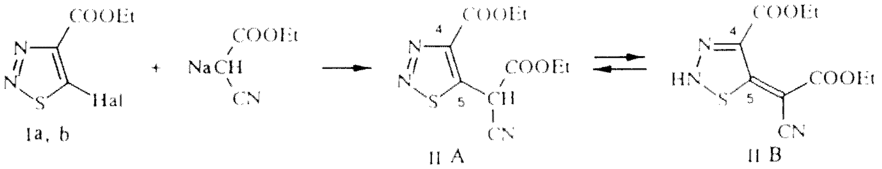
Chemistry of Heterocyclic Compounds, Vol. 31, No. 12, 1995

C-NUCLEOPHILIC SUBSTITUTION IN 1,2,3-THIADIAZOLE

E. V. Tarasov, Yu. Yu. Morzherin, and V. A. Bakulev

Earlier [1-3] it was shown that 5-halogeno-1,2,3-thiadiazoles readily enter into substitution reactions with S-, N-, and O-nucleophiles. At the same time, C-nucleophilic substitution is unknown for this heterocyclic system.

We found that the C-substitution product (II) is formed with a 75% yield during the reaction of the bromide (Ia) with sodiocyanoacetic ester.



I a Hal = Br, b Hal = Cl

In its IR spectrum (potassium bromide) there absorption bands for the two ethoxycarbonyl groups at 1690 and 1695 and also a band for the CN group at 2205 cm^{-1}. In the PMR spectrum, recorded in DMSO-d_6, there are signals for the protons of the two COOEt groups: 4.26 (2H, q, J = 7.5 Hz, CH_2), 4.07 (2H, q, J = 7.5 Hz, CH_2), 1.3 (3H, t, J = 7.5 Hz, CH_3), and 1.18 ppm (3H, t, J = 7.5 Hz, CH_3). In the PMR spectrum recorded in deuterochloroform, in addition to the above-mentioned protons, there are also a broad singlet at 6.08 and a narrow singlet at 5.85 ppm, the overall intensity of which corresponds to one proton. The ^{13}C NMR spectrum (DMSO-d_6) contains signals at 168.83 (CO), 162.88 (CO), 157.68 ($C_{(4)}$), 140.03 (C_5), 119.77 (CN), 59.68 (CH_2), 59.15 (CH_2), 14.9 (CH_3), and 14.26 (CH_3) ppm. The spectrum recorded in deuterochloroform differs in that the signal of the $C_{(4)}$ atom is shifted downfield by 10.53 while the signal of the $C_{(5)}$ atom is shifted upfield by 6.52 ppm; in addition there is a signal at 35.09 ppm, which can be assigned to the carbon atom of the CH group.

The signals at 5.85 and 6.08 ppm in the spectrum in deuterochloroform can be assigned to the two tautomeric forms A and B of (II) (to the protons of the CH and NH group respectively). The existence of the two tautomers may also explain the absence of signals for the methine group in the NMR spectra recorded in DMSO-d_6.

From the chloride (Ib) under analogous conditions, the product (II) is formed with a yield of less than 5%.

The nitrile group in compound (II) is extremely reactive. Thus, the corresponding amide (III) is formed even with prolonged holding in water. PMR spectrum of (III) (DMSO-d_6): 8.3 and 7.9 (2H, ss, NH_2), 5.8 (1H, s, CH), 4.41 (2H, q, J = 7.0 Hz, CH_2), 4.12 (2H, q, J = 7.0 Hz, CH_2), 1.36 (3H, t, J = 7.0 Hz, CH_3), and 1.16 ppm (3H, t, J = 7.0 Hz, CH_3).

5-(1-Ethoxycarbonyl-1-cyanomethyl)-4-ethoxycarbonyl-1,2,3-thiadiazole (II). To the solution obtained by adding 0.19 g (8.4 mmole) of sodium to 10 ml of absolute cyanoacetic ester, we added 1 g (4.2 mmole) of compound (Ia). The reaction mixture was kept with stirring at 70°C for 1 h. To the reaction mixture we then added 100 ml of ether. The precipitated sodium salt of compound (II) was filtered off and washed with ether (3 × 10 ml). The obtained salt was dissolved in 20 ml of water and acidified to pH 1 with hydrochloric acid. The precipitate was filtered off and washed with cold water (2 × 10 ml). The yield was 75%; mp 94-96°C. Found %: C 44.82, H 4.10, N 15.40, S 11.70. $C_{10}H_{11}N_3O_4S$. Calculated %: C 44.60, H 4.12, N 15.60, S 11.91.

Urals State Technical University, Urals Pedagogical Institute, Ekaterinburg. Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 12, pp. 1698-1699, December, 1995. Original article submitted November 22, 1995.

REFERENCES

1. P. Demaree, M. Doria, and J. M. Muchowski, J. Heterocycl. Chem., **15**, 1811 (1978).
2. G. L'abbe and E. Vanderstede, J. Heterocycl. Chem., **26**, 1295 (1989).
3. Yu. Yu. Morzherin, E. V. Tarasov, and V. A. Bakulev, Khim. Geterotsikl. Soedin., No. 4, 548 (1994).