

N-ARYL-3-CYANOAZETIDIN-2,4-DIONES. A CORRECTION

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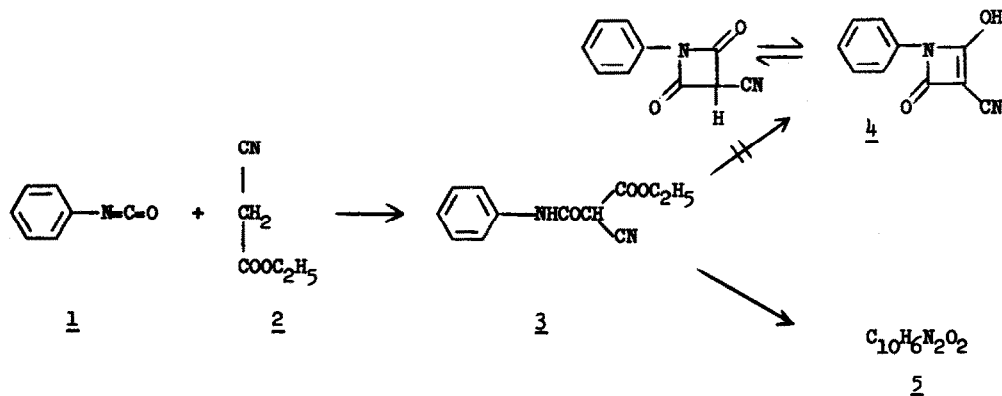
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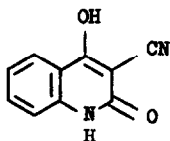
A recent literature claim was made by Capuano and Zander¹ that the reaction of aryl isocyanates 1 with ethyl cyanoacetate 2 gave intermediates 3 which could be annelated by thermolysis to N-aryl-3-cyanoazetidin-2,4-diones 4. However, the physical data presented in support of the assigned structure 4 appeared to us to be ambiguous, particularly since the claimed synthesis of 4 from 3 was not an unequivocal process. Therefore, we decided to reinvestigate the reaction sequence outlined in Scheme 1.

Scheme 1

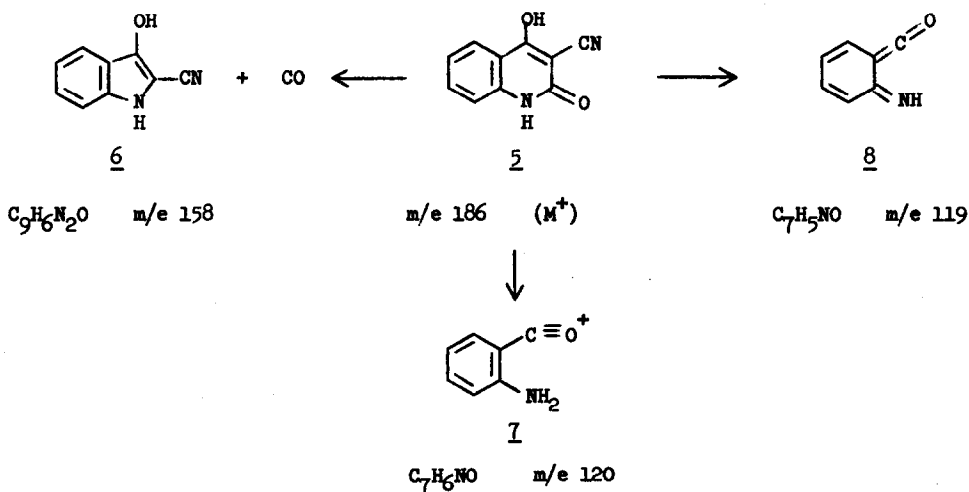


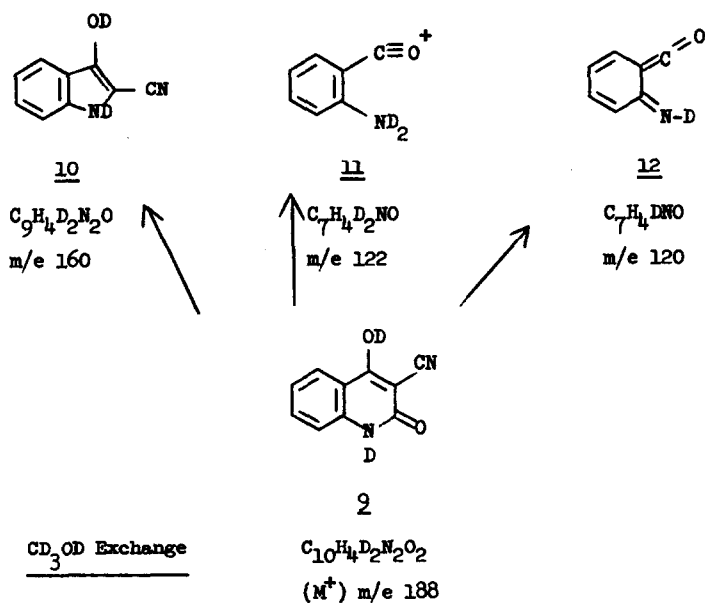
On reacting redistilled ethyl cyanoacetate with freshly distilled phenyl isocyanate under the conditions reported by Capuano and Zander,¹ compound 3 was isolated in comparable yields. But when 3 was heated with xylene under reflux for 20 hrs., we obtained a compound 5, C₁₀H₆N₂O₂ (Combustion analysis: % C, 64.74; H, 3.46; N, 15.16), of m.p. 289-293°C. (Decomp. with gas evolution) (Lit.¹ 289°). The ir spectrum (Nujol) of 5 showed characteristic enolic O-H bands at $\bar{\nu} = 3,130 \text{ cm}^{-1}$, an α,β -unsaturated nitrile CN absorption (strong) at $2,250 \text{ cm}^{-1}$, and a

broad amide CO band at $1,685\text{ cm}^{-1}$. No bands were visible above $\bar{\nu} = 1,700\text{ cm}^{-1}$ [$\bar{\nu}$ N-benzoyl-3-(p-benzoylphenyl)-azetidin-2,4-dione² has $\bar{\nu}\text{ C=O} = 1,705\text{ cm}^{-1}$ (sharp)]. The nmr spectrum of 5 [$\text{SO}(\text{CD}_3)_2$ with tetramethylsilane as internal reference] showed two hydrogen bonded downfield protons at $11.8\ \delta$ (1H) (OH enolic) and at $10.75\ \delta$ (1H) (NH), respectively. At temperatures above 50°C ., the proton signals coalesced at $12.3\ \delta$ integrating to 2H. From the shape and the distribution of the aromatic absorption, a singly substituted phenyl group was not indicated. The aromatic multiplet of 5 was spread out between $7\text{--}8.15\ \delta$ integrating to 4H. (In compound 4 the aromatic signals should have integrated to 5H.) On the basis of this information alone, we were able to rule out structure 4 and deduced that compound 5 was 3-cyano-4-hydroxycarbostryl.

5

Analysis of the fragmentation pattern in the mass spectrum of 5, shown in Scheme 2, corroborated the carbostryl assignment to the structure of 5.

Scheme 2



Compound 5 has a molecular ion peak (M^+) at 186 units. Loss of CO gives fragment 6 to which we assign an indole structure.⁴ Fragments 5 or 6 would give 7 and 8. Of significance in the molecular ionization study was that treatment of 5 with CD_3OD effected a mass increase of 2 units to give 9 ($m/e = 188$) showing that there were two replaceable hydrogens in 5, a fact totally incompatible with the azetidin-2,4-dione structure 4. Fragments analogous to those obtained from 5, but with mass increases corresponding to one or two deuterium atoms, were identified from 9 (10, 11, and 12).

Evidently, Capuano and Zander have obtained carbostyryl derivatives 5 described in the literature,⁵ and not the azetidin-2,4-diones 4.

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