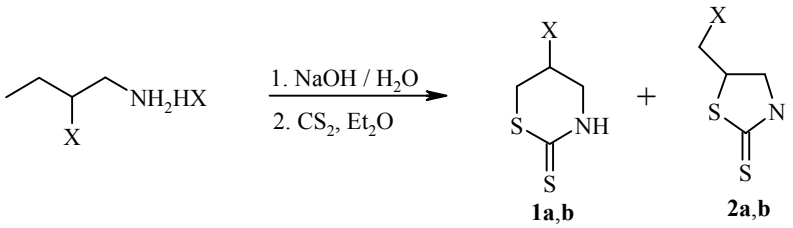
Chemistry of Heterocyclic Compounds, Vol. 38, No. 12, 2002

SYNTHESIS AND REARRANGEMENT OF 5-HALO-3,4,5,6-TETRAHYDRO-1,3-THIAZINE-2-THIONES AND 5-HALOMETHYLTHIAZOLIDINE-2-THIONES

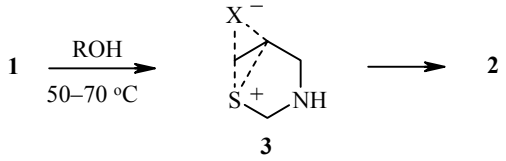
T. P. Trofimova, V. M. Fedoseev, and S. E. Tkachenko

Keywords: 5-halomethylthiazolidine-2-thiones, 5-halo-3,4,5,6-tetrahydro-1,3-thiazine-2-thiones, rearrangement of 5-halo-3,4,5,6-tetrahydro-1,3-thiazine-2-thiones.

We have observed that the reaction of carbon disulfide with bases of 2,3-dihalopropylamines in ether leads to a mixture (1:1) of isomeric cyclic dithiocarbamates: 5-halo-3,4,5,6-tetrahydro-1,3-thiazine-2-thiones (**1a,b**) and 5-halomethylthiazolidine-2-thiones (**2a,b**).



1, **2** **a** X = Cl, **b** X = Br



Such a reaction of 2,3-dibromopropyl isothiocyanate with amines leads to mixtures of isomeric cyclic β-bromopropyl isothioureas [1].

Mixtures of heterocycles **1** and **2** proved to be difficult to separate by chromatography. The pure isomers could be isolated only by using low-temperature crystallization. Compounds **1** and **2** are rather stable in the crystalline state and in some solvents (alcohols, acetone, chloroform).

At the same time, tetrahydrothiazines **1**, when heated in alcohols (MeOH, EtOH, *i*-PrOH) easily rearrange to isomeric thiazolidines **2**; in this case, isomerization of bromo derivatives **1b** occurs much faster than for the chloro derivatives **1a**. Obviously the rearrangement is a special case of isomerization of

M. V. Lomonosov Moscow State University, Moscow 119899, Russia; e-mail: trof@radio.chem.msu.ru.
Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 12, pp. 1733-1734, December, 2002. Original article submitted November 21, 2002.

0009-3122/02/3812-1533$27.00

β-halo sulfides, also occurring in a number of related β-halo isothioureas [2]. Interestingly, the rearrangement is not accompanied by formation of solvolysis products. This suggests a fairly low polarity for the bicyclic cationoid intermediate **3**, probably an intimate ion pair.

5-Halo-3,4,5,6-tetrahydro-1,3-thiazine-2-thiones 1. A solution of NaOH (0.72 g, 18 mmol) in water (15 ml) was added dropwise, with stirring and cooling down to 0°C, to a solution of 2,3-dihalopropylamine hydrohalide (18 mmol) in a minimal amount of water. The mixture was extracted with ether (4×20 ml). The ether extracts were combined, evaporated under vacuum down to a volume of 50 ml, and cooled down to -12°C. Carbon disulfide (0.69 g, 9 mmol) was added to this solution at -12°C. The reaction mixture was allowed to stand in a closed container at -12±1°C for 20 h. The precipitate was filtered out, washed several times with water and ether, and dried under vacuum. The material obtained was chromatographically pure six-membered isomer **1**.

Compound 1a. Yield 40%; mp 165-168°C. R_f 0.34 (Silufol UV-254, isoamyl acetate). IR spectrum (vaseline oil), ν, cm^{-1}: 3110 (N–H), 1340 (C–N), 1240 (C=S). ^{1}H NMR spectrum (200 MHz, DMSO-d_6), δ, ppm: 10.3 (1H, s, NH); 4.9 (1H, m); 3.7 (1H, m); 3.6 (1H, m); 3.5 (1H, m); 3.1 (1H, m). Found, %: C 28.78; H 3.57; Cl 19.87; N 8.24. $C_4H_6ClNS_2$. Calculated, %: C 28.66; H 3.58; Cl 21.19; N 8.36.

Compound 1b. Yield 44%; mp 152-154°C. R_f 0.37 (Silufol UV-254, isoamyl acetate). IR spectrum (vaseline oil), ν, cm^{-1}: 3100 (N–H), 1360 (C–N), 1260 (C=S). ^{1}H NMR spectrum (200 MHz, DMSO-d_6), δ, ppm: 10.3 (1H, s, NH); 5.0 (1H, m); 3.75 (1H, m); 3.6 (1H, m); 3.5 (1H, m); 3.2 (1H, m). Found, %: C 22.88; H 3.18; N 6.63. $C_4H_6BrNS_2$. Calculated, %: C 22.64; H 2.85; N 6.63.

5-Halomethylthiazolidine-2-thiones 2. The ether mother liquor obtained in isolating isomer **1** was evaporated down to a volume of 25 ml and held in a closed container at -12±1°C for 20 h. The precipitate was removed. The ether layer was evaporated, the crystalline mass obtained was washed several times with water and ether and dried under vacuum. The material obtained was chromatographically pure five-membered isomer **2**.

Compound 2a. Yield 34%; mp 88-91°C. R_f 0.29 (Silufol UV-254, isoamyl acetate). IR spectrum (vaseline oil), ν, cm^{-1}: 3110 (N–H), 1340 (C–N), 1250 (C=S). ^{1}H NMR spectrum (200 MHz, acetone-d_6), δ, ppm: 10.2 (1H, s, NH); 4.3 (1H, m); 4.2 (1H, m); 4.0 (1H, m); 3.9 (2H, m). Found, %: C 28.68; H 3.60; N 8.05. $C_4H_6ClNS_2$. Calculated, %: C 28.66; H 3.58; N 8.36.

Compound 2b. Yield 44%; mp 152-154°C. R_f 0.30 (Silufol UV-254, isoamyl acetate). IR spectrum (vaseline oil), ν, cm^{-1}: 3100 (N–H), 1360 (C–N), 1260 (C=S). ^{1}H NMR spectrum (200 MHz, DMSO-d_6), δ, ppm: 10.2 (1H, s, NH); 4.3 (1H, m); 4.0 (1H, m); 3.8 (1H, m); 3.75 (1H, m); 3.7 (1H, m). Found, %: C 22.88; H 3.18; N 6.63. $C_4H_6BrNS_2$. Calculated, %: C 22.64; H 2.85; N 6.63.

REFERENCES

1. S. E. Tkachenko, A. N. Pushin, and V. M. Fedoseev, *Zh. Obsch. Khim.,* **57**, 2400 (1987).
2. A. N. Pushin, S. E. Tkachenko, and V. M. Fedoseev, *Izv. Akad. Nauk SSSR. Ser. Khim.*, 733 (1986).