SYNTHESIS OF 5-BENZOYLMETHYL-4-(2-BENZOYLVINYLTHIO)CARBAMIDOYL-2-IMINO-1,3,4-THIADIAZOLIDINE PERCHLORATE

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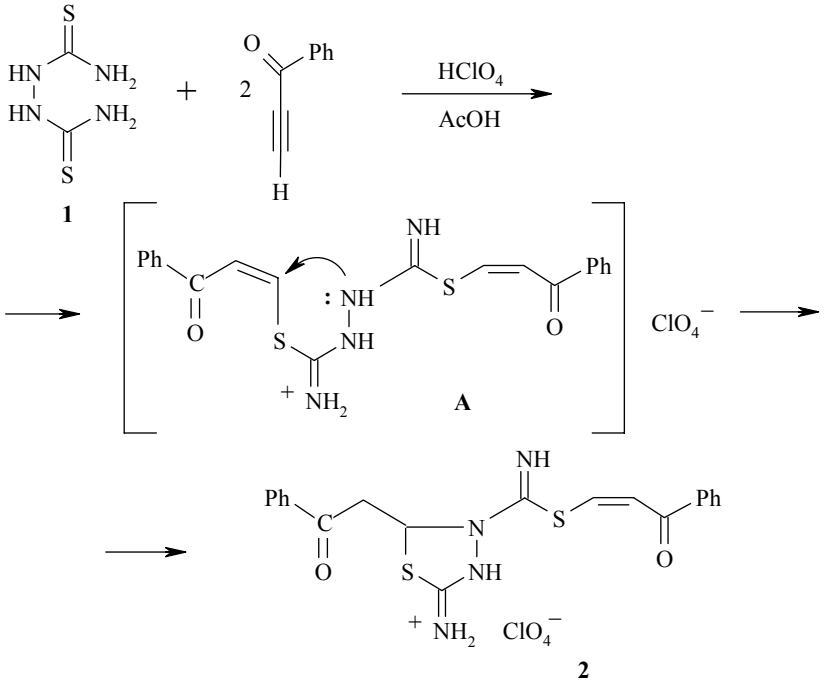
Compounds with 1,3,4- and 1,2,5-thiadiazole and thiadiazolidine rings show antibacterial, fungicidal, anti-inflammatory, and antitubercular activity [1-7] hence the investigation of novel derivatives of these compounds is of significant interest.

We have discovered a novel method of synthesizing 2-imino-1,3,4-thiadiazolidine perchlorates by treating 1,2-di(thiocarbamoyl)hydrazine (**1**) with benzoylacetylene in glacial acetic acid in the presence of $HClO_4$.



The formation of the substituted 2-imino-1,3,4-thiadiazolidine perchlorate **2** likely occurs *via* as stage of formation of the intermediate perchlorate **A** which undergoes an intramolecular cyclization to perchlorate **2** under the reaction conditions.

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The IR spectrum of compound **2** shows the presence of a broad band at 1080-1100 (typical of the ClO_4^- anion), conjugated carbonyl absorption at 1680 and unconjugated at 1710, and NH group stretching vibrations in the range 3200-3300 cm^{-1}. In the ^1H NMR spectrum of this compound the olefinic protons absorb at 8.07-8.09 ppm (d, $J_{\alpha,\beta}$ = 9.3 Hz, COCH=, *cis* isomer) and 8.81-8.83 ppm (d, $J_{\alpha,\beta}$ = 9.3 Hz, SCH=). The resonance for the methylene protons appears as an AB quartet in each part of which there appears a spin-spin coupling to the methine proton in the region 3.98-4.05 and 4.32-4.36 ppm (dddd CH_2–CH). The signal for the methine proton on the chiral carbon atom appears as a triplet at 6.96-6.99 ppm.

The ease of formation of the ring at the hydrazine fragment can be explained by the occurrence of an "α-effect", i.e. an increase in the nucleophilicity of the nitrogen atom due to the presence next to it of a further nitrogen atom with a lone pair of electrons.

A result of the reaction might also be expected to be the formation of 7-benzoylmethyl-5-benzoylvinylthio-2-imino-1,3,4,6-thiatriazepine perchlorate had the cyclization taken place involving the imino group nitrogen atom. However, the IR, ^1H NMR and ^{13}C NMR spectroscopic data confirmed the presence of only compound **2**.

The IR spectrum of compound **2** was recorded on a Specord IR-75 instrument for a KBr tablet. ^1H NMR and ^{13}C NMR Spectra were obtained on a Bruker DPX-400 instrument (400 and 100 MHz respectively) using DMSO-d_6 and with HMDS (δ 0.05 ppm) as internal standard.

5-benzoylmethyl-4-(2-benzoylvinylthio)carbamidoyl-2-imino-1,3,4-thiadiazolidine perchlorate (2). Perchloric acid (40%, 0.5 ml, 4 mmol) was added to a solution of the 1,2-di(thiocarbamoyl)hydrazine (**1**) (0.6 g, 4 mmol) in glacial acetic acid (15 ml) and then a solution of benzoylacetylene (1.0 g, 8 mmol) in glacial acetic acid (20 ml) was added slowly with vigorous stirring. The reaction mixture was stirred for 8 h at 20°C and the precipitate formed was filtered off and washed on the filter with acetone. The insoluble starting compound **1** (0.12 g) remained on the filter. The acetone solution was evaporated to dryness and the residue was heated in methanol with vigorous stirring at 60°C for 30 min. The precipitate insoluble in methanol was filtered off and dried in *vacuo*. The yield of compound **2** was 0.9 g (45%) as dark red crystals with mp 200-202°C. ^1H NMR spectrum, δ, ppm (*J*, Hz): 3.98-4.05, 4.32-4.36 (2H, t, *J* = 6.8, C<u>H</u>$_2$CH; 8.07-8.09 (1H, d, $J_{\alpha,\beta}$ = 9.3, =CHCO, *cis*-isomer); 6.96-6.99 (1H, t, *J* = 6.8, CH_2C<u>H</u>); 7.53-8.51 (10H, m, C_6H_5); 8.81-8.83 (1H, d, $J_{\alpha,\beta}$ = 9.3, SCH=). ^{13}C NMR spectrum, δ, ppm: 44.36 (CH_2), 67.61 (C_5), 115.30 (=CHO), 128.27-135.49 (2 C_6H_5), 148.82 (S–CH=), 164.53 (C_2); 166.50 ((S–(=NH)–N), 182.56, 196.96 (2 C=O). Found, %: C 47.22; H 3.80; Cl 7.19; N 11.41, S 12.55. $C_{20}H_{19}ClN_4O_6S_2$. Calculated, %: C 47.01; H 3.72; Cl 6.95; N 11.00; S 12.54.

REFERENCES

1. A. E. Abdel-Rahman and A. M. Mahmoud, *Rev. Roum, Chim.*, **27**, 781 (1982).
2. T. N. Komarova, A. E. Aleksandrova, A. S. Nakhmanovich, R. A. Shchegoleva, and T. I. Vinogradova, *Khim.-Farm. Zh.*, **23**, 1481 (1989).
3. M. Carmack and L. M. Weinstock, US Patent 3066147; *Ref. Zh. Khim.*, 5N262P (1965).
4. Y. Pokach and G. W. Reader, US Patent 4094986; *Ref. Zh. Khim.*, 3O380P (1979).
5. H. K. Shukla, N. C. Desai, R. R. Astik, and K. A. Thaker, *J. Indian Chem. Soc.*, **61**, 168 (1984).
6. L. M. Weinstock, US Patent 3488360*; Ref. Zh. Khim.*, 4N12P (1971).
7. T. E. Glotova, A. E. Aleksandrova, A. S. Nakhmanovich, and T. I. Vinogradova, *Khim.-Farm. Zh.*, **24**, No. 11, 48 (1990).