## β-AZIRIDINYLACROLEINS IN REACTIONS WITH NUCLEOPHILIC REAGENTS

A. V. Eremeev, D. A. Tikhomirov, V. A. Tyusheva, and É. É. Liepin'sh

The reactivities of  $\beta$ -aziridinylcinnamaldehyde and  $\beta$ -(2-methylaziridinyl)acrylaldehyde with respect to amines, hydrazines, and semicarbazide were studied.  $\beta$ -Aminoacroleins were obtained by reaction of secondary amines with aziridinylacroleins. The reaction of aziridinylcinnamaldehyde with primary amines gives the corresponding imines. It was established that in its reaction with hydrazines and semicarbazide aziridinylacrolein is more inclined to undergo heterocyclization reactions (the formation of pyrazoles and pyrazolines) than aziridinylcinnamaldehyde.

 $\beta$ -Aziridinylacroleins [1] constitute a new type of 1-substituted aziridine and are vinylogs of the widely known class of conjugated amino vinyl ketones. In this connection, it seems of interest to study their chemical transformations in reactions with nucleophilic reagents in order to compare the reactivities of aziridinylacroleins and aminovinyl ketones.

The presence in  $\beta$ -aziridinylacroleins Ia,b of an aziridine nitrogen atom, which has increased s character of the orbital of the unshared pair of electrons, leads to a decrease in the effectiveness of the conjugation with the carbonyl group [2]. It may therefore be assumed that the reactivities of Ia,b and aminovinyl ketones in which there is an sp<sup>3</sup>-hybridized nitrogen atom in reactions with nucleophilic reagents will differ. The presence of electrophilic centers at C(1) and C(3) in Ia,b determines two possible reaction pathways depending on the character of the attacking nucleophile.

In fact, on the basis of the experimental data, it was established that secondary aliphatic and cyclic amines attack  $\beta$ -aziridinylacroleins Ia,b primarily at the C(3) atom to give  $\beta$ -aminoacroleins IIa-e.



I a  $R^1 = H$ ,  $R^2 = C_6H_5$ ; b  $R^1 = CH_3$ ,  $R^2 = H$ ; II a  $R^2 = C_6H_5$ ,  $R^3 = R^4 = CH_3$ ; b  $R^2 = C_6H_5$ ,  $R^3 - R^4 = -(CH_2)_4 - ;$  c  $R^2 = H$ ,  $R^3 = R^4 = CH_3$ ; d  $R^2 = H$ ,  $R^3 - R^4 = -(CH_2)_4 - ;$  e  $R^2 = H$ ,  $R^3 - R^4 = -(CH_2)_5 - ;$  f  $R^2 = R^4 = H$ ,  $R^3 = C_6H_5$ ; III a  $R^1 = H$ ,  $R^2 = R^3 = C_6H_5$ ; b  $R^1 = H$ ,  $R^2 = C_6H_5$ ,  $R^3 = CH_3$ 

Secondary amines react with aziridinylacroleins in ether at 0°C. However, aziridinylacrolein Ia does not react with piperidine even when the mixture is heated to 100°C. This anomaly can probably be explained by purely steric factors determined by the considerable volume of the piperidine molecule and the phenyl group of enamine Ia.

In contrast to secondary amines, the direction of the reactions with primary amines is determined by the structures of the starting aziridinylacroleins. Aniline and methylamine

Institute of Organic Synthesis, Academy of Sciences of the Latvian SSR, Riga 226006. Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 4, pp. 483-488, April, 1978. Original article submitted April 14, 1977.

TABLE 1. Parameters of the PMR Spectra of IIa-e (CC14)

Com-			J, Hz				
pound	CH=O =CH		R <sup>2</sup>	R <sup>3</sup> and R <sup>4</sup>	$HR^{2}-C = = C-H$	CH-CII	
IIa IIb II <b>c</b> IId	8,56 8,63 9,03 8,95 8,99	5,13 5,08 4,95 4,85 5,00	7,2—7,5 7,2—7,5 7,22 7,27 7,02	$\begin{array}{c} 2,80\\ 3,2 \ (\alpha\text{-}\mathrm{CH}_2), \ 1,95 \ (\beta\text{-}\mathrm{CH}_2)\\ 3,00\\ 3,37 \ (\alpha\text{-}\mathrm{CH}_2), \ 2,00 \ (\beta\text{-}\mathrm{CH}_2)\\ 3,30 \ (\alpha\text{-}\mathrm{CH}_2), \ 1,6 \ (\beta\text{-}\mathrm{CH}_2), \\ 1,2 \ (\gamma\text{-}\mathrm{CH}_2)\end{array}$	12,6 12,7 12,8	8,1 8,2 8,0 8,0 8,0 8,0	

react with Ia at the carbonyl group to give imines IIIa,b. The reactions of these amines with Ib lead to the formation of  $\beta$ -anilinoacrolein (IIf) and imine IV. The mesomeric effect of the phenyl group evidently lowers the electrophilicity of the  $C_{(3)}$  atom in  $\beta$ -aziridinyl-acrolein Ia, and because of this the reaction takes place at the carbonyl group.

 $\beta$ -Aminoacroleins IIa-e are exclusively the E isomers (Table 1); this is in agreement with the data in [2]. Compound IV exists in the cis-s-cis form, and the magnetic equivalence of H<sub>x</sub> and H<sub>y</sub> is explained by intramolecular transfer of the N-H proton [3]. Imines IIIa,b are mixtures of the Z, E isomers. The physical constants of IIa-f, IIIa,b, and IV are presented in Table 2.

On the basis of the experimental data it may be concluded that  $\beta$ -aziridinylacroleins Ia,b have higher reactivities than aminovinyl ketones, for which the reactions of amines at the carbonyl group in neutral or basic media are uncharacteristic [2].

The direction of the reactions of aziridinylacroleins Ia,b with hydrazine and its derivatives is also determined by the structures of the starting aldehydes. Azine V is the product of the reaction of Ia with hydrazine. The reaction of enamine Ia with methylhydrazine leads to a mixture of two isomeric pyrazoles VIa and VIb with predominance of isomer VIb (65%). Two competitive reactions involving the addition of the substituted nitrogen atom to the two electrophilic centers  $[C(_1) \text{ and } C(_3)]$  of  $\beta$ -aziridinylacrolein Ia and subsequent cyclization to isomeric pyrazoles VIa, b evidently take place in this case. The higher percentage of VIb in the mixture consitutes evidence for easier addition of methylhydrazine to the carbonyl group of enamine Ia.



Hydrazone VII and semicarbazone VIII are formed in the reaction of aldehyde Ia with 1,1dimethylhydrazine and semicarbazide. The structures of V-VIII were proved on the basis of the IR and PMR spectra. The lines were assigned to the resonance of the protons of each of the isomers VIa and VIb in conformity with the data in [4].

In contrast to Ia,  $\beta$ -aziridinylacrolein (Ib) is more inclined to undergo heterocyclization. Hydrazine and p-bromophenylhydrazine react with enamine Ib to give pyrazoles IX and X.

The reaction of Ib with 1,1-dimethylhydrazine leads to a mixture, the principal component of which, according to the PMR spectral data, is  $\beta$ -aziridinylacrolein dimethylhydrazone (XI). The presence of proton signals at 6.87 (1H, d, J = 8.3 Hz, CH=N), 6.33 (1H, d, J = 13.1 Hz, =CH-), 5.62 (1H, dd, J = 8.3 and 13.1 Hz, N-CH=), 2.68 [6H, s, N(CH\_3)\_2], 1.6-2.1 (3H, m, aziridine ring protons), and 1.22 ppm (3H, d, J = 5.2 Hz, CH\_3) in the PMR spectrum of XI (CCl\_4) constitutes evidence for this. The IR spectrum of the mixture contains stretching vibrations at 1575 (C=C) and 1635 cm<sup>-1</sup> (C=N), which are related to hydrazone XI. The second product is evidently 2-ethoxy-3-dimethylaminopropionitrile (XII), which constitutes ~10% of the mixture. The stretching vibrations of the nitrile group appear at 2210 cm<sup>-1</sup>

TABLE 2. Physical Constants of IIa-f, IIIa,b, and IV

Com-	mn °C	Found, %		Empirical	Calc., %		IR spectrum, $\nu$ , cm <sup>-1</sup>			m <sup>-1</sup>	20		
pound	(lit. mp)	с	н	N	formula	с	н	N	C=0	C=C	NH	C=N	Yield,
IIa IIb IIC IId	38-40 (0,01) 100-102 (0,01) 26-28* (0,01) 53-55 55-57 (0,01)	75,3 76,3 60,6 66,8	7,6 7,4 9,0 9,0	8,3 6,1 14,1 11,4	C <sub>11</sub> H <sub>13</sub> NO C <sub>13</sub> H <sub>15</sub> NO C <sub>5</sub> H <sub>9</sub> NO C <sub>7</sub> H <sub>11</sub> NO	75,5 76,3 60,8 67,0	7,4 7,5 9,2 8,8	8,0 6,4 14,0 11,2	1625 1635 1620 1625	1585 1585 1580 1585			66 52 75 67
IIe IIf IIIa IIIb IV	$\begin{array}{c} 33 - 37 \ (0,01) \\ 70 - 73^* \ (0,01) \\ 121 - 122^* \\ 146 - 148 \\ 60 - 62 \ (0,01) \\ 40 - 42 \ (0,01) \end{array}$	68,9 73,3 82,2 77,4 61,1	9,6 6,4 6,6 7,8 10,2	10,4 10,0 11,7 15,1 28,3	$\begin{array}{c} C_8 H_{13} NO \\ C_9 H_9 NO \\ C_{17} H_{16} N_2 \\ C_{12} H_{14} N_2 \\ C_5 H_{10} N_2 \end{array}$	69,0 73,6 82,4 77,6 61,3	9,4 6,2 6,5 7,6 10,2	10,1 9,6 11,3 15,1 28,6	1630 1625 — —	1575 1595 1590 1600 323	3210 — 0—33		60 26 62 85 70

\*According to the data in [8], IIc has bp 80-91°C (1 mm), IIe has bp 133-135°C (3 mm), and IIf has mp 122°C.

(C=N). The data from the PMR spectrum do not contradict the proposed structure. In addition, the mass spectrum of the mixture is characterized by the presence of molecular peaks at 153 and 142, which correspond to the masses of XI and XII.



The reaction of 1,1-dimethylhydrazine with  $\beta$ -aziridinylacrolein (Ib) evidently proceeds via two competitive pathways: at the carbonyl group to give hydrazone XI, and at the  $C_{(3)}$ atom to give a  $\beta$ -dimethylhydrazinoacrolein intermediate, which undergoes cyclization to a quaternary pyrazolium base. Amino nitrile rearrangement of the latter in ethanol leads to nitrile XII. The results obtained in the reaction of  $\beta$ -aziridinylacrolein Ib with semicarbazide confirm the proposed scheme for the formation of XII. 1-Carbamido-5-hydroxy-2-pyrazoline (XIII) is evidently formed through intermediates A and B. This assumption is in agreement with the data in [5] in which Castells and Roser were able in some cases to isolate compounds similar to B.

## EXPERIMENTAL

The PMR spectra of 10% solutions of the compounds in  $CCl_4$ ,  $CDCl_3$ , and  $d_6$ -DMSO were obtained with a Perkin-Elmer R-12A spectrometer (60 MHz) with tetramethylsilane as the internal standard. The IR spectra of mineral oil and hexachlorobutadiene supensions and liquid films of the compounds were obtained with a UR-20 spectrometer. The mass spectra were recorded with an MS-905 spectrometer.

<u> $\beta$ -Aminoacroleins IIa-e (Table 2)</u>. A solution of 0.02 mole of aziridinylacrolein Ia or Ib in 20 ml of absolute ether was added with stirring at 0°C to 0.02 mole of secondary amine in 20 ml of absolute ether, after which the mixture was stirred at 18°C for 4 h. The solvent was removed by evaporation and the residue was vacuum distilled.

<u>N-(3-Aziridinyl-3-phenyl-2-propenylidene)aniline (IIIa)</u> (Table 2). A solution of 1.73 g (0.01 mole) of aziridinylacrolein Ia in 20 ml of ether was added with stirring at 0°C to 0.93 g (0.01 mole) of aniline in 20 ml of ether, and the mixture was stirred at 18°C for 8 h. The solvent was removed by evaporation, and the residue was crystallized from ethanol to give 1.5 g (62%) of imine IIIa, which judging from the PMR spectrum (in CCl<sub>4</sub>), is a mixture of the Z and E isomers in a ratio of 2:3, respectively. PMR signals of the Z isomer:  $\delta$  2.03 [4H, s, (CH<sub>2</sub>)<sub>2</sub>N], 5.98 (1H, d, J = 9.0 Hz, C=CH), and 8.06 ppm (1H, d, J = 9.0 Hz, C=CH), and PMR signals of the E isomer:  $\delta$  2.20 [4H, s, (CH<sub>2</sub>)<sub>2</sub>N], 6.16 (1H, d, J = 9.5 Hz, C=CH), and

8.64 ppm (1H, d, J = 9.5 Hz, CH=N). The aromatic protons form a multiplet at 6.8-7.6 ppm.

<u>N-(3-Aziridinyl-3-phenyl-2-propenylidene)methylamine (IIIb) (Table 2)</u>. A solution of 1.73 g (0.01 mole) of Ia in 20 ml of ether was added with stirring at  $-5^{\circ}$ C to a 0.31 g (0.01 mole) sample of methylamine in 20 ml of ether, and the mixture was stirred at 18°C for 8 h. The solvent was then removed by evaporation, and the residue was vacuum distilled at 60-62°C (0.01 mm) to give 1.6 g (85%) of imine IIIb, which, judging from the PMR spectrum (in CCl<sub>4</sub>), is a mixture of the Z and E isomers in a ratio of 2:1, respectively. PMR signals of the Z isomer:  $\delta$  1.88 [4H, s, (CH<sub>2</sub>)<sub>2</sub>N], 5.70 (1H, d, J = 8.7 Hz, C=CH), 7.74 (1H, m, J = 8.7 and 1.1 Hz, CH=N), and 3.16 ppm (3H, d, J = 1.1 Hz, NCH<sub>3</sub>). PMR signals of the E isomer:  $\delta$  2.03 [4H, s, (CH<sub>2</sub>)<sub>2</sub>N], 3.33 (3H, d, J = 1.3 Hz, NCH<sub>3</sub>), 5.85 (1H, d, J = 8.7 Hz, C=CH), and 8.44 ppm (1H, m, J = 8.7 and 1.3 Hz, CH=N). The aromatic protons form a multiplet at 7.2-7.5 ppm.

<u>N-(3-Methylamino-2-propenylidene)methylamine (IV) (Table 2)</u>. A solution of 4.4 g (0.04 mole) of aziridinylacrolein Ib in 20 ml of ether was added with stirring at -5°C to a two-fold excess of methylamine in 20 ml of ether, and the mixture was stirred at 20°C for 12 h. The solvent was then removed by evaporation, and the residue was vacuum distilled at 40-42° (0.01 mm) to give 2.7 g (70%) of IV. PMR spectrum (CCl<sub>4</sub>):  $\delta$  3.00 (6H, s, NCH<sub>3</sub>), 4.68 (1H, t, J = 8.6 Hz, =CH-), 6.9 (1H, s, NH), and 7.07 ppm (2H, d, J = 8.6 Hz, N-CH- and -CH-N).

3-Anilino-2-propenal (IIf) (Table 2). A solution of 3.9 g (0.04 mole) of freshly distilled aniline in 30 ml of ethanol was added with stirring at 20°C to 4.4 g (0.04 mole) of Ib in 40 ml of ethanol. After 18 h, the solvent was removed by evaporation, and the residue was crystallized from ethanol to give 1.5 g (26%) of IIf.

<u>3-Aziridinyl-3-phenyl-2-propenal Azine (V)</u>. A solution of 0.32 g (0.01 mole) of hydrazine in 30 ml of ethanol was added with stirring at -20°C to 1.73 g (0.01 mole) of Ia in 50 ml of ethanol, after which the temperature was raised to 20°C, and the mixture was allowed to stand for 18 h. The ethanol was removed by evaporation, and the residue was crystallized from petroleum ether diethyl ether to give 1.32 g (65%) of azine V with mp 148-150°C. IR spectrum: 1612 (C=N) and 1562 cm<sup>-1</sup> (C=C). PMR spectrum (CC1<sub>4</sub>):  $\delta$  1.88 [4H, s, (CH<sub>2</sub>)<sub>2</sub>N], 5.76 (1H, d, J = 9.9 Hz, C=CH), 7.3 (5H, s, C<sub>6</sub>H<sub>5</sub>), and 7.99 ppm (1H, d, J = 9.9 Hz, CH=N). Found: C 77.0; H 6.5; N 16.6%. C<sub>22</sub>H<sub>22</sub>N<sub>4</sub>. Calculated C 77.2; H 6.4; N 16.3%.

<u>1-Methyl-3(5)-phenylpyrazole (VI)</u>. A solution of 1.2 g (0.025 mole) of methylhydrazine in 40 ml of ethanol was added with stirring at 20°C to 4.3 (0.025 mole) of aldehyde Ia in 80 ml of ethanol, and the mixture was heated at 50°C for 8 h. The ethanol was removed by evaporation, and the residue was vacuum distilled to give 1.7 g (44%) of a mixture of VIa, b with bp 36-38°C (0.01 mm). PMR spectrum (CC1<sub>4</sub>): for VIa,  $\delta$  3.87 (3H, s, NCH<sub>3</sub>) and 6.19 ppm (1H, d, J = 2.5 Hz, 4-H); for VIb,  $\delta$  3.88 (3H, s, NCH<sub>3</sub>) and 6.42 ppm (1H, d, J = 2.5 Hz, 4-H). The 3-H signal in the spectrum of VIa and the 5-H signal in the spectrum of VIb are hidden under the multiplet of aromatic protons at 7.2-7.8 ppm. The VIa:VIb ratio is 1:2.

<u>3-Aziridiny1-3-pheny1-2-propenal Dimethylhydrazone (VII)</u>. A solution of 3.3 g (0.019 mole) of aldehyde Ia in 20 ml of ethanol was added with stirring at 20°C to 1.2 g (0.02 mole) of 1,1-dimethylhydrazine in 20 ml of ethanol, and the mixture was stirred at 60° for 4 h. The ethanol was then evaporated and the residue was vacuum distilled to give 2.8 g (68%) of VII with bp 85°C (0.01 mm). IR spectrum: 1620 (C-N) and 1580 cm<sup>-1</sup> (C-C). PMR spectrum (CC1<sub>4</sub>): for the Z isomer,  $\delta$  1.80 [4H, s, (CH<sub>2</sub>)<sub>2</sub>N], 2.64 [6H, s, N(CH<sub>3</sub>)<sub>2</sub>], 5.70 (1H, d, J = 9.0 Hz, C=CH), and 6.94 ppm (1H, d, J = 9.0 Hz, CH=N); for the E isomer,  $\delta$  1.95 [4H, s, (CH<sub>2</sub>)<sub>2</sub>N], 2.81 [6H, s, N(CH<sub>3</sub>)<sub>2</sub>], and 5.94 ppm (1H, d, J = 9.4 Hz, C=CH). The signal of the CH=N proton of the E isomer is hidden under the multiplet of aromatic protons at 7.2-7.6 ppm. The Z:E ratio is 2:1. Found: C 72.3; H 7.6; N 19.6%. C<sub>13</sub>H<sub>17</sub>N<sub>3</sub>. Calculated: C 72.7; H 7.5; N 19.5%.

<u>3-Aziridinyl-3-phenyl-2-propenal Semicarbazone (VIII)</u>. A solution of 4.3 g (0.025 mole) of aldehyde Ia in 10 ml of ethanol was added with stirring at 20°C to 1.9 g (0.025 mole) of semicarbazide in 50 ml of ethanol, and the mixture was stirred for 12 h. It was then filtered, the ethanol was removed from the filtrate by evaporation, and the residue was crystal-lized from ether to give 3.3 g (58%) of colorless crystals with mp 157-159°C (from ethanol). IR spectrum: 1680 (C=O), 1595 (C=N), and 1575 cm<sup>-1</sup> (C=C). PMR spectrum (d<sub>6</sub>-DMSO): for the Z isomer,  $\delta$  1.94 [4H, s, (CH<sub>2</sub>)<sub>2</sub>N], 5.78 (1H, d, J = 9.3 Hz, C=CH), and 7.60 ppm (1H, d, J = 9.3 Hz, CH=N); for the E isomer,  $\delta$  2.08 [4H, s, (CH<sub>2</sub>)<sub>2</sub>N], 5.95 (1H, d, J = 9.3 Hz, C=CH), and 8.29 ppm (1H, d, J = 9.3 Hz, CH=N). The NH protons of both isomers resonate in the form of singlets at 9.9, 6.3, and 6.2 ppm, and the aromatic protons resonate at 7.4-7.6 ppm. The Z:E ratio is 1:1. Found: C 62.3; H 5.9; N 24.0%. C<sub>12</sub>H<sub>14</sub>N<sub>4</sub>O. Calculated: C 62.6; H 6.1; N 24.3%.

Pyrazole (IX). A solution of 0.96 g (0.03 mole) of hydrazine in 50 ml of ethanol was added slowly with stirring at  $-20^{\circ}$ C to 3.3 g (0.03 mole) of Ib in 50 ml of ethanol, after which the temperature was raised slowly to room temperature, and the mixture was stirred for 6 h. The ethanol was evaporated, and the residue was vacuum distilled at  $30-32^{\circ}$  (0.01 mm). The distillate crystallized to give 0.56 g (31%) of pyrazole with mp 69-70°C (from petroleum ether) (mp 69.5-70.0°C [6]). PMR spectrum (CDCl<sub>4</sub>):  $\delta$  6.30 (1H, t, J = 2.0 Hz, 4-H), 7.60 (2H, d, J = 2.0 Hz, 3- and 5-H), and 12.0 ppm (1H, s, NH).

<u>1-(p-Bromophenyl)pyrazole (X)</u>. A solution of 3.7 g (0.02 mole) of p-bromophenylhydrazine in 50 ml of ethanol was added with stirring at 20°C to 2.2 g (0.02 mole) of Ib in 50 ml of ethanol, and the mixture was refluxed for 4 h. It was then filtered, and the ethanol was removed from the filtrate by evaporation. The residue was dissolved in ether, the ether solution was filtered, and the ether was removed from the filtrate by evaporation. The residue was vacuum distilled at 65°C (0.01 mm). The distillate crystallized to give 1.9 g (43%) of pyrazole X with mp 70-71°C (mp 71.5° [7]). PMR spectrum (CCl<sub>4</sub>):  $\delta$  7.78 (1H, d, J = 2.3 Hz, 3-H), 7.51 (4H, s, C<sub>6</sub>H<sub>4</sub>), 7.49 (1H, d, J = 1.6 Hz, 5-H), and 6.35 ppm (1H, d, J = 2.3 and 1.6 Hz, 4-H).

<u>Reaction of  $\beta$ -Aziridinylacrolein Ib with 1,1-Dimethylhydrazine</u>. A solution of 4.4 g (0.04 mole) of Ib in 50 ml of ethanol was added with stirring at -20°C to a solution of 2.4 g (0.04 mole) of 1,1-dimethylhydrazine in 50 ml of ethanol, after which the temperature was slowly raised to room temperature, and the mixture was stirred for 12 h. The ethanol was evaporated, and the residue was vacuum distilled at 38-39° (0.01 mm) to give 3.4 g (55%) of a product, which, according to the PMR spectral data, contained  $\beta$ -aziridinylacrolein dimethyl-hydrazone XI and nitrile XII in a ratio of 9:1.

<u>1-Carbamido-5-hydroxy-2-pyrazoline (XIII)</u>. A solution of 3.3 g (0.03 mole) of aldehyde Ib in 50 ml of ethanol was added with stirring at 20°C to a solution of 2.2 g (0.03 mole) of semicarbazide in 100 ml of ethanol, and the mixture was stirred for 35 h. The resulting precipitate was removed by filtration and crystallized from ethanol. The alcohol mother liquor was evaporated, and the residue was crystallized from ethanol to give 3.0 g (78%) of pyrazoline XIII with mp 165-166°C. IR spectrum: 3215 (0-H) and 1665 cm<sup>-1</sup> (C=O). PMR spectrum (d<sub>6</sub>-DMSO):  $\delta$  6.93 (1H, t, J = 1.2 Hz, 3-H), 6.1 (2H, s, NH<sub>2</sub>), 6.0 (1H, s, OH), 5.67 (1H, dd, J = 6.7 and 2.0 Hz, 5-H), 3.02 (1H, m, J = 18.4, 6.7, and 1.2 Hz, 4-H), and 2.58 ppm (1H, m, J = 18.4, 2.0, and 1.2 Hz, 4-H). Found: C 37.3; H 6.0; N 32.0%. C<sub>4</sub>H<sub>7</sub>N<sub>3</sub>O<sub>2</sub>. Calculated: C 37.2; H 6.0; N 32.5%.

## LITERATURE CITED

- 1. Z. V. Eremeev, D. A. Tikhomirov, and É. É. Liepin'sh, Khim. Geterotsikl. Soedin., No. 2, 207 (1977).
- 2. Ya. F. Freimanis, The Chemistry of Enamino Ketones, Enamino Imines, and Enamino Thiones [in Russian], Zinatne (1974).
- 3. W. J. Berry, J. L. Finar, and E. F. Mooney, Spectrochim. Acta, 21, 1095 (1965).
- 4. J. L. Aubagnac, J. Elguero, and R. Jacquier, Bull. Soc. Chim. France, No. 9, 3306 (1969).
- 5. J. Castells and R. Roser, Ann. Fis. Quim., <u>62B</u>, 409 (1966).
- 6. H. Pechmann, Ber., 31, 2950 (1898).
- 7. A. I. Misbahul and M. L. Brian, Can. J. Chem., 41, 1540 (1963).
- 8. S. M. Makin, Abla Ahmed Ishmael, V. V. Yastrebov, and K. I. Petrov, Zh. Org. Khim., 2120 (1971).