4-Methyl-3,4-dihydro-2-quinolone (III), with mp 98°C [9], and 4-methyl-3,4-dihydro-1-
isoquinolone (IV), with mp 81°C* [8], were similarly obtained from α-phenylethylacetylhydrox-
amic acid and PPA.

**LITERATURE CITED**


*For optically active compounds.

**INVESTIGATION OF NITROGEN- AND SULFUR-CONTAINING HETEROCYCLES.**

37.* REACTION OF o-AMINO MERCAPTO DERIVATIVES OF PYRIDINE AND PYRIMIDINE WITH
ESTERS OF β-HALO-α,γ-DIKETO ACIDS

L. G. Levkovskaya, I. E. Mamaeva, O. S. Anisimova, and T. S. Safonova

The synthesis of two-ring 1,4-thiazine systems was previously accomplished on the
basis of the reaction of o-amino mercapto derivatives of pyridine and pyrimidine
with dicarbonyl compounds — halo β-keto esters and halo β-diketones. In the pre-
sent paper it is shown that the primary products of this reaction are S-β-keto-
alkylmercapto derivatives, which are subsequently cyclized to the corresponding
hydroxy amino compounds. The latter are converted to N-acylamino-S-β-carbethoxy
(keto)alkylmercapto derivatives under the influence of an alkaline agent. The
indicated compounds were isolated and characterized [2, 3].

Continuing our recent research [2, 3] to obtain biologically active substances among
derivatives of two-ring 1,4-thiazine systems we investigated the reaction of o-amino mercapto
derivatives of pyridine and pyrimidine with tricarbonyl compounds — esters of β-halo α, γ-diketo
acids.

We have shown that the reaction of 2-mercapto-3-amino-6-chloropyridine (I) and 4-meth-
oxy-5-amino-6-mercaptopurinimide (II) with esters of β-chloro-β-acylpyruvic acids in the
presence of a slight excess of alkaline agents such as KOH, NaH, and triethylamine leads to
the formation of the previously unknown heterocyclic systems — oxazolidino[3,2-d]pyrido[2,3-b]-
and oxazolidino[3,2-d]pyrimido[4,5-b]-1,4-thiazines (VIIa-g).

In analogy with the reaction of o-amino mercapto derivatives of pyridine and pyrimidine
with dicarbonyl compounds, we assumed that the initial step in the reaction of I and II with
esters of β-halo α, γ-diketo acids is evidently alkylation of the sulfur atom to give inter-
mediate III (see the scheme below), which subsequently undergoes cyclization to hydroxy amino
compound IV. The conditions for the destructive cleavage of IV at the C₆–C₇ bond, as a result
of which the corresponding N-oxamoyl-S-β-ketoalkylmercapto derivatives Va–e (Table 1) are

*See [1] for communication 36.

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cow 119021. Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 2, pp. 250-253,
TABLE 1. Characteristics of Va-e and VIIa-g

<table>
<thead>
<tr>
<th>Compound</th>
<th>mp, °C (from ethanol)</th>
<th>Found, %</th>
<th>Empirical formula</th>
<th>Calculated, %</th>
<th>Yield, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Va</td>
<td>132-134</td>
<td>45.5, 4.1, 11.0, 8.7, 10.1</td>
<td>C₁₀H₇ClN₁O₄S</td>
<td>45.5, 4.1, 11.2, 8.8, 10.1</td>
<td>20.3</td>
</tr>
<tr>
<td>Vb</td>
<td>125-127</td>
<td>48.9, 4.9, 9.9, 8.1, 9.2</td>
<td>C₁₀H₇ClN₁O₄S</td>
<td>48.9, 4.9, 10.1, 8.1, 9.3</td>
<td>22</td>
</tr>
<tr>
<td>Vc</td>
<td>123-125</td>
<td>50.2, 5.2, 9.7, 7.8, 8.9</td>
<td>C₁₀H₇ClN₁O₄S</td>
<td>50.2, 5.3, 9.7, 7.8, 8.9</td>
<td>43</td>
</tr>
<tr>
<td>Vd</td>
<td>129-131</td>
<td>53.9, 3.9, 9.4, 7.3, 8.4</td>
<td>C₁₀H₇ClN₁O₄S</td>
<td>53.9, 3.9, 9.4, 7.4, 8.4</td>
<td>61</td>
</tr>
<tr>
<td>VIIa</td>
<td>232-234</td>
<td>44.3, 2.7, 13.0, 10.5, 11.8</td>
<td>C₁₀H₇ClN₁O₄S</td>
<td>44.4, 2.6, 13.1, 10.3, 11.8</td>
<td>70</td>
</tr>
<tr>
<td>VIIb</td>
<td>194-195</td>
<td>46.5, 3.2, 12.5, 10.1, 11.1</td>
<td>C₁₀H₇ClN₁O₄S</td>
<td>46.4, 3.2, 12.5, 9.8, 11.2</td>
<td>60</td>
</tr>
<tr>
<td>VIIc</td>
<td>154-156</td>
<td>48.4, 3.7, 11.9, 9.3, 10.7</td>
<td>C₁₀H₇ClN₁O₄S</td>
<td>48.2, 3.7, 11.9, 9.4, 10.7</td>
<td>61</td>
</tr>
<tr>
<td>VIIId</td>
<td>146-148</td>
<td>49.8, 3.7, 11.5, 8.7, 10.2</td>
<td>C₁₀H₇ClN₁O₄S</td>
<td>49.9, 3.4, 11.4, 9.0, 10.2</td>
<td>22</td>
</tr>
<tr>
<td>VIIe</td>
<td>180-181</td>
<td>54.1, 4.8, 15.7, 11.6</td>
<td>C₁₀H₇N₂O₂S</td>
<td>44.9, 3.4, 15.7, 12.0, 22</td>
<td>93</td>
</tr>
<tr>
<td>VIIg</td>
<td>166-168</td>
<td>55.8, 5.8, 15.1, 11.5</td>
<td>C₁₁H₉N₂O₂S</td>
<td>47.0, 3.9, 14.9, 11.4</td>
<td>59</td>
</tr>
</tbody>
</table>

formed, are created under the influence of the alkaline agent. The presence of a carbonyl group in the thio ester fragment and an oxalic acid ester residue attached to the nitrogen atom in the N-oxamoyl-S-β-ketoalkylmercapto derivatives promotes the formation of intermediate two-ring hydroxy amino compound VI, the subsequent formation of a lactone ring from which leads to the formation of three-ring systems VIIa-g (Table 1).

The sequence of reactions leading to the heterocyclic system — oxazolidino[3,2-d]pyrido [2,3-b]-1,4-thiazine — is confirmed by the isolation of intermediate N-oxamoyl-S-β-ketoalkylmercapto derivatives Va-e and their conversion to VIIa, c, d. Thus N-oxamoyl-S-β-ketoalkylmercapto derivatives Va-c were isolated and characterized in the reaction of I with β-chloro-β-acetyl-, β-butyryl-, and β-valerylpicryl acid esters under mild conditions (at −5 to −10°C); Va-c (if they are not isolated from the reaction mixture) undergo conversion to three-ring lactones VIIa, c, d. This process also occurs during recrystallization and storage in air of the indicated compounds. When esters of β-chloro-β-isovaleryl- and β-chloro-β-benzoylpyruvic acids are used as the carbonyl component in the reaction, the process stops at the step involving the formation of stable oxamic acid esters Vd, e, which cannot be converted to oxazolidino[3,2-d] derivatives under the conditions indicated above. In a study of the reaction of 4-methoxy-5-amino-6-mercaptopyrimidine (II) with esters of β-halo-β-acylpyruvic acids we were unable to isolate the intermediate N-oxamoyl-S-β-ketoalkylmercapto derivatives: the principal reaction products are oxazolidino[3,2-d]pyrimido[4,5-b]-1,4-thiazines (VIIg, g).

The structures of both the intermediates and the final compounds were confirmed by the data from the IR, PMR, and mass spectra (Table 2) and also by a number of their chemical transformations. Absorption bands at 1700-1730 cm⁻¹, which can be ascribed to the C=O groups of an ester and a ketone, are observed in the IR spectra of Va-e. In contrast to the compounds with open structures, the IR spectra of VIIa-g contain an absorption band at 1820 cm⁻¹.