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# A 1,3-DIPOLAR CYCLOADDITION REACTION OF 1-METHYLINDAZOLE

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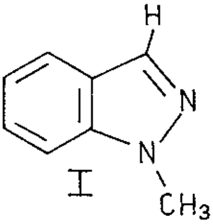
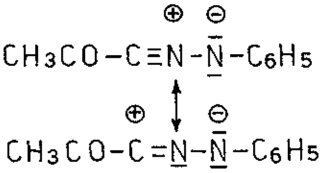
A 1,3-dipolar cycloaddition reaction of 1-methylindazole with C-acetyl-N-phenyl-nitrilimine was performed. The cycloadduct could be used to synthetize 1,2,4-triazole derivatives.

In the framework of our studies[1] on the behaviour of heterocyclic systems towards nitrilimines, we have carried out the reaction between 1-methylindazole (I) and C-acetyl-N-phenyl-nitrilimine (II), prepared in situ. Treatment of (I) with stoichiometric amount of α-chloro-(N-phenylhydrazone)acetone and three-fold excess of triethylamine (THF, 20 days, room temperature) gave a reaction mixture which, after triethylamine hydrochloride being filtered off and the solvent evaporated under vacuum, afforded 1-phenyl-3-acetyl-5-methyl-1,9b-dihydro-5H-1,2,4-triazol-[4,3b]indazole (III), mp 134-135°, in 40% yield. The structure of the cycloadduct (III) was assigned on the basis of elemental analysis, spectroscopic data and chemical transformation. An examination of the nmr spectrum [($C_6D_6$) δ: 2.17 (3H, s, -CO-$CH_3$), 3.26 (3H,

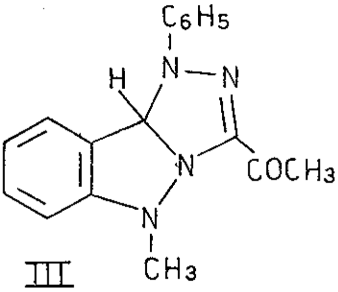


I

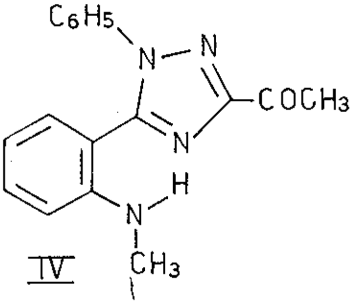


$$CH_3CO-C\equiv\overset{\oplus}{N}-\overset{\ominus}{\underline{\bar{N}}}-C_6H_5 \updownarrow CH_3CO-\overset{\oplus}{C}=\underline{N}-\overset{\ominus}{\underline{\bar{N}}}-C_6H_5$$

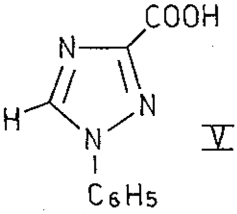
II



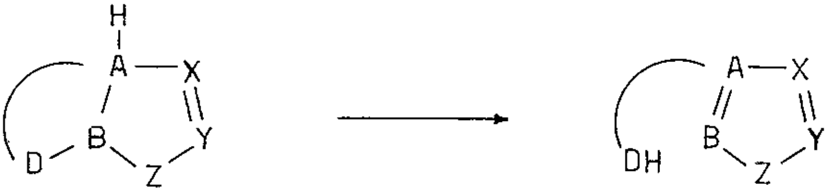
III



IV



V



VI

VII

s, $-N-\underline{CH}_3$), 6.61 (1H, s, 8a-$\underline{H}$), 6.35-7.10 ( 9H, m, Ar-$\underline{H}$)] revealed large shielding effect on 9b-H and $-N-CH_3$ protons with respect to 3-H and $-N-CH_3$ protons of (I) ($\Delta\delta$ = -1.30 and -0.27 respectively). This shielding effect substantiated the absence of ring current clearly supporting the structure proposed. The carbonyl frequency [ν max (nujol mull) 1666 $cm^{-1}$ ] observed is also consistent with (III). A sample of (III) with catalytic amount of conc. HCl (THF, 24 hr, room temperature) gave, after evaporation of the solvent under vacuum, 1-phenyl-3-acetyl-5-[o-methylaminophenyl]-1,2,4-triazole (IV), in almost quantitative yield. The structure of (IV), mp 201-202°, was deduced on the basis of the following evidence: ir ν max (nujol mull) 3322, 1690 $cm^{-1}$ ; nmr ($DMSO-d_6$) δ : 2.63 (3H, s, $-CO-\underline{CH}_3$), 2.68 (3H, d, $-N-\underline{CH}_3$, J=4.5), 6.03 (1H, br q, N$\underline{H}$, J=4.5), 6.20-7.70 (4H, m, Ar-$\underline{H}$), 7.39 (5H, s, $N-C_6\underline{H}_5$); uv $^{EtOH}_{max}$ nm (log ε): 221sh (4.37), 258sh (4.06), 3.44 (3.65). Moreover, a suspension of (IV) in a warm solution of sodium hydroxide treated with $KMnO_4$, afforded 1-phenyl-1,2,4-triazol-3-carboxylic acid (V)[2].

The results obtained give further information on the behaviour, as dipolarophiles, of the nitrogen heteroaromatic compounds putting in evidence the tendency of C=N bond of 1-methylindazole (I) to react towards nitrilimines so as the C=N bond of some mono[3] and diazines[4], azomethines[5], oximes[6], etc.. As expected, the unsubstituted nitrogen controls the orientation of the dipole. Furthermore the transformation of (III) into (IV) furnishes an interesting alternative route to synthetize 1,2,4-triazole derivatives. This behaviour is similar to that of other non aromatic cycloadducts[7,8] which, by treatment with acids, give aromatic compounds through an elimination reaction, e.g.scheme (VI → VII).

## REFERENCES AND FOOTNOTES

1 a) M.Ruccia, N.Vivona, F.Piozzi, and M.C.Aversa, *Gazz.Chim.Ital.*, 1969, **99**, 588; b) M.Ruccia, N.Vivona, G.Cusmano, and M.L.Marino, *Gazz.Chim.Ital.*, 1970, **100**, 358; c) M.Ruccia, N.Vivona, and G. Cusmano, *Tetrahedron Letters*, 1972, 4703; d) M.Ruccia, N.Vivona, G. Cusmano, M.L.Marino, and F.Piozzi, *Tetrahedron*, 1973, **29**, 3159.

2 M.Ruccia and N.Vivona, *Ann.Chimica*, 1969, **59**, 434.

3 R.Fusco, P.Dalla Croce, and A.Salvi, *Tetrahedron Letters*, 1967, 3071; *Gazz.Chim.Ital.*, 1968, **98**, 511.

4 P.Dalla Croce, *J.Heterocyclic Chem.*, 1975, **12**, 1133.

5 R.Huisgen, R.Grashey, H.Knupfer, R.Kunz, and M.Seidel, *Ber.*, 1964, **97**, 1085.

6 R.Huisgen, R.Grashey, E.Auferhaar, and R.Kunz, *Ber.*, 1965, **98**, 642.

7 A.Corsico Coda, P.Grünanger, and G.Veronesi, *Tetrahedron Letters*, 1966, 2911; P.Caramella, *Tetrahedron Letters*, 1968, 743; L.Q. Khanh and B.Laude, *Compt.Rend.*, [C], 1973, **276**, 109.

8 Likewise, we have observed that cycloadduct obtained from N-methylindole and diphenyl-nitrilimine gives 1,3-diphenyl-4- o-methylaminophenyl pyrazole by treatment with HCl in ethanolic solution at room temperature, through a fission of D-B bond (unpublished results). A different behaviour showed cycloadducts obtained from N-substituted indole derivatives and C-acetyl or C-carbethoxy-N-phenyl-nitrilimines. In these cases, in fact, under similar experimental conditions we have observed the cleavage of the B-Z bond[1a,1d].

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