

Cyclisation Reaction of Dibenzoylmethanemono-(tosylhydrazone) with Butyllithium and Lead tetraacetate.

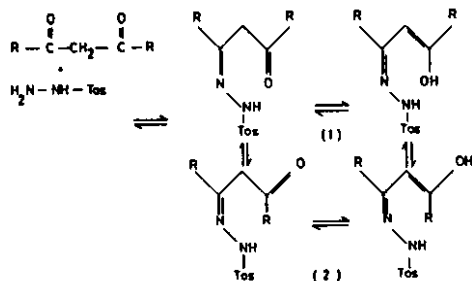
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(Received 13th December, 1987, Revised 11th April, 1988)

Summary: Dibenzoylmethanemono(tosylhydrazone) undergoes cyclisation reaction with butyllithium and lead tetraacetate to afford 3,5-diphenylpyrazole in good yield in both cases. Mechanistic schemes have been postulated to account for these reactions.

Various attempts have been reported to explore the synthetic utility of hydrazones and other related derivatives [1-11].

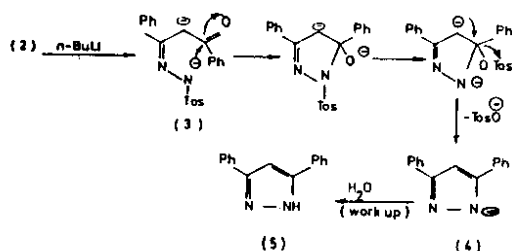
Reactions of β -diketones with tosylhydrazine are likely to yield two isomeric tosylhydrazones:



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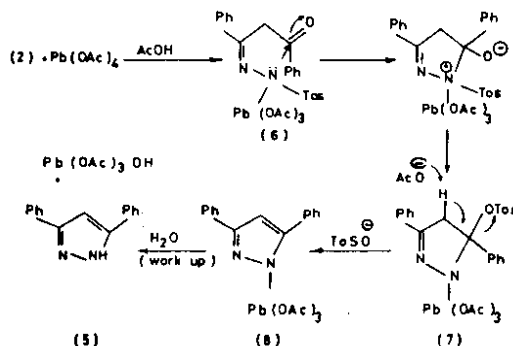
The monotosylhydrazone, when $R = \text{CH}_3$, has already been reported to be a kinetically controlled product and immediately cyclises to corresponding *N*-tosylpyrazole [12]. In view of its facile cyclisation tendency it was assumed to have (E)-configuration. On the other hand mono(tosylhydrazone), when $R = \text{C}_6\text{H}_5$, has been considered to be a thermodynamically controlled product and presumably possesses (Z)-configuration in analogy with (Z)-hydrazone of 3-phenylpropionaldehyde (13-14). The (Z)-tosylhydrazone 2, when $R = \text{C}_6\text{H}_5$, failed to cyclise when refluxed vigorously for two hours in methanol containing hydrochloric acid suggesting that it was not an acid catalysed reaction. In an attempt to bring about the cyclisation of this tosylhydrazone, when $R = \text{C}_6\text{H}_5$, it was decided to treat it separately with lead tetraacetate (LTA) and butyllithium, which are known to react with hydrazones [15].

It is obvious from the experimental section that dibenzolylmethane-mono(tosylhydrazone)(DBM-MTH, 2, $R = \text{C}_6\text{H}_5$) reacts separately with *n*-BuLi and LTA to afford 3,5-diphenylpyrazole in good yields in both cases. In order to account for the formation of this pyrazole, following mechanistic scheme has been postulated for this cyclisation reaction using *n*-BuLi:



A dianion similar to dianion 3 has already been proposed in the mechanism of formation of olefins through the reaction of tosylhydrazones with alkyllithium reagents [10-11]. This dianion 3 is likely to undergo cyclisation reaction, as shown, with loss of a TosO^- anion to produce an intermediate 4, which may abstract a proton from the medium to yield compound 5, which had mp corresponding to 3,5-diphenylpyrazole.

The following scheme has been proposed for the reaction of LTA with the tosylhydrazone 2 to yield 3,5-diphenylpyrazole:



Intermediate of the type 6, which may be considered to be formed by the nucleophilic displacement of an acetate ligand, have been proposed for many of the reaction of LTA with organic nitrogen compound [15]. This intermediate undergoes cyclisation, as indicated, to yield an intermediate 7, which loses a TosO^- anion by attack of an acetate ion to transform into another intermediate 8. The latter decomposes to compound 5.

With these limited experiments, it is premature to conclude that the methods described here are of a general nature. However, detailed investigations are in progress to explore their synthetic utility.

Experimental

Melting points were determined on a Kofler microscope hot-stage and are uncorrected. IR absorption spectra were recorded on a Perkin-Elmer 'Infracord' (137) spectrometer. The NMR spectra were recorded for DMSO- d_6 solution containing TMS as an internal standard using varian T 60 and Hitachi Perkin-Elmer R-241 60 MHz spectrometers.

Dibenzoylmethanemono(tosylhydrazone) (DBM-MTH.2):

It was prepared from dibenzoylmethane and tosylhydrazine as reported in our earlier paper [12].

Acid treatment of Dibenzoylmethanemono(tosylhydrazone):

DBM-MTH 2 (1.12 g; 0.002 mole) was vigorously refluxed for 2 h in methanol (100 ml) containing 2 ml hydrochloric acid (1N). Work up recovered the starting material quantitatively.

Reaction of Dibenzoylmethanemono(tosylhydrazone) with Butyllithium:

Dibenzoylmethanemono(tosylhydrazone) (5.6 g; 0.01 mole) suspended in sodium-dried ether (100 ml) was placed in a 1-liter flask equipped with a stirrer and a two-way adaptor carrying a dropping funnel and a guard tube containing calcium chloride. After the apparatus was swept with oxygen free nitrogen, butyllithium (16.0 g; 0.25 mole) in sodium dried ether (100 ml) was added dropwise with stirring over a period of 1h maintaining the temperature at 15°C. The stirring continued at 15°C till the entire mixture turned to a clear solution. At this stage water was added dropwise to destroy an excess of butyllithium. The contents of the flask were poured in a separating

funnel and extracted with ether (100 ml). The aqueous layer was extracted four times with ether, dried ($MgSO_4$) and concentrated to yield a crystalline colourless solid of 3,5-diphenylpyrazole (1.68 g; 77%); m.p. 198-200°C; (lit [16], m.p. 200°C). Anal. calcd. for $C_{15}H_{12}N_2$: C 81.83; H 5.45; N 12.73. (Found: C 81.34; H 5.62; N 12.93). NMR (DMSO- d_6) δ 3.30 (s, NH disappearing on D_2O shake), δ 7.20 (s, CH), δ 7.40 and δ 7.90 (m, aromatic protons).

Reaction of Dibenzoylmethanemono(tosylhydrazone) with Lead tetraacetate:

A solution of lead tetraacetate (4.43 g; 0.01 mole) in 1,2-dichloroethane (200 ml) was added to a suspension of dibenzoylmethanemono-tosylhydrazone (5.6 g; 0.01 mole) in 1,2-dichloroethane (25 ml) in 15 min without allowing the temperature to exceed 10°C. Then the reaction mixture was warmed to 20-30°C and stirred for another 15 min. The solution developed a slightly yellowish colour. The reaction mixture was stirred with water (200 ml) and allowed to stand to form two layers. The organic layer was washed successively with water and dilute sodium hydrogencarbonate until it was acid free. The dichloroethane extract was dried (Na_2SO_4) and concentrated to leave behind 1.8g (82%) of the pyrazole 5, which was identified with an authentic sample by IR and NMR spectroscopy and mixed melting point.

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