

LETTERS TO THE EDITOR

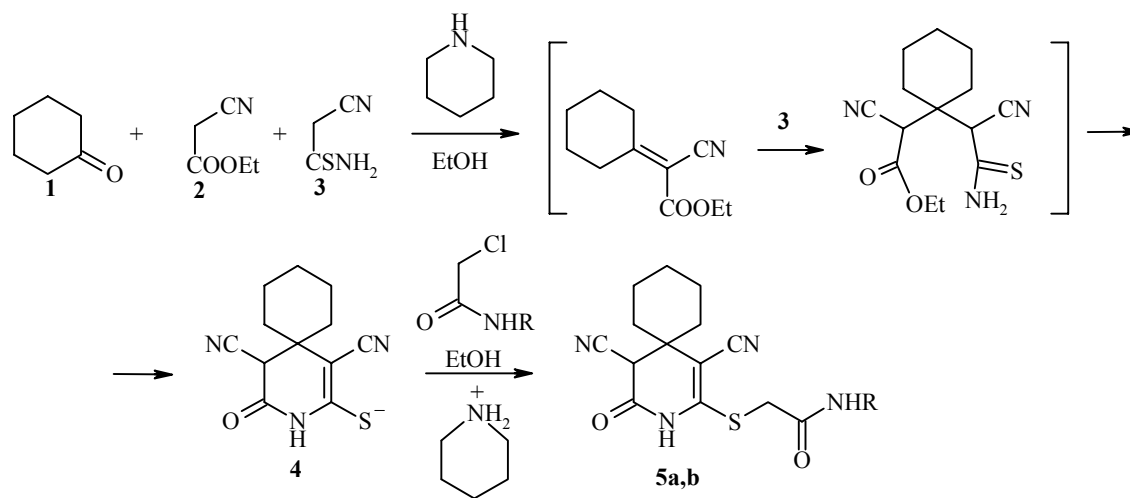
MULTICOMPONENT SYNTHESIS OF PIPERIDINIUM 3,5-DICYANO- 4-CYCLOHEXANESPIRO-2-OXO- 1,2,3,4-TETRAHYDOPYRIDINE-6-THIOLATE

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Cyclopentanone and isatin can react with malonitrile and cyanothioacetamide to form spiro-linked dihydropyridines [1,2]. We do not know of other examples of multicomponent synthesis of this type. An attempt to obtain the spiro-linked analog from cyclohexanone by a one-pot synthesis proved to be unsuccessful [1].

We have observed that when cyanoacetate (**2**) and cyanothioacetamide (**3**) are added successively to cyclohexanone (**1**) in the presence of piperidine in absolute ethanol (~20°C), the salt **4** is formed in 67% yield, and is then used in synthesis of alkylthiopyridones **5**. A change in the order of addition of the starting reagents leads to a substantial decrease in the yields of the target product **4**.



a R = 4-ClC₆H₄, **b** R = 4-EtC₆H₄

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Piperidinium 3,5-Dicyano-4-cyclohexanespiro-2-oxo-1,2,3,4-tetrahydropyridine-6-thiolate (4). Yield 67%; mp 183-185°C. IR spectrum (vaseline oil), ν , cm^{-1} : 3216, 3472 (NH, N^+H_2), 2239, 2173 (2CN), 1683 (CO). ^1H NMR spectrum (DMSO- d_6), δ , ppm: 1.42-1.77 (16H, m, $(\text{CH}_2)_8$); 3.09 (4H, m, $\text{N}(\text{CH}_2)_2$); 3.78 (1H, s, C_3H); 8.37 (2H, br. s, N^+H_2); 8.98 (1H, br. s, NH). Found, %: C 61.22; H 7.11; N 16.75. $\text{C}_{12}\text{H}_{12}\text{N}_3\text{OS}\cdot\text{C}_5\text{H}_{12}\text{N}$. Calculated, %: C 61.42; H 7.28; N 16.85.

6-[N-(4-Chlorophenyl)carbamoyl]methylthio-3,5-dicyano-4-cyclohexanespiro-2-oxo-1,2,3,4-tetrahydropyridine (5a). Yield 88%; mp 233-235°C. IR spectrum (vaseline oil), ν , cm^{-1} : 3300 (2NH), 2235, 2197 (2CN), 1740, 1691 (2CO). ^1H NMR spectrum (DMSO- d_6), δ , ppm, J , Hz: 1.22-1.83 (10H, m, $(\text{CH}_2)_5$); 3.91 (2H, s, SCH_2); 4.28 (1H, s, C_3H); 7.26, 7.59 (4H, both d, Ar, $^3J = 8.8$); 10.42, 11.32 (2H, both s, 2NH). Found, %: C 57.77; H 4.57; N 13.29. $\text{C}_{20}\text{H}_{19}\text{ClN}_4\text{O}_2\text{S}$. Calculated, %: C 57.90; H 4.62; N 13.50.

3,5-Dicyano-4-cyclohexanespiro-6-[N-(4-ethylphenyl)carbamoyl]methylthio-2-oxo-1,2,3,4-tetrahydropyridine (5b). Yield 81%; mp 179-181°C. IR spectrum (vaseline oil), ν , cm^{-1} : 3313 (2NH), 2234, 2196 (2CN), 1719, 1650 (2CO). ^1H NMR spectrum (DMSO- d_6), δ , ppm, J , Hz: 1.22 (3H, t, Me, $^3J = 7.6$); 1.42-1.83 (10H, m, $(\text{CH}_2)_5$); 2.59 (2H, q, CH_2 , $^3J = 7.6$); 3.90 (2H, s, SCH_2); 4.26 (1H, s, C_3H); 7.09, 7.47 (4H, both d, Ar, $^3J = 8.4$); 10.22, 11.44 (2H, both s, 2NH). Found, %: C 64.51; H 5.72; N 13.66. $\text{C}_{22}\text{H}_{24}\text{N}_4\text{O}_2\text{S}$. Calculated, %: C 64.68; H 5.92; N 13.71.

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