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LETTERS TO THE EDITOR

Alternative Reaction Medium for the Synthesis of 1-Propargylpyrazoles

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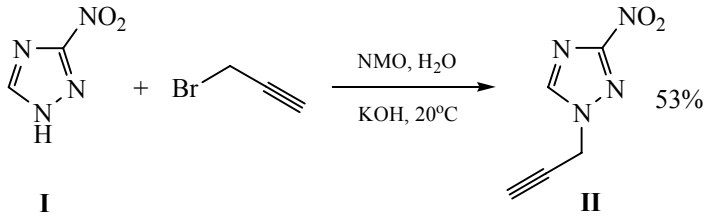
Synthesis of *N*-propargyl substituted heterocycles and development of available and technologically simulated processes for their preparation are among the goals of organic chemistry due to the fact that these compounds are starting materials for producing polyconjugated polymer compounds with semiconductor properties and components used for the synthesis of radio-pharmaceuticals [1].

The methods of obtaining of 1-propargylpyrazoles under phase transfer catalysis [2, 3], as well as by catalysis with potassium carbonate [4] are known. However we failed to obtain 1-propargyl-3-nitro-1,2,4-triazole **II** from 3-nitro-1,2,4-triazole under these conditions. The use of an aqueous solution of *N*-methyl-morpholine *N*-oxide (NMO) as the reaction medium and potassium hydroxide as catalyst made it possible to obtain 3-nitro-1-propargyl-1,2,4-triazole **II** in 53% yield, therewith the formation of allene by-product was not observed (Scheme 1).

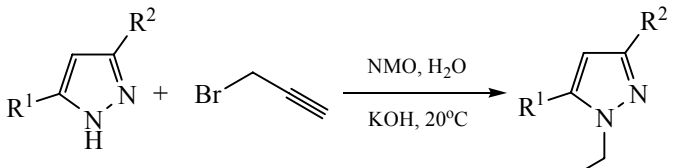
Reacting pyrazole **IIIa**, 3(5)-methylpyrazole **IIIb**, and 3,5-dimethylpyrazole **IIIc** with propargyl bromide under similar conditions led to the formation of the

Scheme 1.



I **II**

Scheme 2.



IIIa–IIIc **IVa–IVd**

$R^1 = R^2 = H$ (**IIIa, IVa**); $R^1 = CH_3$, $R^2 = H$ (**IIIb, IVb**); $R^1 = H$, $R^2 = CH_3$ (**IIIb, IVc**); $R^1 = R^2 = CH_3$ (**IIIc, IVd**).

corresponding 1-propargylpyrazoles **IVa**–**IVd** in 66–79% yields (Scheme 2).

Hence, the use of aqueous *N*-methylmorpholine *N*-oxide and an equimolar amount of potassium hydroxide can serve as an alternative medium to obtain 3-nitro-1-propargyl-1,2,4-triazole and 1-propargylpyrazoles.

3-Nitro-1-propargyl-1,2,4-triazole (II). A mixture of 11.4 g (0.1 mol) of 3-nitro-1,2,4-triazole **I**, 9 g (0.15 mol) of potassium hydroxide, and 50 mL of 50% aqueous *N*-methylmorpholine-*N*-oxide solution was stirred for 1 h at 80°C. Next, 15 mL (0.15 mol) of propargyl bromide was added dropwise, and the mixture was stirred at 20°C for 5 h. The reaction product was extracted with chloroform. The extract was washed with water and dried over magnesium sulfate. After removing the solvent, the residue was distilled in a vacuum. Yield 8 g (53%), bp 155°C (1 mmHg). IR spectrum, ν, cm^{-1}: 2100 (C≡CH), 1500 (ring). ^{1}H NMR spectrum (DMSO-d_6), δ, ppm (*J*, Hz): 3.24 t (1H, ≡CH, *J* 2.6), 5.27 d (2H, NCH_2, *J* 2.6), 8.79 s (1H, H^5).

1-Propargylpyrazole (IVa) was prepared similarly from 3.4 g (0.05 mol) of pyrazole **IIIa** and 10 mL (0.12 mol) of propargyl bromide. Yield 3.5 g (66%), bp 80°C (1 mmHg), n_D^{20} 1.4960. IR spectrum, ν, cm^{-1}: 2120 (C≡CH), 1500 (ring). ^{1}H NMR spectrum (DMSO-d_6), δ, ppm (*J*, Hz): 2.96 t (1H, ≡CH, *J* 2.6), 4.95 d (2H, NCH_2, *J* 2.6), 6.21 d. d (1H, H^4, *J* 2.4, 1.6), 7.36 d. d (1H, H^3, *J* 1.6, 0.8), 7.65 d. d (1H, H^5, *J* 2.4, 0.8).

3(5)-Methyl-1-propargylpyrazole (IVb,c) was prepared similarly from 8.2 g (0.1 mol) of 3(5)-methylpyrazole **IIIb** and 21 mL (0.24 mol) of propargyl bromide. Yield 9.5 g (79%), bp 45–48°C (1 mmHg), n_D^{20} 1.500. A ratio of isomer **IVb** : **IVc** = 2.5 : 1. IR spectrum, ν, cm^{-1}: 2100 (C≡CH), 1510 (ring). ^{1}H NMR spectrum (DMSO-d_6), δ, ppm (*J*, Hz): 2.39 s (3H, 3-CH_3), 2.21 br.s (3H, 5-CH_3), 2.90 t (1H, ≡CH, *J* 2.6), 4.84 d (2H, NCH_2, *J* 2.2), 5.97 d (1H, H^4, *J* 2.2), 7.20 d (1H, H^3, *J* 2.2), 7.49 d (1H, H^5, *J* 2.2).

3,5-Dimethyl-1-propargylpyrazole (IVd) was prepared similarly from 9.6 g (0.1 mol) of 3,5-dimethylpyrazole **IIIc** and 21 mL (0.24 mol) of propargyl bromide. Yield 10.5 g (78%), bp 59°C (1 mmHg), n_D^{20} 1.4990. IR spectrum, ν, cm^{-1}: 2100 (C≡CH), 1510 (ring). ^{1}H NMR spectrum (DMSO-d_6), δ, ppm (*J*, Hz): 2.12 s (3H, 3-CH_3), 2.29 d (3H, 5-CH_3, *J* 0.8), 2.76 t (1H, ≡CH, *J* 2.6), 4.75 d (2H, NCH_2, *J* 2.6), 5.73 q (1H, H^4, *J* 0.8).

^{1}H and ^{13}C NMR spectra (DMSO-d_6–CCl_4, 1 : 3, 300 K) were obtained on a Varian Mercury-300VX spectrometer operating at 300.05 and 75.46 MHz, respectively, internal reference TMS. IR spectra (thin layer) were recorded on a Specord 75 IR instrument.

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