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TRIAZOLINES X[1]. ORGANIC SYNTHESIS VIA 1,2,3-TRIAZOLINE INTERMEDIATES. A UNIQUE SYNTHESIS OF 4-ANILINOPYRIDAZINE

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The paper illustrates the utility of the 1,2,3-triazoline heterocycle in organic systhesis. The 4,5-acyl-substituted triazoline (2) decomposes in situ to yield the enaminodiketone (3) and the diacylaziridine (5). With hydrazine, (3) undergoes ring closure to yield the hitherto unknown 4-anilinopyridazine (4); (5), however, yields the pyrazole (7). A mechanism is suggested for the formation of (7).

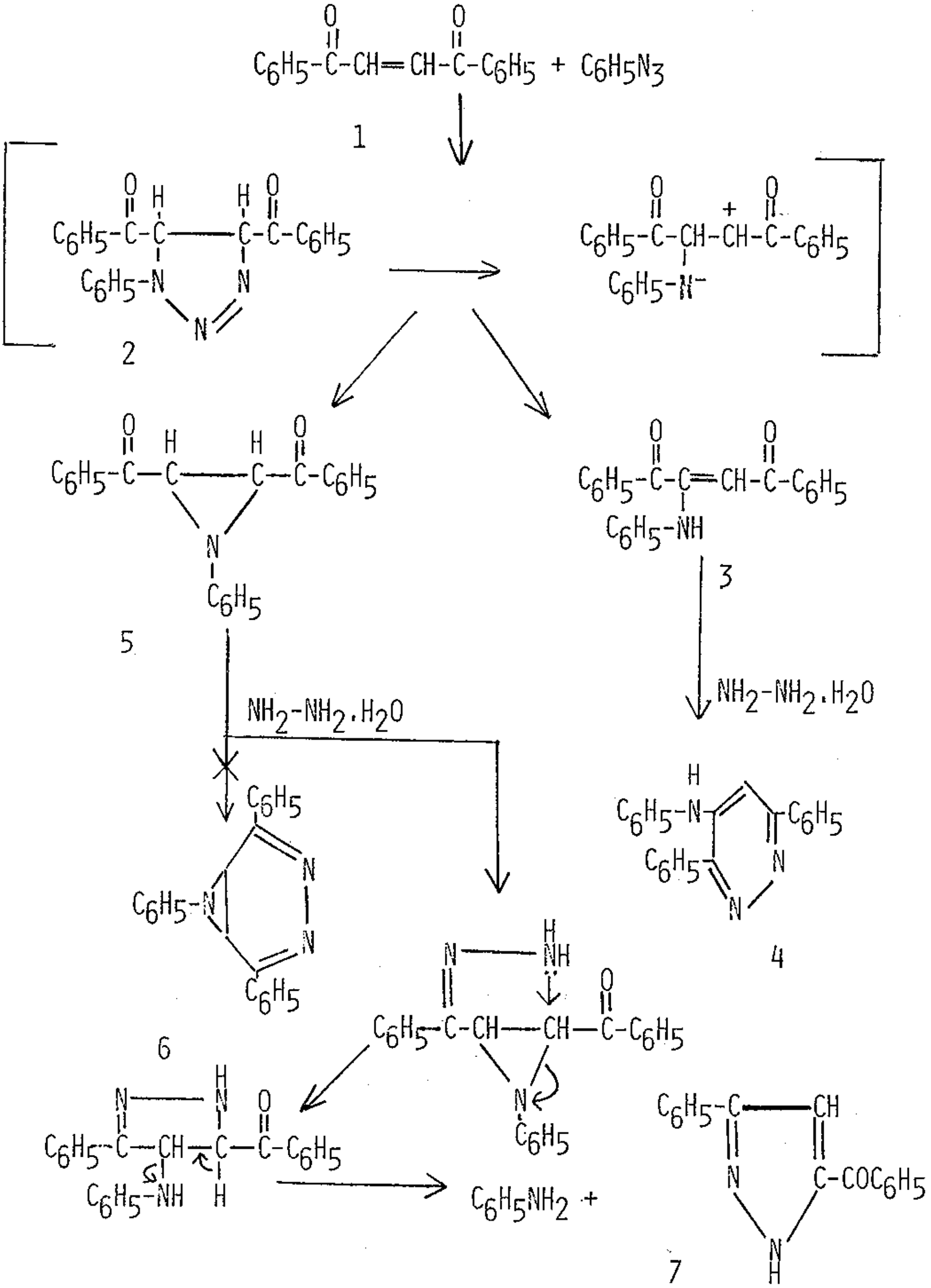
Organic synthesis utilizing heterocycles has been assuming much importance in recent years[2]. The four major decomposition paths of the 1,2,3-triazoline heterocycle[3] provide useful routes to the synthesis of azomethines, aziridines and ketones[2]. We report here, a unique synthesis of the hitherto unknown 3,6-diphenyl-4-anilinopyridazine (4) via a 4,5-acyl-substituted-1,2,3-triazoline intermediate (2). The latter, obtained by reacting phenyl azide with dibenzoylethylene (1) in refluxing methanol, decomposes in situ, by way of nitrogen expulsion followed by a C-N proton shift[4], to yield the enaminodiketone (3), which undergoes ring closure with hydrazine to give the 4-anilinopyridazine (4).

The majority of the aminopyridazines, including arylaminopyridazines, is synthesized, in general, by the displacement of halogen atoms by amino groups in the halopyridazine compounds[5]. The preparation of the halopyridazines themselves, usually requires involved multistep reactions[5], unlike the two-step reaction reported here for the total synthesis of 3,6-diphenyl-4-anilinopyridazine (4).

An attempt is also made to effect ring closure of the diacylaziridine (5), formed in minor amounts during the in situ decomposition of (2)[4], to the pyridazine compound (6). However, in place of the latter, a pyrazole (7) is obtained, the formation of which could be conceived according to the reaction mechanism outlined in Scheme 1.

In order to achieve the preparation of the enaminodiketone (3) and aziridine (5), the reaction mixture comprising dibenzoylethylene (0.02 mol) and phenyl azide (0.03 mol) in methanol (30 ml) was refluxed for 19 hr and stood at room temperature when the aziridine separated out. It crystallized from methanol to give 320 mg of (5), mp 231-232°. Mass spectrum m/e [M^+], 327; ^{13}C-NMR (DMSO-d_6) was consistent with the symmetrical structure (5); in the proton decoupled spectrum, the two equivalent aziridine carbon atoms appeared as a singlet at 150.66 p.p.m., while in a proton coupled spectrum, they appeared as a doublet with a large coupling constant (J_{CH} = 180 hz) which is characteristic for aziridines[6]. The remaining solution, upon evaporation to dryness, gave a syrupy residue that crystallized from methanol to give a 40% yield of (3), bright yellow crystals, mp 126-127°. Mass spectrum, m/e [M^+], 327; NMR spectrum ($CDCl_3$), δ12.48 (broad, NH), 8.03-7.70 (4 doublets, 4 ArH), 7.50-7.10 (m, 6 ArH), 7.10-6.84 (m, 5 ArH) and 6.09 (s, CH).

For the synthesis of 3,6-diphenyl-4-anilinopyridazine (4), several experiments were performed to evaluate the optimum conditions under which maximum purity of compound and yield could both be realized. In an ideal experiment, a solution of the enaminodiketone (3) (3 mmol) in boiling


+ C6H5N3
1
2
3
4
5
6
7
NH2-NH2.H2O
NH2-NH2.H2O
C6H5NH2 +

ethanol (20 ml) was treated with hydrazine (95%, 20 drops) in ethanol (5 ml). The resulting mixture was refluxed for exactly 20 min, treated with a pinch of "norit", boiled for an additional half minute, and filtered. The filtrate was cooled and treated with excess water, when a yellow sticky precipitate was formed. It was triturated with ether and crystallized from methanol, to give colorless crystals (24% yield), mp 176-178°. Mass spectrum, m/e [M^+], 323; NMR spectrum ($CDCl_3$), δ 6.27 (broad, NH of C_6H_5NH) and 7.93-6.97 (closely placed multiplets, 15 ArH and CH).

Similar reaction of dibenzoylaziridine (5) with hydrazine yielded the pyrazole (7), mp.185-186°. Mass spectrum, m/e [M^+], 248; NMR spectrum ($CDCl_3$), δ 12.37 (broad, NH), 8.0-7.5 (m, including sharp singlet, 4 ArH and CH), and 7.5-7.17 (m, 6 ArH).

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