Tetrahedron Letters No.35, pp. 3871-3872, 1968. Pergamon Press. Printed in Great Britain.

A DIRECT SYNTHESIS OF DIHYDROTETRAZINES

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(Received in UK 27 May 1968; accepted for publication 7 June 1968)

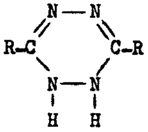
Dihydrotetrazines have been conveniently prepared from hydrazine hydrate and imidoethers[1]. They have been also formed from thioamides and hydrazine hydrate, alone[2] or mixed with sulphur[3].

The reaction between either anhydrous hydrazine[4] or hydrazine hydrate[5] and nitriles was reported to take place over a period of several days. Moreover, 1-amino-1,3,4-triazoles are frequently formed in this reaction[6].

Recently, it has been reported that a hydrazine hydrate-sulphur mixture, in ethanolic solution, effects smooth reduction of aromatic nitro compounds to the respective amines[7]. We now wish to report a direct synthesis of dihydrotetrazines by the action of a hydrazine hydrate-sulphur mixture on different nitriles.

Treatment of a solution of benzonitrile (0.05 mole) in ethanol (15 ml) with hydrazine hydrate (10 ml), followed by the addition of flowers of sulphur (1 g) and heating the mixture at reflux for 1-3 hours afforded (82 % yield) of 1,2-dihydro-3,6-diphenyl-1,2,4,5-dihydrotetrazine (I); yellow needles (from chloroform); m.p. and mixed m.p. with an authentic sample[2] was 192-193°.

With acetonitrile under the same conditions of reaction, dimethyldihydrotetrazine (I,R = CH_3) was formed in rather poor yields (20 %).



I,R = C_6H_5

Extension of this reaction procedure to include different ring-substituted nitriles resulted in the formation of the corresponding dihydrotetrazine in good yields (I,R = C_6H_5-CH_2, 84 %; p-CH_3-C_6H_4, 94 %; p-Cl-C_6H_4, 92 %; p-Br-C_6H_4, 88 %; p-CH_3O-C_6H_4, 76 %). Identity of the products was established by comparison of their melting points with known dihydrotetrazines and by correct combustion values. They all underwent oxidation in air to the respective coloured tetrazines.

o-Methylbenzonitrile did not undergo this reaction. It seems that the o-methyl group exerts a steric effect sufficient to prevent the azine ring formation.

The intermediate in this reaction is not definitly a thiohydrazide, since phenylthiohydrazide did not react, under similar conditions of reaction, to give any diphenyldihydrotetrazine. A hydrocarbon m.p. 48° was isolated from the reaction mixture and was not further characterised.

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