenient type is 3A (powder), and the less convenient types are 5A (powder) and 13X (powder) [Union Showa].

Table 1

Physical Data of Quinoxaline 1,4-Dioxides **3a-i**

Compound No.	R ¹	R ²	Reaction Time (day)	Yield (%)	Mp (°C)	Formula or Mp (°C) reported [a]	Ms (high resolution)		Elemental Analysis		
							M ⁺ m/e	Found (Calcd.)	C	H	N
3a	CH ₃	C ₆ H ₅	1	82	229-231	229-231 [4]					
3b	CH ₂ COOCH ₃	OCH ₃	5	50	156-157	155-157 [3]					
3c	C ₆ H ₄ NO ₂ (4)	OC ₂ H ₅	1	83	160-161	160-162 [3]					
3d	C ₆ H ₅	NHC ₆ H ₅	1	71	227-229	227-229 [3]					
3e	CH ₃	NHC ₆ H ₅	1	88	226-228	C ₁₆ H ₁₃ N ₃ O ₃	295.0951 (295.0955)	65.10 (65.08)	4.44 4.44	14.08 14.23	
3f	CH ₃	NHC ₆ H ₄ OCH ₃ (2)	2	87	201-203	C ₁₇ H ₁₅ N ₃ O ₄	325.1071 (325.1062)	63.04 (62.76)	4.76 4.65	12.67 12.92	
3g	CH ₃	NHC ₆ H ₄ OCH ₃ (4)	3	80	196-198	C ₁₇ H ₁₅ N ₃ O ₄	325.1049 (325.1062)	62.99 (62.76)	4.66 4.65	12.91 12.92	
3h	CH ₃	NHC ₆ H ₄ Cl (4)	2	84	247-249	C ₁₆ H ₁₂ ClN ₃ O ₃	329.0543 (329.0565)	58.48 (58.28)	3.86 3.67	12.44 12.74	
3i	CH ₃	NHC ₆ H ₄ CH ₃ (2)	2	85	206-208	C ₁₇ H ₁₅ N ₃ O ₃	309.1138 (309.1112)	65.94 (66.01)	4.85 4.89	13.53 13.59	

[a] The products **3a-d** were characterized by comparison of their melting points, ir and ¹H-nmr spectra with those of authentic samples prepared according to ref [3,4].

Table 2

Spectral Data of the New Compound **3**

Compound No.	IR (cm ⁻¹)	¹ H-NMR δ (ppm), TMS
3e	1688, 1550	2.51 (s, 3H, CH ₃), 7.12-7.73 (m, 5H arom), 7.91-8.13 (m, 2H, 6-, 7-H), 8.43-8.58 (m, 2H, 5-, 8-H), 11.02 (s, 1H, NH) [a]
3f	1677, 1535	2.84 (s, 3H, CH ₃), 3.88 (s, 3H, OCH ₃), 6.83-7.15 (m, 4H arom), 7.78-7.88 (m, 2H, 6-, 7-H), 8.43-8.57 (m, 2H, 5-, 8-H), 10.60 (s, 1H, NH) [b]
3g	1670, 1550	2.68 (s, 3H, CH ₃), 3.76 (s, 3H, OCH ₃), 6.69, 7.59 (2d, 2H each, J = 9 Hz each, 4H arom), 7.67-7.77 (m, 2H, 6-, 7-H), 7.91-8.09 (m, 2H, 5-, 8-H), 10.78 (s, 1H, NH) [b]
3h	1678, 1551	2.50 (s, 3H, CH ₃), 7.48, 7.72 (2d, 2H each, J = 9 Hz each, 4H arom), 7.92-8.12 (m, 2H, 6-, 7-H), 8.43-8.59 (m, 2H, 5-, 8-H), 11.17 (s, 1H, NH) [a]
3i	1660, 1546	2.45 (s, 3H, CH ₃), 2.85 (s, 3H, CH ₃), 7.04-7.30 (m, 4H arom), 7.77-7.91 (m, 2H, 6-, 7-H), 8.34-8.47 (m, 2H, 5-, 8-H), 10.80 (s, 1H, NH) [b]

[a] DMSO-d₆. [b] Deuteriochloroform.

EXPERIMENTAL

General Procedure.

3-Methyl-2-[2-methoxyphenyl]aminocarbonylquinoxaline 1,4-Dioxide **3f**.

To a solution of **1** (2.00 g, 0.015 mole) and *o*-acetoacetanilide (**2f**, 3.05 g, 0.015 mole) in methanol (50 ml) was added molecular sieve [3A (powder), 20 g] and the mixture is evaporated in an evaporator at 20°. The molecular sieve containing the adsorbed reagents was allowed to stand for 2 days without drying, at room temperature. It was then added to a silica gel column and product **3f** was eluted with dichloromethane/methanol (98/2), yield 4.15 g (87%). Recrystallization from methanol afforded yellow needles, mp 201-203°.

REFERENCES AND NOTES

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