HALOGENATION OF SOME SUBSTITUTED 3-ALLYL-2-MERCAPTO-3,4-DIHYDROTHIENO[2,3-d]PYRIMIDINES

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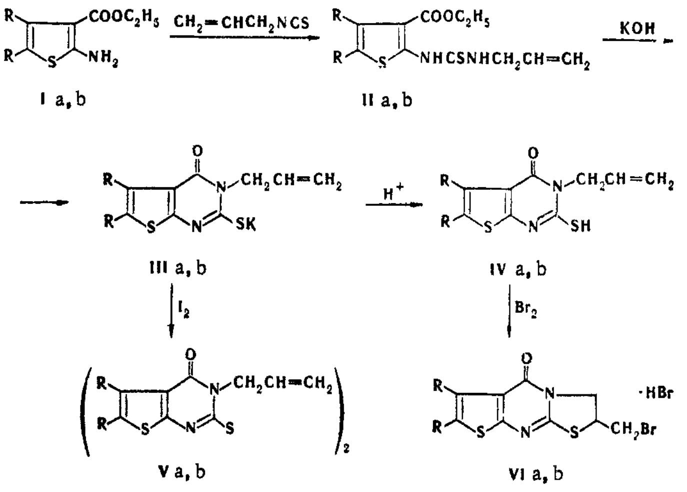
The bromination and iodination of substituted 3-allyl-2-mercapto-4-oxo-3,4-dihydrothieno-[2,3-d]pyrimidines have been studied.

The bromination and iodination of N-allylthiourea is accompanied by cyclization with the formation of a thiazoline ring [1-3]. In view of this, it appeared of interest to study the halogenation of condensed thiophene and pyrimidine derivatives in which an N-allylthioureido group is involved in a pyrimidine ring.

Compounds (I) [4] and allyl isothiocyanate gave the N-allylthioureas (IIa) [5] and (IIb), which were converted into the thienopyrimidine derivatives (III, IV).



III–VI a R–R = $-(CH_2)_4-$; b R = CH_3

Compounds (IVa) [5] and (IVb) undergo bromination with the formation of a thiazolidine ring condensed with a pyrimidine ring [compounds (VI)]. In contrast to (IV), on bromination and iodination, compounds (IIIa) [5] and (IIIb) are converted into the disulfides (V) as a consequence of the attack of the halogen molecule primarily on the mercaptide residue (see, for example, [6]) and not the double bond of the allyl radical. In the further action of bromine, the disulfides add it at the double bond of the allyl radical.

The structure of the compounds obtained was confirmed by their IR and UV spectra. Characteristic of the IR spectra of compounds (V and VI) is intense carbonyl-group absorption in the 1730-1640 cm^{-1} region. In the UV spectra of compounds (IIb, IIIb, and IVb) there is an absorption maximum at 240-245 nm, which is due to the thioamide chromophore. For compounds (V and VI) having not a thione but a sulfide group, the absorption maximum at 240-245 nm is absent, and maxima appear in the longer-wave region. These results agree with the UV spectra of 2-mercaptobenzothiazole and its S-sodium salt and other S-substituted derivatives [7].

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EXPERIMENTAL

The UV spectra were taken on an SF-4A instrument at concentrations of the substances in ethanol of 10^{-5} M. The IR spectra were taken on a UR-10 instrument, the substances being molded with KBr.

2-(N-Allylthioureido)-3-ethoxycarbonyl-4,5-dimethylthiophene (IIb). A mixture of 2 g (0.01 mole) of 2-amino-3-ethoxycarbonyl-4,5-dimethylthiophene and 1 g (0.01 mole) of allyl isothiocyanate in ethanol was heated on the boiling water bath for 4 h. Yield 2.2 g (74%), mp 128-130°C (from ethanol). Found, %: C 52.2; N 9.3; S 21.4. $C_{13}H_{18}N_2O_2S_2$. Calculated, %: C 52.3; N 9.4; S 21.5.

Potassium Salt of 3-Allyl-2-mercapto-5,6-dimethyl-4-oxo-3,4-dihydrothieno[2,3-d]pyrimidine (IIIb). A mixture of 3 g (0.01 mole) of (IIb) and 1.1 g (0.02 mole) of caustic potash in aqueous ethanol was heated on the boiling water bath for 4 h. Yield 2 g (70%), mp > 250°C (from ethanol). Found, %: C 45.5; N 9.7; S 22.3. $C_{11}H_{11}KN_2OS_2$. Calculated, %: C 45.5; N 9.6; S 22.1.

3-Allyl-2-mercapto-5,6-dimethyl-4-oxo-3,4-dihydrothieno[2,3-d]pyrimidine (IVb). This was obtained by the acetic acid acidification of an aqueous solution of (IIIb). Yield 94%, mp 191-192°C (from ethanol). Found, %: C 52.4; N 11.0; S 25.6. $C_{11}H_{12}N_2OS_2$. Calculated, %: C 52.4; N 11.1; S 25.4.

Di(3-allyl-4-oxo-3,4,5,6,7,8-hexahydrobenzo[4,5]thieno[2,3-d]pyrimidin-2-yl) Disulfide (Va). With careful stirring, a solution of 1.3 g (0.005 mole) of iodine in ethanol or of 0.8 g (0.005 mole) of bromine in carbon tetrachloride was added to a solution of 3.2 g (0.001 mole) of (IIIa) in a mixture of carbon tetrachloride and ethanol (2 : 1). A loose precipitate deposited, which was separated off and washed with water. Yield 2 g (71%), mp 198-199°C (from dioxane). Found, %: C 56.3; N 10.0; S 23.1. $C_{26}H_{26}N_4O_2S_4$. Calculated, %: C 56.3; N 10.1; S 23.1.

Di(3-allyl-5,6-dimethyl-4-oxo-3,4-dihydrothieno[2,3-d]pyrimidin-2-yl) Disulfide (Vb). This was obtained from (IIIb) in a similar manner to (Va). Yield 76%, mp 179-181° C (from ethanol). Found, %: C 52.7; N 11.2; S 25.6. $C_{22}H_{22}N_4O_2S_4$. Calculated, %: C 52.6; N 11.2; S 25.5.

2-Bromomethyl-5-oxo-2,3,4,5,6,7,8,9-octahydrobenzo[4,5]thieno[2',3'-d]thiazolo[2,3-*a*]pyrimidine Hydrobromide (VIa). With constant stirring and ice cooling, a solution of 1.6 g (0.01 mole) of bromine in 5 ml of carbon tetrachloride was added to a solution of 2.8 g (0.01 mole) of (IVa) in carbon tetrachloride. Yield 2.3 g (52%), mp 219-221°C (from diethylacetamide). Found, %: N 6.4; S 14.6; Br^- 19.9. $C_{13}H_{13}BrN_2OS_2 \cdot HBr$. Calculated, %: N 6.4; S 14.6; Br^- 20.1.

2-Bromomethyl-5-oxo-6,7-dimethyl-2,3,4,5-tetrahydrothieno[2,3-d]thiazolo[2,3-*a*]pyrimidine Hydrobromide (VIb). Obtained by the bromination of (IVb) as for (VIa). Yield 61%, mp 145-147°C (from methanol). Found, %: N 6.8; S 15.6; Br^- 19.9. $C_{11}H_{11}BrN_2OS_2 \cdot HBr$. Calculated, %: N 6.8; S 15.5; Br^- 19.4.

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