Chemistry of Heterocyclic Compounds, Vol. 38, No. 5, 2002

LETTERS TO THE EDITOR

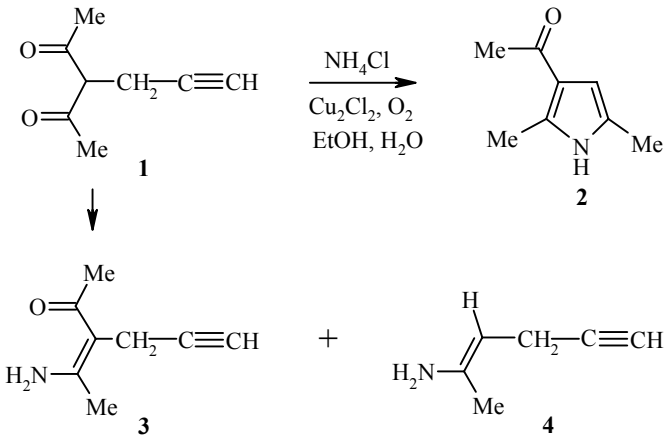
NEW METHOD FOR THE SYNTHESIS OF PYRROLES

S. A. Vizer, E. Kh. Dedeshko, and K. B. Erzhanov

Keywords: 1-acetyl-3-butynyl methyl ketone, 3-acetyl-2,5-dimethylpyrrole, cyclization.

NH-Pyrroles have been prepared from esters of α-amino-β-keto acids and ketones (Knorr synthesis), from 1,4-diketones and ammonia by the reaction of β-keto acids with ammonia and a chlorinated ketone (Hantsch method) [1], by the heterocyclization of ketoximes with acetylene (Trofimov reaction), and by the reaction of ketoximes with vinyl halides, with 1,2-dichloroethane, or 1,2-dibromoethane [2].

We are the first to report that 3-acyl-2,5-dimethylpyrrole (**2**) may be obtained by the reaction of 1-acyl-3-butynyl methyl ketone (**1**) with ammonium chloride in aqueous ethanol at 50-60°C catalyzed by freshly prepared Cu_2Cl_2 with continuous air bubbling and heating.



The greatest yield of pyrrole **2** (49%) was achieved using a three-fold excess of Cu_2Cl_2 and 10-fold excess of NH_4Cl. Pyrrole **2**, whose structure was confirmed by elemental analysis, IR and ^1H NMR spectroscopy, is a rather stable compound, which darkens upon exposure to light. This compound may be stored for a long period in a refrigerator in the dark but undergoes partial decomposition to an enamine and the starting ketone upon chromatography on silica gel.

The reaction of **1** with ammonia in aqueous ethanol at 50-60°C leads to the formation of only a 4:1 mixture of enamines **3** and **4**. Pyrrole **2** is also not formed in the reaction of diketone **1** with NH_4Cl in aqueous ethanol taking $CuCl_2$ as the catalyst.

A. B. Bekturov Institute of Chemical Sciences, Ministry of Education and Science of the Republic of Kazakhstan, 480100 Almaty, Kazakhstan; e-mail: vizer@astel.kz. Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 5, pp. 702-203, May, 2002. Original article submitted March 13, 2001.

 0009-3122/02/3805-0616$27.00

1-Acetyl-3-butynyl Methyl Ketone (1) was obtained from acetylacetone and propargyl bromide [3].

3-Acetyl-2,5-dimethylpyrrole (2). A solution of diketone **1** (1.32 g, 0.01 mol) in ethanol (15 ml) was added with vigorous stirring and air bubbling to a solution of NH_4Cl (5.35 g, 0.1 mol) and freshly prepared Cu_2Cl_2 (2.97 g, 0.03 mol) in water (25 ml). The mixture was heated at 50-60°C for 2 h. After cooling, a saturated solution of NaCl and aqueous ammonia were added. The mixture was extracted with benzene. The benzene solvent was distilled off. The residue was subjected to chromatography on a column packed with Silpearl silica gel (*d* 40 mm, *h* 130 mm) using 10:1 benzene–acetone and then 10:2 benzene–acetone as the eluent to give 0.67 g (49%) pyrrole **2** as a light orange powder; mp 81-82°C, R_f 0.69 (on Silufol UV-254 with 5:1 benzene–acetone as the eluent). IR spectrum in KBr pellet, ν, cm^{-1}: 1360, 1376, 1448, 1524, 1592 (C=C–N pyrrole), 1620 (C=O), 3160 (N–H). ^1H NMR spectrum ($CDCl_3$), δ, ppm: 2.18 (3H, s, 5-CH_3); 2.36 (3H, s, 2-CH_3); 2.48 (3H, s, –C(O)–CH_3); 6.14 (1H, s, 4-H); 9.21 (1H, s, N–H). Found: *m/z* 137 $[M]^+$. Calculated: M 137. Found, %: C 70.01; H 8.54. $C_8H_{11}NO$. Calculated, %: C 70.04; H 8.08.

REFERENCES

1. *Chemical Handbook* [in Russian], Khimiya, Leningrad (1975).
2. B. A. Trofimov and A. I. Mikhaleva, *N-Vinylpyrroles* [in Russian], Nauka (Siberian Branch), Novosibirsk (1984).
3. J. Houben, *Methods in Organic Synthesis* [Russian translation], ONTI, Moscow (1935), Vol. 3(2), p. 439.