Pergamon

Tetrahedron Letters, Vol. 38, No. 41, pp. 7241-7242, 1997

0040-4039/97 $17.00 + 0.00

PII: S0040-4039(97)01680-8

Synthesis of 2,5-Bis(*N,N*-dialkylamino)thiophenes or 1-Alkyl-2-*N,N*-dialkylamino-5-methylthiopyrroles from Propargylic Amines and Isothiocyanates

Olga A. Tarasova[a], Nina A. Nedolya[a], Vladimir Yu. Vvedensky[a], Lambert Brandsma[b] and Boris A. Trofimov[a]

a. Institute of Organic Chemistry, Russian Academy of Sciences, Siberian Branch, 1 Favorsky Street, 664033 Irkutsk, Russia

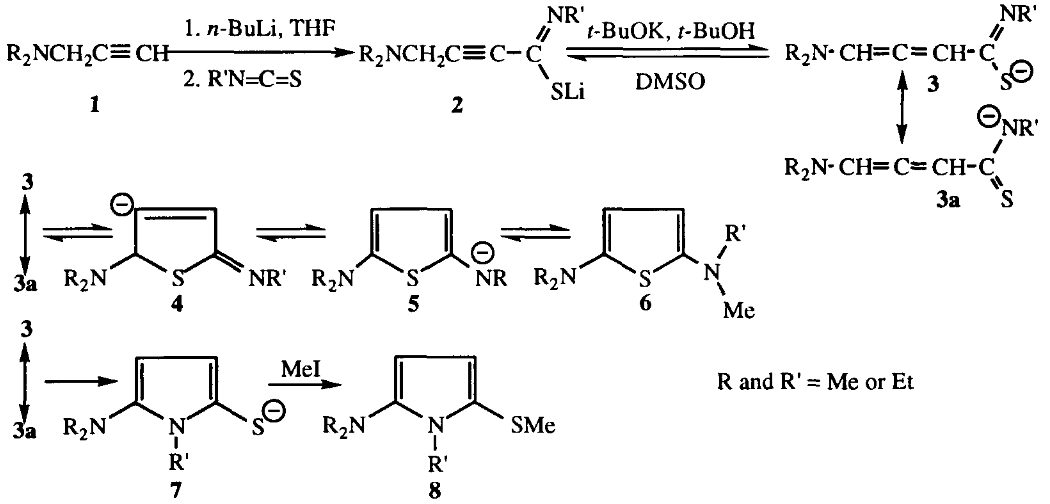
b. Department of Preparative Organic Chemistry of the University, Debye Institute, Padualaan 8, 3584 CH Utrecht, The Netherlands

Abstract: Reaction of lithiated propargylic amines with isothiocyanates, followed by addition of *t*-BuOK, *t*-BuOH and methyl iodide gives either 2,5-bis(*N,N*-dialkylamino)thiophenes or 1-alkyl-2-*N,N*-dialkylamino-5-methylthiopyrroles depending on the temperature during the treatment with the base. © 1997 Elsevier Science Ltd.

Lithiated acetylenes **1** react with isothiocyanates[1] affording the thiolates **2**. This addition and the possibility to establish an equilibrium between acetylenes and allenes under basic conditions suggested an application in the synthesis of 2,5-bis(*N,N*-dialkylamino)thiophenes **6**. Such compounds could have interesting chemical properties deviating from those of other thiophene derivatives and are not readily accessible otherwise. Thus, solutions of the adducts **2** (R and R' = Me or Et) were treated with a variety of base-cosolvent combinations in order to effect the obligatory isomerization to the intermediates **3** and their subsequent cyclization. Finally the reaction mixtures were quenched with methyl iodide. Using the system *t*-BuOK-*t*-BuOH-DMSO and keeping the temperature below 20 °C the expected thiophene derivatives **6** were obtained in good yields. If, however, prior to carrying out the methylation, the solution was kept at a higher level (40 to 50 °C) for a sufficiently long period, only the pyrrole derivatives **8** were obtained, in fair to good yields.

This interesting duality in product formation may be explained by assuming a reversal of the sequence **1** to **5** and subsequent ring closure of the tautomeric form **3a** to intermediate **7**, which possibly has a greater thermodynamic stability compared to **5**.

Starting with $CH_3C{\equiv}CH$, $C_2H_5C{\equiv}CH$ and $CH_3OCH_2C{\equiv}CH$ only the thiophene derivatives (analogous with **6**) were formed, even after heating at elevated temperatures before the final quench reaction.



R and R' = Me or Et

In the literature we found the transformation of 2,5-diamino-3,4-dicyanothiophene to 2-amino-3,4-dicyano-5-mercaptopyrrole by NaOH[2], which seems similar, but which must proceed by a different mechanism.

EXPERIMENTAL PROCEDURES

To a solution of 0.10 mol of *n*-BuLi in 63 ml of hexane and 70 ml of THF was added below 20 °C 0.10 mol of $HC{\equiv}CCH_2NMe_2$. After addition of 0.10 mol of $CH_3N{=}C{=}S$ the mixture was heated at 40 °C for 20 min. To the light-brown solution was added at -25 °C a mixture of 0.10 mol of *t*-BuOK, 0.10 mol of *t*-BuOH and 50 ml of DMSO. After stirring for 15 min at 15 °C, 20 g of methyl iodide was added at -10 °C and the temperature was allowed to rise. After heating for an additional 15 min at 40 °C 150 ml of water was added and the product was isolated *via* extraction with ether, washing with water, drying over K_2CO_3 and distillation. **6** (R and R' =Me), purity 95%, b.p. 80 °C/0.7 torr, was obtained in 73% yield. The ^1H NMR-spectrum showed signals at 2.75 (12 H) and 5.67 (2 H) ppm.

If the addition of methyl iodide was preceded by heating for 30 min at ~45 °C, the pyrrole derivative **8** (R and R' = Me), b.p. ~75 °C/0.7 torr, purity 97%, was obtained in 48% yield. The ^1H NMR-spectrum showed signals at 2.22 (3 H), 2.65 (6 H), 3.57 (3 H), 5.65 (1 H), 6.25 (1 H) ppm.

Analogous results were obtained in the cases R and R' = Me or Et.

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(*Received in UK* 30 *May* 1997; *revised* 1 *August* 1997; *accepted* 15 *August* 1997)