Chemistry of Heterocyclic Compounds, Vol. 45, No. 8, 2009

LETTERS TO THE EDITOR

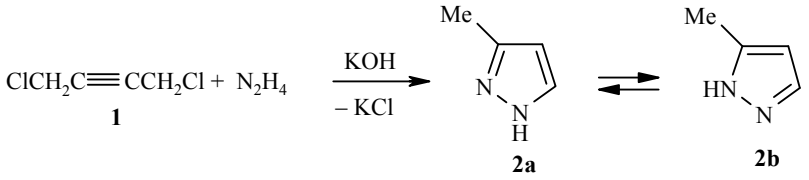
NEW SYNTHESIS OF 3(5)-METHYLPYRAZOLE

E. P. Levanova[1]*, V. A. Grabel'nykh[1], K. A. Volkova[1], N. V. Russavskaya[1], L. V. Klyba[1], A. I. Albanov[1], and N. A. Korchevin[1]

Keywords: hydrazine, 1,4-dichloro-2-butyne, methylpyrazole.

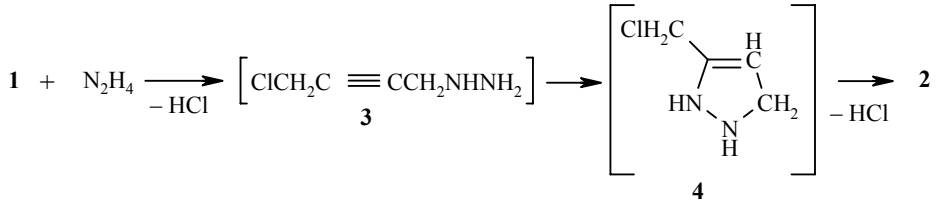
Pyrazole derivatives are the basis of many drugs, pesticides, dyes, and analytical reagents and other practically important substances [1]. The most important methods for the synthesis of pyrazoles are based on the condensation of hydrazines with 1,3-dicarbonyl compounds, vinyloxy compounds, or the precursors and derivatives of vinyloxy compounds [1, 2].

We have found that the reaction of 1,4-dichloro-2-butyne **1** with hydrazine in the presence of potassium hydroxide leads to 3(5)-methylpyrazole **2** in 43% yield (not optimized).



1 **2a** **2b**

The formation of pyrazole **2** probably proceeds through the replacement of one chlorine atom in dichloride **1** by a hydrazine residue. The second chlorine atom undergoes reductive replacement. Intermediates such as hydrazine **3** and pyrazoline **4** could not be identified in the reaction mixture.



3 **4**

* To whom correspondence should be addressed, e-mail: venk@irioch.irk.ru.

[1]A. I. Favorsky Irkutsk Institute of Organic Chemistry, Siberian Branch of the Russian Academy of Sciences, Irkutsk 664033, Russia.

Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 8, pp. 1265-1266, August, 2009. Original article submitted April 30, 2009.

The ^{1}H and ^{13}C NMR spectra were taken on a Bruker DPX 400 spectrometer at 400 and 106 MHz, respectively, in $CDCl_3$ with HMDS as the standard. The mass spectrum was taken on a Shimadzu GCMS-QP5050A mass spectrometer at 70 eV.

3(5)-Methylpyrazole 2. Dichloride **1** (7.0 g, 57 mmol) was added to a solution of KOH (4.5 g, 75 mmol) in hydrazine hydrate (30 ml) at 25°C. The reaction mixture was stirred for 1 h at 40-50°C, cooled, and extracted with dichloromethane. Removal of the solvent gave 2.0 g 3(5)-methylpyrazole **2**, bp 74-76°C (4.5 mm Hg) (204-205°C (752 mm Hg) [3]). The ^{1}H NMR spectrum, δ, ppm (*J*, Hz) showed averaged signals for tautomeric forms **2a** and **2b**: 2.25 (3H, s, CH_3); 6.00 (1H, d, H-4); 7.43 (1H, d, $^{3}J_{3,4} = 1.5$, H-5(3)). The signal for the NH proton was not detected in the ^{1}H NMR spectrum due to extensive broadening related to the tautomeric transition. The ^{13}C NMR spectrum, δ, ppm, consists of two narrow signals at 11.52 (CH_3) and 103.89 (C-4) and two broad signals at 134.41 (C-5(3)) and 142.80 (C-3(5)). The broadening of the two latter carbon signals is related to the large difference in the chemical shifts of these nuclei in the interconverting tautomers. Mass spectrum, *m/z* (I_{rel}, %): 82 $[M]^+$ (41.8), 81 $[M-H]^+$ (27.6), 67 $[M-CH_3]^+$ (1.0), 54 $[M-N_2]^{+\cdot}$ (11.7), 53 $[C_4H_5]^+$ (4.7).

REFERENCES

1. D. Barton and W. D. Ollis (editors), *General Organic Chemistry* [Russian translation], Vol. 8, Khimiya, Moscow (1985).
2. V. I. Ivanskii, *Chemistry of Heterocyclic Compounds* [in Russian], Vysshaya Shkola, Moscow (1978).
3. A. N. Nesmeyanov, N. K. Kochetkov, and M. I. Rybinskaya, *Izv. Akad. Nauk SSSR, Otdel. Khim. Nauk*, 350 (1950).