

A Novel One-pot Synthesis of Pyrroles from 1,2,5-Selenadiazole and 1,3-Diketones

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A one-pot reaction of 4-methyl-3-phenylcarbamoyl-1,2,5-selenadiazole **2** and 1,3-diketones in the presence of zinc dust and acetic acid gave 1,2-disubstituted 3-methyl-4-phenylcarbamoilpyrroles **3**.

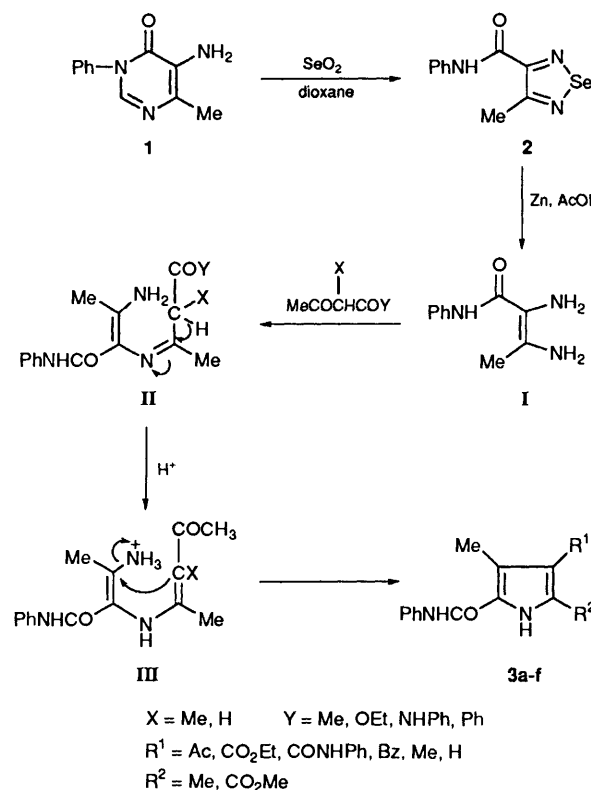
The synthesis of Pyrroles, which occur widely in living systems and are important in view of their potential biological activity, is restricted to a small number of classical methods.¹ In the course of our study of the utilization of organoselenium compounds² we were interested to find that 1,2,5-selenadiazole reacts in an uncommon way with 1,3-diketones to provide a novel synthesis of a variety of 2,3,4,5-substituted pyrroles. Here we report a one-pot synthesis of pyrroles from 1,2,5-selenadiazole and 1,3-diketones.

4-Methyl-3-phenylcarbamoil-1,2,5-selenadiazole³ **2** a compound we obtained earlier by an intriguing transformation with selenium dioxide from 5-amino-6-methyl-3-phenylpyrimidin-4(3*H*)-one⁴ **1** was thought likely to be easily reduced to give a diamine, which might then react with 1,3-diketones such as acetylacetone or benzoylacetone, to give diazepines. Thus, the reaction of compound **2** with acetylacetone in isopropyl alcohol in the presence of zinc dust and acetic acid was examined. Unexpectedly, 3-acetyl-2,4-dimethyl-5-phenylcarbamoilpyrrole **3a** accompanied by small amount of 2,4-dimethyl-5-phenylcarbamoilpyrrole **3b** were formed, structural assignments for the two compounds being based on spectral evidence (IR, ¹H NMR and mass). Furthermore, compound **3a** was identical with the product from the reaction of α -nitrosoacetanilide with acetylacetone in the presence of zinc dust and acetic acid. α -Nitrosoacetanilide was prepared from acetoacetanilide by the reaction with sodium nitrite. Similarly, compound **2** reacted with acetoacetanilide, ethyl acetoacetate, benzoylacetone and 3-methylpentane-2,4-dione, to afford the corresponding pyrroles (Table 1). In contrast, in its reaction with dibenzoylacetone compound **2** afforded, solely, 2,5-dimethyl-3,6-bis(phenylcarbamoil)pyrazine⁴ rather than a pyrrole. The reaction of compound **2** with dimethyl acetylenedicarboxylate gave the pyrrole **3g**.

Conversion of **2** into **3** may be explained as follows. Initial reductive elimination of selenium from **2** by means of zinc dust and acetic acid would give a diamine **I**. Condensation of one of the amino groups of the diamine with a 1,3-diketone would afford intermediate **II**; protonation of the second amino group, **III**, followed by elimination and cyclization would form compound **3**. Deacetylation would afford a little of **3b**.

Experimental

Typical Preparation of 3a from 2.—To a solution of compound **2** (0.1 mmol) in isopropyl alcohol (4 cm³) were added acetylacetone (30 mg), zinc powder (50 mg) and acetic acid (1 cm³). The resulting mixture was stirred and heated at 80 °C for 40 min after which it was neutralized with aqueous sodium hydrogencarbonate. Zinc powder was filtered off and the filtrate was extracted with ethyl acetate. The extract was dried (MgSO₄) and concentrated to give crystalline material which was recrystallized from ethanol to afford colourless needles of **3a**; **3b** from the mother liquor.



Scheme 1

Table 1 Yields of the pyrroles **3a–g** from **2**

Product ^a	M.p. (t/°C)	R ¹	R ²	Yield (%)
3a	237–238	Ac	CH ₃	73
3b	156–158	H	CH ₃	6
3c	178–179	CO ₂ Et	CH ₃	87
3d	276–277	CONHPh	CH ₃	60
3e	194–195	Bz	CH ₃	50
3f	151–153	Me	CH ₃	21
3g^b	114–116	CO ₂ Me	CO ₂ Me	32

^a All products gave satisfactory spectral results and elemental analyses.

^b This compound was obtained by the reaction of compound **2** with dimethyl acetylenedicarboxylate.

Compound **3a**: ν_{\max} (KBr)/cm⁻¹ 3430, 3300 (NH) and 1640 (C=O); δ_{H} (270 MHz, [²H₆]-DMSO) 2.37 (3 H, s, COMe), 2.49 (3 H, s, Me), 2.51 (3 H, s, Me), 7.06–7.65 (5 H, m, Ph), 10.15 (1 H, s, NH) and 12.87 (1 H, s, NH); m/z (EI) 256 (M⁺). Compound **3b**: ν_{\max} (KBr)/cm⁻¹ 3360 (NH), 3300 (NH) and 1640 (C=O); δ_{H} (270 Mz, [²H₆]-DMSO) 2.27 (3 H, s, Me), 2.34 (3 H, s, Me),

5.74 (1 H, s, =CH), 7.00–7.65 (5 H, m, Ph), 9.13 (1 H, s, NH) and 10.99 (1 H, s, NH); m/z (EI) 214 (M^+).

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