CHAPTER VI

SYNTHESIS OF THIENO(2,3-d)PYRIMIDIN-4(3H)-ONES

Introduction

4-Hydrazinothieno(2,3-d)pyrimidines required as starting materials for the synthesis of (1,2,4)triazolo-
thieno(3,2-e)pyrimidines were synthesized from the corresponding 2-unsubstituted or 2-substituted thieno(2,3-d)-pyrimidin-4(3H)-ones. The 2-unsubstituted thienopyrimidin-4-(3H)-ones were prepared by refluxing a mixture of o-aminoester and excess of formamide. Since the preparation of 2-substituted thienopyrimidin-4(3H)-ones by the condensation of o-aminoesters with substituted amides does not seem to be attractive, an alternate approach was employed. The method involves cyclization of thiophene-o-aminoesters with appropriate nitriles in the presence of hydrogen chloride gas.

Nitriles have been shown to react with nucleophiles such as alcohols, thiols and amines in the presence of halogen acids to yield iminoethers, iminothioethers and amidines.
Such an amidine synthesis when applied to an o-aminocarbonyl compounds should in principle lead to condensed pyrimidines. In fact, this approach has successfully been employed for the synthesis of a variety of condensed pyrimidines. Thus, o-aminocarbonyl compounds when reacted with nitriles in the presence of dry hydrogen chloride gas afford condensed pyrimidines in good yields, under mild reaction conditions. A number of carbonyl variants like ketones (478), esters, amides (479) and nitriles (480) of benzene, thiophene, isothiazole, pyrrole, pyridine and furan have been utilised as o-aminocarbonyl compounds. The nitrile components used in such cyclizations are mainly, alkyl, aralkyl, aryl, heterocyclic and a variety of substituted aliphatic nitriles such as cyanates, thiocyanates and cyanamides.
Present work, Results and Discussion

The 4-oxothienopyrimidines required as the starting materials for 4-hyrazinothienopyrimidines in the present study were prepared by this facile one-pot reaction of o-aminocesters with alkyl, aralkyl and aromatic nitriles in the presence of dry hydrogen chloride gas in dioxane.
Earlier, it has been observed that the reaction of o-aminoesters (484) with acrylonitrile yield 2-\((2'\text{-chloroethyl})\)-4-hydroxythieno(2,3-d)pyrimidines (485), possibly by the initial formation of 2-chloropropionitrile from acrylonitrile and hydrogen chloride followed by its reaction with the o-aminoesters.

However, the reaction of o-aminoester (484) with cinnamonitrile under similar conditions afforded 2-styryl-4-oxothieno(2,3-d)pyrimidin-4(3H)-ones (486) in good yields (Table XVI).
The highly reactive nitrilium or imidoyl halide derivative, formed by the reaction of a nitrile with HCl, presumably reacts with o-aminocarbonyl compound to yield the o-functionalyzed amide (487) which cyclizes intramolecularly to the corresponding condensed pyrimidines (488). Evidently, the protonation of the o-aminoester also appears to facilitate the cyclization. Interestingly, in the reaction of o-aminocarboxamides with nitriles it has been found that, under carefully controlled conditions, the amide intermediates are indeed isolable which have been further cyclized to different pyrimidines under a variety of reaction conditions.

An unusual formation of 4-chloropyrimidines in the reaction of o-aminonitriles with halogenonitriles has also been
observed. However, the reaction of o-aminonitriles (489) with cinnamononitrile in the presence of dry hydrogen chloride gas yielded only 4-amino-2-styrylthienopyrimidines (490) (Table XVII).

The thieno(2,3-d)pyrimdin-4(3H)-ones (488) on treatment with refluxing phosphorous oxychloride for 10-12 hours yielded 4-chlorothieno(2,3-d)pyrimidines (491) in 35-68% yields (Table XVIII). The 4-chloropyrimidines (270), (271), (277), (278), (282), and (284) could also be prepared in 55-80% yields by treating the corresponding thienopyrimidin-4-ones with phosphorous oxychloride in excess of dimethylformamide at lower temperature of around 0-5°C. All the 4-chloro derivatives were recrystallized from either n-hexane or n-hexane-benzene mixture.

The 4-chlorothieno(2,3-d)pyrimidines on treatment with hydrazine hydrate (99-100%) in refluxing ethanol yielded the desired 4-hydrazino(2,3-d)pyrimidines (492) (Table XIX) (Scheme XXXI).
The synthesis of some 2-(2-arylvinyl)-thieno(2,3-d)pyrimidin-4(3H)-ones was also investigated. The condensation of aromatic aldehydes with 2-methyl substituted heterocycles has been widely employed for the synthesis of 2-arylvinylheterocycles including quinazolines. However, the
attempted condensation of 2-methylthieno(2,3-d)pyrimidin-4(3H)-
one's with benzaldehyde under acidic, basic and thermal
conditions resulted in the recovery of the starting mate-
rials. Thus, heating either an equimolar quantities of
thienopyrimidin-4-one (493) and benzaldehyde in acetic acid
and acetic anhydride or in the presence of sodium ethoxide
in ethanol or heating a mixture of thienopyrimidin-4-one
(493) and benzaldehyde at elevated temperature did not
yield the desired 2-styrylthienopyrimidin-4(3H)-one (505).

Wittig olefination of 2-thienopyrimidinyl-
methylphosphonium chlorides with aromatic aldehydes was,
therefore, attempted as an alternate approach for the syn-
thesis of 3-unsubstituted-2-(2-arylvinyl)thieno(2,3-d)-
pyrimidin-4(3H)-ones. The 2-chloromethylthienopyrimidin-4-
(3H)-ones (494) required as starting material are acces-
ible through the HCl catalysed reaction of chloroacetanitrile
with o-aminocetester (484) (Scheme XXXII). The 2-chloro-
methylthienopyrimidin-4(3H)-ones were then reacted with tri-
phenyl phosphine. While simple reflux of the two components
in benzene lead to the recovery of the starting materials,
the desired phosphonium salts could however be obtained
by heating 2-chloromethyl derivatives (494) and
triphenyl phosphine in refluxing toluene or xylene. The resulting thienopyrimidinylmethylphosphonium chlorides (495) could be reacted with various aromatic aldehydes employing a mild base, such as aqueous potassium carbonate solution, in methanol to yield the desired 2-(2-arylyinyl)-thieno(2,3-d)pyrimidin-4(3H)-ones (496), (Table XVI), (Scheme XXXII).

\[
\begin{align*}
\begin{array}{c}
\text{(484)} \\
\text{R}_1 \quad \text{SO}_2 \text{NH}_2 \\
\text{R}_2 \end{array} \\
\begin{array}{c}
\text{C}_6\text{H}_5\text{CH}_2\text{CN} \\
\text{H}_3\text{O} \\
\end{array} \\
\begin{array}{c}
\text{C}_6\text{H}_5\text{NH} \\
\text{R}_1 \quad \text{R}_2 \\
(\text{494}) \\
\end{array} \\
\begin{array}{c}
\text{ArCHO} \\
\text{K}_2\text{CO}_3/\text{CH}_3\text{OH} \\
\text{CH}_2\text{OH}_\text{Ar} \\
\end{array} \\
\begin{array}{c}
\text{(496)} \\
\text{R}_1 \quad \text{NH} \\
\text{R}_2 \quad \text{OH}_\text{Ar} \\
\end{array} \\
\begin{array}{c}
\text{R}_1 \quad \text{R}_2 \\
\text{O} \\
\text{(495)} \\
\end{array} \\
\begin{array}{c}
\text{ArCHO} \\
\text{(493) R}_1 \text{R}_2 \text{O} \\
\end{array}
\end{align*}
\]

Scheme XXXII
2-Styrylthieno(2,3-d)pyrimidin-4(3H)-ones (486) could also be prepared by the reaction of o-aminoamide (497) with cinnamaldehyde in refluxing ethanol in the presence of trace amount of concentrated hydrochloric acid as catalyst.

Further, the 3-phenylsubstituted-2-methylthienopyrimidin-4-(3H)-one (498) could be condensed with aromatic aldehydes under basic catalysis. Thus, 2-methyl-3-phenylthienopyrimidine (498) when reacted with aldehydes in the presence of equimolar quantities of sodium ethoxide in ethanol at around 40-50°C yielded the 2-(2-arylvinyl)-3-phenylthienopyrimidines (499) as indicated by their physical and spectral characteristics (Table XVI).
The 4-chlorothieno(2,3-d)pyrimidines synthesised are low melting, colorless to pale yellow needle shaped, and are fairly soluble in ethanol and chloroform. The 4-chlorothienopyrimidines (270), (272) and (274) exhibit two characteristic absorptions around 240 nm and 285 nm in UV region.

The 4-hydrazinothieno(2,3-d)pyrimidines are colorless to yellowish crystalline solids. Though these hydrazines are, in general, sparingly soluble in ethanol and chloroform, 3-ethyl-4-hydrazinothieno(2,3-d)pyrimidine (296), highly soluble in these solvents, is an exception. 4-Hydrazinothienopyrimidines (286), (290) and (292) reveal two absorption maxima around 220 nm and 285 nm while 4-hydrazino-2,5-diphenylthienopyrimidine (299) exhibits only single absorption maxima at 322 nm in UV region. The IR spectra of 4-hydrazinothienopyrimidines show the characteristic NH stretching absorptions around the region 3300 cm⁻¹ and 3100 cm⁻¹.
All the 2-(2-arylviny1)thieno(2,3-d)pyrimidin-4(3H)-ones are bright yellow colored needle shaped compounds. The 2-(2-arylviny1)-3-phenylthieno(2,3-d)pyrimidin-4(3H)-ones (515) and (516) are red colored crystalline solids. While most of the 2-styrylthienopyrimidines are only sparingly soluble in organic solvents like ethanol, chloroform and benzene, the 2-(2-arylviny1)-3-phenylthienopyrimidin-4(3H)-ones are easily soluble in ethanol and chloroform. The 4-amino-2-styrylthienopyrimidines (517) and (518) are colorless to pale yellow crystalline needles and are moderately soluble in ethanol and chloroform.

An examination of the IR spectra of 2-(2-arylviny1)-thienopyrimidin-4(3H)-ones (505-516) reveals the characteristic carbonyl stretching absorption due to the 4-oxo group in the region 1680-1660 cm\(^{-1}\). The carbonyl stretching absorption due to the ester function in the spectrum of 6-carbethoxy-5-methyl-2-styrylthieno(2,3-d)pyrimidin-4(3H)-one (507) appears at 1720 cm\(^{-1}\). The asymmetric and symmetric stretching frequencies of the NO\(_2\) group in the spectra of 511, 514 and 516 appear around 1590-1580 cm\(^{-1}\) and 1390-1340 cm\(^{-1}\), respectively. 4-Amino-2-styrylthienopyrimidines (517) and (518) exhibit the characteristic NH stretching absorption around 3400, 3300 and 3200 cm\(^{-1}\).
IR spectra of all the 2-(2-arylvinyl)thienopyrimidin-4(3H)-ones, 4-amino-2-styrylthienopyrimidines, 4-chloro- and 4-hydrazino-2-styrylthienopyrimidines are characterised by absorptions around the region 1600-1580 cm\(^{-1}\) and at around 980-960 cm\(^{-1}\). The strong band around 980-960 cm\(^{-1}\) may be due to the out of plane deformation of \textit{trans} hydrogens attached to the C-C\(^{275,276}\).

2-Styrylthienopyrimidin-4(3H)-ones (505) and (515) exhibit a characteristic doublet around the region \(\delta 7.87-8.08\) (\(J=14.0\) and 15.6 Hz) in \(\text{NMR}\) assignable to the more deshielded vinylic proton on the carbon atom attached to the pyrimidine ring at 2-position and another doublet due to the other vinylic proton at around \(\delta 6.34-6.91\) (\(J=14\) and 15.6 Hz). The large coupling constants observed lend support to the \textit{trans} configuration of the olefinic double bond in these 2-(2-arylvinyl)thienopyrimidines.

Intense molecular ion peak characterises the mass spectra of 2-styrylthieno(2,3-d)pyrimidin-4(3H)-ones (505, 510 and 515). The 4-oxo-5,6,7,8-tetrahydrobenzo(b)thienopyrimidines (505) and (515) exhibit prominent M-28 peak due to the ions 520 and 521 formed by the loss of ethylene molecule through the \textit{retro-Diels-Alder
cleavage of the cyclohexyl moiety. This mode of fragmentation receives further confirmation by the presence of an intense mass peak at m/e 280 due to the ion 520, in the spectrum of the tetrahydropyrido[1,2-a]thieno[3,2-c]pyrimidine (510).

Further, the spectra of these compounds show a peak at m/e 279, which is more intense than the peak at m/e 280. This peak may be due to the even electron ion 523 arising by the loss of H* in 505 and 510 or by the loss of C6H5 in 515, followed by the retro-Diels-Alder cleavage.

Moderately intense peaks due to the C6H5CH=CHC=NH at m/e 129 and m/e 130 are also observed in the spectra of 2-styrylthienopyridinelines (505), (510) and (515).
The degradation pattern of 2-styryl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidin-4(3H)-one (505) can be depicted, as shown in the Scheme XXXIII.

Intense peak at m/e 306 observed in the mass spectrum of 510 may be assigned to the even-electron ion 524 formed by the expulsion of $C_6H_5CH_2$ radical from the molecular ion. The loss of $C_6H_5CH=CHCN$ and CO from the ion 524 possibly leads to the ions 525 and 526 at m/e 179 and 151, respectively. Further, the ion at m/e 322 of moderate intensity may be formulated as 527 formed by the loss of $C_6H_5$ from the benzyl moiety of the pyridine ring (XXXIV).
Other prominent peaks found in the spectrum of thienopyrimidine (510) are due to the fragmentation of ion of m/e 280 as shown in the Scheme XXXV.

![Scheme XXXV](image)

The fragmentation pattern exhibited by 3-phenyl-2-styryl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidin-4-(3H)-one (515) is depicted in Scheme XXXVI. Some of the
Scheme XXXVI
intense peaks observed in the spectrum are at m/e 369, 356 and m/e 307, which are possibly due to the ions 528, 521 and 529, formed by the loss of CH$_3$, CH$_2$=CH$_2$ and C$_6$H$_5$, respectively from the molecular ion. Loss of C$_6$H$_5$CH=CHCN or C$_6$H$_5$CH=CH from the ion 521, possibly, leads to the formation of ions m/e 227 and 253.

An intense peak observed at m/e 206 may be due to the formation of cation 530 from the molecular ion.

$$\text{(515) m/e 384}$$

$$\text{(530) m/e 206}$$

The mass spectrum of 4-amino-2-styryl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidine (517) shows intense molecular ion peak at m/e 307. Other intense peaks
observed in the spectrum are at m/e 306, 292, 291, 290, 279, 278, 262, 252, 204, 178, 177, 150 and m/e 123. The loss of H from the parent ion, possibly, yields the even electron ion 531 at m/e 306. The ion 531 further expels CH2=CH2 from the cyclohexyl moiety to yield the ion peak of m/e 278 which is more abundant than the ion 534 at m/e 279. Elimination of C6H5CH=CHCN from 532 results in the formation of cation 533 at m/e 149.
The fragments m/e 279, 150 and 123 may be formulated as the ions 534, 535 and 536, respectively, by the successive loss of \( \text{CH}_2=\text{CH}_2 \), \( \text{C}_6\text{H}_5\text{CH}^\cdot\text{CHCN} \) and HCN from the molecular ion. Loss of \( \text{C}_6\text{H}_5\text{CH}^\cdot\text{CH}, \text{HCN} \) and \( \text{CH}_2=\text{CH}_2 \) from the parent ion may account for the fragments of m/e 204, 177 and 149 found in the spectrum of this compound (Scheme XXXVII).

The mass spectrum of 517 is also characterized by intense peaks at m/e 291 and 290, possibly, due to the elimination of \( \text{NH}_2 \) and \( \text{NH}_3 \) from the parent ion to yield 537 and 538. These ions further lose \( \text{CH}_2=\text{CH}_2 \) and \( \text{C}_6\text{H}_5\text{CH}^\cdot\text{CHCN} \) as shown in the Scheme XXXVIII.

Intense peaks corresponding to m/e 178, 177, 129 and 130 may be due to the retro-Diels-Alder cleavage of the molecular ion to yield the ions 539, 540, 541 and 542, respectively.

\[
\text{Scheme XXXVII}
\]

\[
\text{Scheme XXXVIII}
\]
Scheme XXXVII
Scheme XXXVIII
In general, 2-styrylthienopyrimidines are characterised by the following common mode of fragmentation in the mass spectra.

(a) The loss of \( C_6H_5=CH-CN \) and \( C_6H_5=CH \) from the parent ion or from the daughter ions. Intense peaks at m/e 129 and m/e 130 correspond to the cinnamonic and its nitrim ion, respectively.

(b) The retro-Diels-Alder cleavage of the cyclohexyl moiety to loose \( CH_2=CH_2 \) and the loss of \( CH_3 \) radical through the ring cleavage and rearrangement reactions of cyclohexyl moiety.

(c) The loss of \( NH_2 \) and \( NH_3 \) from the parent ion and the elimination of HCN from various daughter ions of 4-amino-styrylthienopyrimidine.

**Biological activity**

The 2-(2-arylvinyl)thienopyrimidines (508), (510), (512), (513) and (517) were screened for antimicrobial activity. The preliminary reports indicate the absence of any significant antimicrobial activity in these compounds against *B. subtilis*, *E. coli*, *S. aureus*, *S. marcescens*, *S. typhi*, *P. aeruginosa*, *S. shigae* and *P. mirabilis* at 200 \( \mu g/ml \) concentration.

The compounds (505), (507), (508), (510), (512) and (513) were also tested for antifertility in mice. None of the compounds showed any antifertility activity at the dose level of 250mg/kg p.o.
**TABLE XVI**

*2-(2-Arylvinyl)thieno(2,3-d)pyrimidin-4(3H)-ones*

<table>
<thead>
<tr>
<th>Compound No.</th>
<th>R&lt;sub&gt;1&lt;/sub&gt;</th>
<th>R&lt;sub&gt;2&lt;/sub&gt;</th>
<th>Ar</th>
<th>M&lt;sub&gt;r&lt;/sub&gt;F. °C</th>
<th>Yield %</th>
<th>Recryst. solv.</th>
<th>Molecular Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>505</td>
<td>(CH&lt;sub&gt;2&lt;/sub&gt;)&lt;sub&gt;4&lt;/sub&gt; -</td>
<td>-</td>
<td>315-317</td>
<td>E-C</td>
<td>58&lt;sup&gt;a&lt;/sup&gt;</td>
<td>C&lt;sub&gt;10&lt;/sub&gt;H&lt;sub&gt;15&lt;/sub&gt;N&lt;sub&gt;2&lt;/sub&gt;OS</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>315-317</td>
<td>46&lt;sup&gt;b&lt;/sup&gt; E-C</td>
<td>C&lt;sub&gt;10&lt;/sub&gt;H&lt;sub&gt;15&lt;/sub&gt;N&lt;sub&gt;2&lt;/sub&gt;OS</td>
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<td></td>
<td></td>
<td></td>
<td>314-316</td>
<td>78&lt;sup&gt;c&lt;/sup&gt; E-C</td>
<td>C&lt;sub&gt;10&lt;/sub&gt;H&lt;sub&gt;15&lt;/sub&gt;N&lt;sub&gt;2&lt;/sub&gt;OS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>506</td>
<td>CH&lt;sub&gt;3&lt;/sub&gt;</td>
<td>CH&lt;sub&gt;3&lt;/sub&gt;</td>
<td>295-297</td>
<td>E-C</td>
<td>39&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td></td>
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<td></td>
<td>295-298</td>
<td>85&lt;sup&gt;b&lt;/sup&gt; E-C</td>
<td>C&lt;sub&gt;10&lt;/sub&gt;H&lt;sub&gt;15&lt;/sub&gt;N&lt;sub&gt;2&lt;/sub&gt;OS</td>
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<tr>
<td>507</td>
<td>CH&lt;sub&gt;3&lt;/sub&gt;</td>
<td>COOC&lt;sub&gt;2&lt;/sub&gt;H&lt;sub&gt;5&lt;/sub&gt;</td>
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<td>A</td>
<td>74&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>232-234</td>
<td>B</td>
<td>54&lt;sup&gt;a&lt;/sup&gt;</td>
<td>C&lt;sub&gt;16&lt;/sub&gt;H&lt;sub&gt;11&lt;/sub&gt;N&lt;sub&gt;2&lt;/sub&gt;OS</td>
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<td>509</td>
<td>C&lt;sub&gt;6&lt;/sub&gt;H&lt;sub&gt;5&lt;/sub&gt;</td>
<td>H</td>
<td>298-300</td>
<td>D</td>
<td>36&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>510</td>
<td>-(CH&lt;sub&gt;2&lt;/sub&gt;)&lt;sub&gt;2&lt;/sub&gt;-N-CH&lt;sub&gt;2&lt;/sub&gt;-</td>
<td></td>
<td>191-193</td>
<td>E</td>
<td>38&lt;sup&gt;c&lt;/sup&gt;</td>
<td>C&lt;sub&gt;24&lt;/sub&gt;H&lt;sub&gt;21&lt;/sub&gt;N&lt;sub&gt;3&lt;/sub&gt;OS</td>
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Table XVI (Contd).

<table>
<thead>
<tr>
<th>Entry</th>
<th>Structure</th>
<th>Melting Point (°C)</th>
<th>Yield (%)</th>
<th>Solvent</th>
<th>Molecular Formula</th>
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<tr>
<td>511</td>
<td>-(CH₂)₄-</td>
<td>272-274</td>
<td>66ᵇ</td>
<td>E-C</td>
<td>C₁₈H₁₅N₃O₃S</td>
</tr>
<tr>
<td>512</td>
<td>-(CH₂)₄-</td>
<td>323-325</td>
<td>71ᵇ</td>
<td>E-C</td>
<td>C₁₉H₁₈N₂O₂S</td>
</tr>
<tr>
<td>513</td>
<td>-(CH₂)₄-</td>
<td>275-281</td>
<td>55ᵇ</td>
<td>D</td>
<td>C₂₁H₂₂N₂O₄S</td>
</tr>
<tr>
<td>514</td>
<td>C₆H₅</td>
<td>&gt;330</td>
<td>85ᵇ</td>
<td>D</td>
<td>C₂₀H₁₃N₃S</td>
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<tr>
<td>515</td>
<td>-(CH₂)₄-</td>
<td>209-211</td>
<td>44ᵈ</td>
<td>PE-B</td>
<td>C₂₄H₂₀N₂O₈</td>
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<tr>
<td>516</td>
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<td>233-235</td>
<td>42ᵈ</td>
<td>PE</td>
<td>C₂₄H₁₉N₂O₅S</td>
</tr>
</tbody>
</table>

* A = Acetic acid; B = Benzene; C = Chloroform; D = Dioxane; E = Ethanol; PE = Petroleum-Ether (60-80).

ᵃ Prepared by condensation of thiophene o-aminocarboxylic acid with cinnamonic acid in the presence of dry hydrogen chloride gas.
ᵇ Prepared by the Wittig condensation of 2-thienopyrimidin-3-yl-methylphosphonium chloride with aromatic aldehyde.
ᶜ Prepared by the condensation of thiophene o-aminoamide with cinnamaldehyde.
ᵈ Prepared by the base catalysed condensation of 2-methyl-3-phenylthio(2,3-d)pyrimidinone with aldehyde.
<table>
<thead>
<tr>
<th>Compound No.</th>
<th>R₁</th>
<th>R₂</th>
<th>M.P. °C</th>
<th>Yield</th>
<th>Recryst. Solvent*</th>
<th>Molecular Formula</th>
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<tr>
<td>517</td>
<td>-((\text{CH}_2\text{)}_4)-</td>
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<td>241-243</td>
<td>36</td>
<td>D</td>
<td>C₁₈H₁₇N₃S</td>
</tr>
<tr>
<td>518</td>
<td>CH₃</td>
<td>CH₃</td>
<td>232-234</td>
<td>35</td>
<td>B</td>
<td>C₁₆H₁₅N₃S</td>
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</table>

* B = Benzene
D = Dioxane
<table>
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<tr>
<th>Compound No.</th>
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<th>R₂</th>
<th>R₃</th>
<th>M.P. °C</th>
<th>Yield %</th>
<th>Method</th>
<th>Recryst. solvent *</th>
<th>Molecular Formula</th>
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<tr>
<td>270</td>
<td>-(CH₂)₄⁻</td>
<td>CH₃</td>
<td>CH₃</td>
<td>96-98</td>
<td>67 A</td>
<td>PE-B</td>
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<td>H</td>
<td>CH₃</td>
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<td>PE-B</td>
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<td>-CH₂CH₂-N-CH₂-</td>
<td>CH₃</td>
<td>109-110</td>
<td>61 A</td>
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<td>C₁₇H₁₆N₂SCl**</td>
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<td>CH₂C₆H₅</td>
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* B = Benzene; PE = Petroleum-Ether (60-80)
** Used in further reactions without elemental analysis
Method A: Phosphorous oxychloride at reflux
Method B: Dimethylformamide-phosphorous oxychloride at 0-5°C
<table>
<thead>
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<th>Compound No.</th>
<th>$R'$</th>
<th>$R_2$</th>
<th>$R_3$</th>
<th>M.P. °C</th>
<th>Yield %</th>
<th>Recrystn. solvent</th>
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<td>-$(\text{CH}_2)_4-$</td>
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<td>CH$_3$</td>
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<td>M-C</td>
<td>C$<em>{9}$H$</em>{12}$N$_4$S</td>
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<td>C$_6$H$_5$</td>
<td>H</td>
<td>CH$_3$</td>
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<td>M</td>
<td>C$<em>{13}$H$</em>{12}$N$_4$S</td>
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* C = Chloroform; E = Ethanol; M = Methanol
** Used in further reaction without elemental analysis.
General procedure for the preparation of thieno(2,3-d)
pyrimidine-4(3H)-ones.

Method I: A mixture of 2-amino-3-carbethoxythiophene
(0.1 mole) and formamide (150ml) was refluxed for 6-8 hours.
The reaction mixture was cooled, and the solid separated
was filtered, washed with water and dried. Recrystallization
from appropriate solvent yielded the corresponding 2-(unsub-
stituted)thieno(2,3-d)pyrimidine-4(3H)-ones. 305-307

Method II: A stream of dry hydrogen chloride gas was passed
through a mixture of 2-amino-3-carbethoxythiophene (0.01
mole) and appropriate nitrile (0.01 mole) in dry
dioxane (30ml) for 4-5 hours. The reaction mixture was
poured into ice-water and basified with 10% ammonium
hydroxide solution. The solid obtained was filtered,
washed with water and dried. Recrystallization from a
suitable solvent yielded the corresponding 2-substituted-
thieno(2,3-d)pyrimidine-4(3H)-one. 308-310

5,6,7,8-Tetrahydrobenzo(b)thieno(2,3-d)pyrimidine-4(3H)-
one-2-methyltriphenylphosphonium chloride (501).

A suspension of 2-chloromethyl-5,6,7,8-tetra-
hydrobenzo(b)thieno(2,3-d)pyrimidine-4(3H)-one (2.54g;
0.01 mole) and triphenyl phosphine (2.62g, 0.01 mole) in
toluene (40ml) was refluxed for 7-8 hours. The reaction
mixture was cooled and the yellow solid separated was filtered and dried. Recrystallization from benzene yielded 3.0g (58%) of yellow crystalline solid, m.p. 248-50°C, used for the condensation with aldehydes without further purification.

5,6-Dimethylthieno(2,3-d)pyrimidin-4(3H)-one-2-methyltriphenylphosphonium chloride (502).

A mixture of 2-chloromethyl-5,6-dimethylthieno(2,3-d)pyrimidin-4(3H)-one \(^{310}\) (2.29g; 0.01 mole) and triphenylphosphine (2.62g; 0.01 mole) in toluene (40ml) was treated according to the procedure described for 501. The yellow crystalline product thus obtained, 2.8g (77%), was used for the condensation with aldehydes without purification.

5-Phenylthieno(2,3-d)pyrimidin-4(3H)-one-2-methyltriphenylphosphonium chloride (503).

A mixture of 2-chloromethyl-5-phenylthieno(2,3-d)-pyrimidin-4(3H)-one \(^{310}\) (2.77g; 0.01 mole) and triphenylphosphine (2.62g; 0.01 mole) in xylene (40ml) was refluxed for 8 hrs and was further treated according to the procedure described for 501. The yellow crystalline solid thus obtained, 4.0g (74%), was used for the condensation with aldehydes without purification.
2-Styryl-5,6,7,8-tetrahydrobenzo(b)thiophene(2,3-d)pyrimidin-4(3H)-one (505).

**Method I:** A stream of dry hydrogen chloride gas was passed through a mixture of 2-amino-3-carbethoxy-4,5,6,7-tetrahydrobenzo(b)thiophene (2.25g; 0.01 mole) and cinna-monitrile (1.42g; 0.011 mole) in dioxane (30ml) for 5 hours. The reaction mixture was allowed to stand overnight at room temperature, poured into ice-water and basified with 10% ammonium hydroxide solution. The yellow precipitate obtained was filtered, washed with water and dried. Recrystallization from ethanol-chloroform yielded 1.8g (58%) of pale yellow crystalline product, m.p. 315-317°C.

**Analysis:**

\[ \text{C}_{18} \text{H}_{16} \text{N}_2 \text{O}_5 \] (308.39) Requires C, 70.10; H, 5.23%

\[ \text{Found} \quad \text{C}, 70.05; \text{H}, 5.51\% \]

\[ \text{IR (KBr)} \quad 1650(\text{C=O}), 1530, 1445, 1400, 1325, 1300, 1205, 1045, 975(\text{CH=CH, trans}), 915, 850, 775, 750 \text{ cm}^{-1} \]

**Method II:** To a solution of 5,6,7,8-tetrahydrobenzo(b)thiophene(2,3-d)pyrimidin-4(3H)-one-2-methyltriphenylphosphonium chloride (501) (2.58g; 0.005 mole) and benzaldehyde
(0.27g; 0.0025 mole) in methanol (25ml) was added, drop-wise, an aqueous solution of potassium carbonate (4ml, 10%), with stirring. The solid obtained was filtered, washed with methanol and dried. Recrystallization from ethanol-chloroform yielded 1.2g (78%) of yellow crystalline product, m.p. 314-316°C.

**Analysis**

$$C_{18}H_{16}N_2O_8$$ (308.39) Requires C, 70.10; H, 5.23%

**Found** C, 70.22; H, 5.61%

**IR (KBr)**: 1650 (C=O), 1530, 1445, 1400, 1325, 1300, 1205, 1150, 1070, 1045, 975 (CH=CH, trans), 915, 850, 815, 775, 750 cm⁻¹

**MS, m/e**: 308 (M⁺), 307, 293, 280, 267, 251, 235, 179, 151, 130, 129

**Method III**: A mixture of 2-amino-3-carboxamido-4,5,6,7-tetrahydrobenzo(b)thiophene (1.96g; 0.01 mole), cinnamaldehyde (1.45g; 0.011 mole) and concentrated hydrochloric acid (0.5ml) in absolute ethanol (30ml) was refluxed for 5 hours. Excess of solvent was removed by distillation under vacuum. The solid obtained was washed with saturated solution of sodium bicarbonate, water and dried. Recrystallization from ethanol-chloroform yielded 1.4g (46%) of yellow crystalline product, m.p. 315-317°C, identical (mmp, TLC, IR) with the compound obtained by method I.
5,6-Dimethyl-2-styrylthieno(2,3-d)pyrimidin-4(3H)-one (506).

**Method I:** A stream of dry hydrogen chloride gas was passed through a mixture of 2-amino-3-carbethoxy-4,5-dimethylthiophene (1.99g, 0.01 mole) and cinnamylitrile (1.42g, 0.011 mole) in dioxane (30ml) for 5 hours. The reaction mixture was further treated according to the procedure described for 505, (method I). Recrystallization from ethanol-chloroform yielded 1.1g (39%) of yellow crystalline product, m.p. 295-297°C.

**Analysis:**
- C, H, N, O8 (282.35) Requires C, 68.06; H, 5.00%; N, 2.24%
- Found: C, 67.96; H, 5.24%

**IR (Nujol):**
- 1660 (C=O), 1475, 1435, 1405, 1350, 1230, 1150, 1445, 1045, 980 (CH=CH, trans), 925, 875, 860, 820, 785 cm⁻¹

**Method II:** A solution of 5,6-Dimethylthieno(2,3-d)pyrimidin-4(3H)-one-2-methyltriphenylphosphonium chloride (502) (2.45g, 0.005 mole) and benzaldehyde (0.27g, 0.0025 mole) in methanol (25ml) was treated with an aqueous solution of potassium
carbonate (4 ml, 10%) according to the procedure described for 505, (Method II). Recrystallization from ethanol-chloroform yielded 1.2 g (85%) of yellow crystalline product, m.p. 296-298°C.

Analysis: C_{16}H_{14}N_{4}OS (282.35) Requires C, 68.06; H, 5.00%

Found: C, 68.15; H, 5.22%

IR (Nujol): 1660 (C=O), 1475, 1435, 1400, 1370, 1350, 1270, 1230, 1035, 900 (CH-CH\text{trans}), 860, 785, 755 cm\(^{-1}\)

NMR (DMSO-d_6): \(\delta\) 2.41 (3H, d, CH\text{3 at C}_5\)), 3.3 (3H, s, CH\text{3 at C}_6\)), 7.53 (5H, m, Ar-H); 8.08 (1H, d, H\text{a}, J=14 Hz), 6.91 (1H, d, H\text{b}, J=14 Hz)

6-Carbethoxy-5-methyl-2-styrylthieno(2,3-d)pyrimidin-4(3H)-one (507).

A stream of dry hydrogen chloride gas was passed through a mixture of 2-amino-3,5-dicarbethoxy-4-methylthiophene (2.57 g; 0.01 mole)\(^{272}\) and cinnamonic acid (1.42 g; 0.011 mole) in dioxane (30 ml) for 5 hours. The reaction mixture was further treated according to the procedure described for 505, (Method I). Recrystallization from glacial acetic acid yielded 2.5 g (74%) of yellow crystalline product, m.p. 278-280°C.
A stream of dry hydrogen chloride gas was passed through a mixture of 2-amino-3-carbethoxy-5-ethyl thiophene (1.99g; 0.01 mole) and cinnamonitrile (1.42g; 0.011 mole) in dioxane (30ml) for 5 hours. The reaction mixture was further treated according to the procedure described for 505. (Method I). Recrystallization from benzene yielded 1.5g (58%) of yellow crystalline product, m.p. 232-234°C.

Analysis : \( \text{C}_16\text{H}_{14}\text{N}_2\text{O}_8 \) (282.35) Requires C, 68.06; H, 5.00% 
\[ \text{Found} \quad \text{C}, 68.33; \text{H}, 5.01\% \]

IR (Nujol) : 1670 (C=O), 1640, 1560, 1460, 1375, 1340, 1300, 1215, 1115, 1045, 970 (CH=CH, \text{trans}), 905, 850, 830, 760 cm\(^{-1}\)

5-Phenyl-2-styrylthieno(2,3-d)pyrimidin-4(3H)-one (509).

A stream of dry hydrogen chloride gas was passed through a mixture of 2-amino-3-carbethoxy-4-phenylthiophene.
(2.47g; 0.01 mole)\(^{272}\) and cinnamaldehyde (1.42g; 0.011 mole) in dioxane (30ml) for 5 hours. The reaction mixture was further treated according to the procedure described for 505, (Method I). Recrystallization from dioxane yielded 1.2g(36%) of yellow crystalline product, m.p. 298-300°C.

**Analysis**

\[
\text{C}_{16}\text{H}_{14}\text{N}_{2}\text{O}_{2}(348.40) \text{ Requires C,68.94; H,4.63}\% \\
\text{Found} \quad \text{C,69.32; H,4.76}\%
\]

**IR (Nujol)**

1650(C=O), 1640, 1560, 1460, 1375, 1340, 1300, 1250, 1220, 1115, 1045, 970(CH-CH, trans), 870, 750 cm\(^{-1}\)

7-Benzyl-2-styryl-5,6,7,8-tetrahydropyrido(4',3',4,5)thieno(2,3-d)pyrimidin-4(3H)-one (510).

A mixture of 2-amino-6-benzyl-3-carboxamido-4,5,6,7-tetrahydrothieno(2,3-c)pyridine (2.87g; 0.01 mole), cinnamaldehyde (1.45g; 0.011 mole) and concentrated hydrochloric acid (0.5ml) in absolute ethanol (30ml) was refluxed for 5 hours. The reaction mixture was further treated according to the procedure described for 505, (Method III). Recrystallization from ethanol yielded 1.5g (38%) of yellow crystalline compound, m.p. 191-193°C.

**Analysis**

\[
\text{C}_{24}\text{H}_{21}\text{N}_{3}\text{O}_{8}(399.49) \text{ Requires C,72.15; H,5.30}\% \\
\text{Found} \quad \text{C,71.95; H,5.65}\%
\]
IR (Nujol) : 1660 (C=O), 1600, 1560, 1480, 1440, 1315, 1290, 1185, 1145, 1010, 980 (CH=CH, \textit{trans}), 845, 790, 755 cm\(^{-1}\)

MS, m/e : 399 (M\(^{+}\)), 390, 370, 322, 300, 293, 280, 179, 177, 151, 130, 129, 123, 91

2-(2-(4-Nitrophenyl)vinyl)-5,6,7,8-tetrahydrobenzo(b)-thieno(2,3-d)pyrimidin-4(3H)-one (511).

A solution of 5,6,7,8-tetrahydrobenzo(b)thieno-(2,3-d)pyrimidin-4(3H)-one-2-methyltriphenylphosphonium chloride (501) (2.58g, 0.005 mole) and 4-nitrobenzaldehyde (0.37g, 0.0025 mole) in methanol (25ml) was treated with an aqueous solution of potassium carbonate (4ml, 10\%) according to the procedure described for 505, (Method II). Recrystallization from ethanol—chloroform yielded 1.2g (68\%) of yellow crystalline product, m.p. 272-274\(^\circ\)C.

Analysis : \(C_{18}H_{15}N_{3}O_{3}\) (353.29) Requires C,61.17; H,4.26%

Found C,60.80; H,4.56%

IR (Nujol) : 1660 (C=O), 1580 (NO\(_{2}\)), 1500, 1480, 1440, 1420, 1390 (NO\(_{2}\)), 1320, 1220, 1050, 970 (CH=CH, \textit{trans}), 920, 875, 865, 755 cm\(^{-1}\)
A solution of 5,6,7,8-tetrahydrobenzo(b)thieno-(2,3-d)pyrimidin-4(3H)-one-2-methyltriphenylphosphonium chloride (501) (2.58 g; 0.005 mole) and 4-methoxybenzaldehyde (0.34 g; 0.0025 mole) in methanol (25 ml) was treated with an aqueous solution of potassium carbonate (4 ml; 10%) according to the procedure described for 505. (Method II). Recrystallization from ethanol–chloroform yielded 1.2 g (71%) of yellow crystalline compound, m.p. 323–325°C.

Analysis: \(C_{19}H_{18}N_2O_2\) (338.12) Requires C, 67.43; H, 5.36%

Found C, 67.62; H, 5.80%

IR (Nujol): 1680 (C=O), 1650, 1610, 1570, 1510, 1485,

1445, 1405, 1385, 1320, 1270, 1240, 1220,

1190, 980 (CH=CH, trans), 750 cm⁻¹

A solution of 5,6,7,8-tetrahydrobenzo(b)thieno-(2,3-d)pyrimidin-4(3H)-one-2-methyltriphenylphosphonium chloride (501) (2.58 g; 0.005 mole) and 3,4,5-trimethoxybenzaldehyde (0.49 g; 0.0025 mole) in methanol (25 ml) was treated with an aqueous solution of potassium carbonate (4 ml; 10%) according to the procedure described for 505, (Method II). Recrystallization from dioxane yielded 1.1 g (55%) of yellow crystalline product, m.p. 279–281°C.
Analysis: $C_{21}H_{22}N_2O_4S(398.46)$ requires C,63.30; H,5.57%
    Found C,63.29; H,5.60%

IR (Nujol) : 1660 (C=O), 1640, 1580, 1500, 1460, 1400,
    1375, 1320, 1300, 1280, 1245, 1200, 1120,
    1050, 970 (CH=CH, trans), 865, 830 cm$^{-1}$

2-(2-(4-Nitrophenyl)vinyl)-5-phenylthieno(2,3-d)pyrimidin-4-
(3H)-one (514).

A solution of 5-phenylthieno(2,3-d)pyrimidin-4(3H)-
one-2-methyltriphenylphosphonium chloride (503) (2.69g; 0.005
mole) and 4-nitrobenzaldehyde (0.37g; 0.0025 mole) in methanol
(25ml) was treated with an aqueous solution of potassium
carbonate (4ml; 10%) according to the procedure described
for 505, (Method II). Recrystallization from dioxane
yielded 1.6g (85%) of yellow crystalline product, m.p. $>330^\circ$C.

Analysis: $C_{20}H_{13}N_3O_3S(375.39)$ requires C,64.00; H,3.49%
    Found C,64.47; H,3.80%

IR (Nujol) : 1650 (C=O), 1640, 1585 (NO$_2$), 1510, 1430,
    1340 (NO$_2$), 1260, 1180, 1110, 970 (CH=CH, 
    trans), 830, 770 cm$^{-1}$
3-Phenyl-2-aryvl-5, 6, 7, 8-tetrahydrobenzo(b)thieno(2, 3-d)pyrimidin-4(3H)-one (515).

A mixture of 2-methyl-3-phenyl-5, 6, 7, 8-tetrahydrobenzo(b)thieno(2, 3-d)pyrimidin-4(3H)-one (2.96 g; 0.01 mole), bezaldehyde (1.2 g; 0.011 mole) and sodium ethoxide (0.75 g; 0.011 mole) in absolute ethanol (50 ml) was warmed on a water bath at 50-60 °C for 15-20 minutes and allowed to stand at room temperature for 12 hours. The solid separated was filtered and dried. Recrystallization from petroleum-ether (60-80)-benzene yielded 1.7 g (44%) of reddish brown crystalline product, m.p. 209-211 °C.

Analysis: C₂₄H₂₀N₂O₈ (384.48) Requires C, 74.97; H, 5.24% Found C, 74.83; H, 5.48%

IR (KBr): 1670 (C=O), 1620, 1545, 1505, 1440, 1330, 1290, 1250, 1220, 1160, 1080, 1020, 960 (CH=CH trans), 950, 860, 770 cm⁻¹

NMR (CDCl₃): δ 1.87 (4H, m, CH₂ at 6 and 7); 2.92 (4H, m, CH₂ at 5 and 8); 7.44 (10H, m, Ar-H); 7.87 (1H, d, Ha, J = 5.6 Hz); 6.34 (1H, d, Hb, J = 15.6 Hz)

MS, m/e: 384 (M⁺), 369, 356, 307, 306, 293, 279, 278, 253, 247, 206, 179, 149
2-(2-(4-Nitrophenyl)vinyl)-3-phenyl-5,6,7,8-tetrahydrobenzo(b)-thieno(2,3-d)pyrimidin-4(3H)-one (516).

A mixture of 2-methyl-3-phenyl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidin-4(3H)-one (2.96g; 0.01 mole), 4-nitrobenzaldehyde (1.66g; 0.011 mole) and sodium ethoxide (0.75g; 0.011 mole) in absolute ethanol (50ml) was treated according to the procedure described for 515. Recrystallization from petroleum-ether (60-80) yielded 1.8g (42%) of reddish brown crystalline compound, m.p. 233-235°C.

Analysis: C_{24}H_{19}N_{3}O_{8} (429.18) Requires C, 67.11; H, 4.46%

Found: C, 66.76; H, 4.59%

IR (KBr): 1675 (C=O), 1590 (NO_{2}), 1505, 1425, 1340 (NO_{2}),
1265, 1220, 1160, 1105, 980, 970 (CH=CH; trans),
835, 775, 765 cm^{-1}

4-Amino-2-styryl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)-pyrimidinone (517).

A stream of dry hydrogen chloride gas was passed through a mixture of 2-amino-3-cyano-4,5,6,7-tetrahydrobenzo-(b)thiophene (1.78g; 0.01 mole) and cinnamonitrile (1.42g; 0.01 mole) in dioxane (30ml) for 5 hours. The reaction mixture was allowed to stand overnight at room temperature,
poured into ice-water and basified with 10% ammonium hydroxide solution. The solid obtained was filtered, washed with water and dried. Recrystallization from dioxane yielded 1.1g (36%) of crystalline product, m.p. 241-243°C.

Analysis: $C_{18}H_{17}N_3S(307.41)$ Requires C, 70.32%; H, 5.57%

Found: C, 70.10%; H, 5.86%

IR (Nujol): 3370, 3300, 3170 (NH$_2$), 1630, 1560, 1540, 1500, 1480, 1450, 1415, 1285, 1190, 1170, 1040, 970 (CH-CH, trans), 910, 790, 755 cm$^{-1}$

MS, m/e: 307 (M$^+$), 306, 292, 291, 290, 279, 278, 262, 252, 204, 170, 177, 162, 150, 149, 134, 130, 129, 123, 91

4-Amino-5,6-dimethyl-2-styrylthieno(2,3-d)pyrimidine (516).

A stream of dry hydrogen chloride gas was passed through a mixture of 2-amino-3-cyano-4,5-dimethylthiophene (1.38g; 0.01 mole) and cinnamonitrile (1.42g; 0.011 mole) in dioxane (30ml) for 5 hours. The reaction mixture was further treated according to the procedure described for 517. Recrystallization from benzene yielded 1.0g (35%) of crystalline product, m.p. 232-234°C.
Analysis: C_{16}H_{15}N_{3}S (281.36) Requires: C, 68.30%; H, 5.37%
Found: C, 68.31%; H, 5.76%

IR (KBr) : 3400, 3310, 3200 (NH_{2}), 1630, 1550, 1510,
1455, 1410, 1385, 1330, 1280, 1180, 1110,
1020, 975 (CH=CH, trans), 910, 870, 795, 780,
760 cm^{-1}

Attempted condensation of 2-methyl-5,6,7,8-tetrahydrobenzo-
(b)thieno(2,3-d)pyrimidin-4(3H)-one with benzaldehyde

(a) Under acidic condition

A suspension of 2-methyl-5,6,7,8-tetrahydrobenzo(b)-
thieno(2,3-d)pyrimidin-4(3H)-one (2.2g, 0.01 mole) and
benzaldehyde (1.16g, 0.011 mole) in a mixture of acetic
anhydride and glacial acetic acid (12ml, 1:1) was heated
on an oil bath for 4 hours. The reaction mixture was
cooled and poured into ice-water. The solid obtained was
filtered, washed with water and dried. Recrystallization
from dimethylformamide yielded 0.9g of colorless crystal-
line product, m.p. 300-302°C, identified as the starting
2-methyl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimi-
dine (mp, mmp, TLC).
b) **Under basic condition**

A mixture of 2-methyl-5,6,7,8-tetrahydrobenzo(b)-thieno(2,3-d)pyrimidin-4-(3H)-one (2.2g; 0.01 mole), benzaldehyde (1.16g; 0.011 mole) and sodium ethoxide (0.68g; 0.01 mole) in absolute ethanol (30ml) was refluxed on a steam bath for 4-5 hours. The reaction mixture was cooled and poured into ice-water. The solid obtained was filtered, washed with water and dried. Recrystallization from dimethylformamide yielded 1.0g of colorless crystalline product, m.p. 300-302°C, identified as starting 2-methylthienopyrimidin-4-one (mp, mmp, TLC).

c) **Under thermal condition**

A mixture of 2-methyl-5,6,7,8-tetrahydrobenzo(b)-thieno(2,3-d)pyrimidin-4(3H)-one (2.2g; 0.01 mole) and excess of benzaldehyde (4.0g) was heated on oil bath for 2 hours. The reaction mixture was cooled and the solid obtained was filtered and dried. Recrystallization from dimethylformamide yielded 1.0g of crystalline product, m.p. 300-302°C, identified as the starting 2-methylthienopyrimidin-4-one by mmp and TLC.
Attempted condensation of 2-chloromethyl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidin-4(3H)-one with triphenyl phosphine in benzene.

A mixture of 2-chloromethyl-4,5,6,7-tetrahydrobenzo(b)thieno(2,3-d)pyrimidin-4(3H)-one (2.54g; 0.01 mole) and triphenyl phosphine (2.62g; 0.01 mole) in benzene (50ml) was refluxed for 6 hours. The reaction mixture was cooled and the solid obtained was filtered, washed with water, dried. Recrystallization from dimethylformamide yielded 1.2g of colorless crystalline product, m.p. 274-276°C identified as the starting 2-chloromethyl-4,5,6,7-tetrahydrobenzo(b)thienopyrimidin-4(3H)-one by mmp and TLC.

Attempted isolation of 2-triphenylphosphoniummethyl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidin-4(3H)-one from 5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidin-4(3H)-one-2-methyltriphenylphosphonium chloride (501).

To a solution of 5,6,7,8-tetrahydrobenzo(b)thieno-(2,3-d)pyrimidin-4(3H)-one-2-methyltriphenylphosphonium chloride (501) (2.58g; 0.005 mole) in absolute ethanol (30ml) was added, dropwise, an aqueous solution of potassium carbonate (4ml; 10%). The reaction mixture was allowed to stand at room temperature for 30 minutes. The solid
settled was filtered off and the filtrate was concentrated under reduced pressure. The residue obtained was filtered and dried. Recrystallization from dimethylformamide yielded 1.3g of colorless crystalline product, m.p. 300-302°C, characterized as 2-methyl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidin-4(3H)-one (493).

Analysis: C<sub>11</sub>H<sub>12</sub>N<sub>2</sub>O<sub>8</sub> (220.28) Requires C, 59.97; H, 5.49

Found C, 60.36; H, 5.94%

IR (Nujol): 1650 (C=O), 1600, 1480, 1435, 1400, 1350, 1300, 1275, 1245, 1200, 1145, 1050, 960, 910, 785 cm<sup>-1</sup>

MS, m/e: 220 (M<sup>+</sup>), 205, 192, 164, 162, 151, 123
Method I: A mixture of 2-methyl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)-pyrimidin-4(3H)-one (4.4g; 0.02 mole) and phosphorous oxychloride (40ml) was refluxed for 12 hours and excess of phosphorous oxychloride was removed by distillation under reduced pressure. The residue was treated with dry benzene (5ml) and the solvent was distilled under vacuum to remove the last traces of phosphorous oxychloride and the resultant gummy residue was triturated with ice and sodium bicarbonate solution. The solid thus obtained was filtered, washed with water and dried in a vacuum desiccator over phosphorous pentoxide. Recrystallization from petroleum-ether (60-80) yielded 3.2g (67%) of a crystalline product, m.p. 96-98°C.

Analysis: C₁₁H₁₁N₂SCl (238.73) Requires C, 55.34; H, 4.61; N, 11.76

Found: C, 55.35; H, 4.76; N, 11.86

IR (KBr): 1560, 1540, 1485, 1415, 1310, 1225, 1175,
1130, 1040, 1025, 995, 955, 910, 855,
840, 760 cm⁻¹

UV (CH₃OH): 240, 285 nm
Method II: Phosphorous oxychloride (10ml) was added to an ice-cold suspension of 2-methyl-5,6,7,8-tetrahydrobenzo-(b)thieno(2,3-d)pyrimidin-4(3H)-one \(308\) (2.2g; 0.01 mole) in dimethylformamide (30ml) and stirred at 0-5°C for 15-20 minutes. The reaction mixture was allowed to stand at room temperature for 12 hours, poured into crushed ice and neutralized with sodium bicarbonate. The solid obtained was filtered, washed with water and dried. Recrystallization from petroleum-ether (60-80) yielded 1.4g(59%) of crystalline product, m.p. 96-98°C, identical (mp, TLC) with the compound obtained by method I.

4-Chloro-2,5,6-trimethylthieno(2,3-d)pyrimidine (271)

Method I: A mixture of 2,5,6-trimethylthienopyrimidin-4(3H)-one \(309\) (6.88g; 0.02 mole) and phosphorous oxychloride (40ml) was treated according to the procedure described for 270, (Method I). Recrystallization from petroleum-ether (60-80) yielded 2.0g (47%) of crystalline product, m.p. 116-117°C.

Analysis : C, H, N, S, Cl (212.70) Requires C, 50.82; H, 4.27%

Found C, 50.99; H, 4.48%

IR (Nujol) : 1585, 1480, 1440, 1410, 1360, 1350, 1240, 1165, 1065, 930, 860, 775, 730 cm\(^{-1}\)
Method IX: Phosphorous oxychloride (10ml) was added to an ice-cold suspension of 2,5,6-Trimethylthieno(2,3-d)pyrimidin-4(3H)-one (1.94g; 0.01 mole) in dimethylformamide (40ml) and stirred at 0-5°C for 15-20 minutes. The reaction mixture was further treated according to the procedure described for 270. (Method II). Recrystallization from petroleum-ether (60-80) yielded 1.3g (61%) of crystalline product, m.p. 116-117°C, identical (m.p., TLC) with the compound obtained by method I.

4-Chloro-2-methyl-5-phenylthieno(2,3-d)pyrimidine (272).

A mixture of 2-methyl-5-phenylthieno(2,3-d)pyrimidin-4(3H)-one (4.84g; 0.02 mole) and phosphorous oxychloride (40ml) was treated according to the procedure described for 270, (Method I). Recrystallization from petroleum-ether (60-80)-benzene yielded 3.5g (67%) of crystalline product, m.p. 171-173°C.

Analysis: \( C_{13}H_{19}N_2Cl(260.74) \) Requires C, 59.88; H, 3.48%
Found C, 60.25; H, 3.42%

IR (Nujol): 1570, 1535, 1500, 1470, 1440, 1395, 1355, 1280, 1215, 1185, 1080, 1015, 920, 885, 840, 825, 805, 780, 740 cm\(^{-1}\)

UV (CHCl\(_3\)): 283nm (log \( \varepsilon \) 3.63)
A mixture of 7-Benzyl-2-methyl-5,6,7,8-tetrahydropyrido[4',3':4,5]thieno[2,3-d]pyrimidine-4(3H)-one (6.22 g; 0.02 mole) and phosphorous oxychloride (80 ml) was treated according to the procedure described for 270. (Method I). Recrystallization from petroleum-ether (60-80)-benzene yielded 4.0 g (61%) of crystalline product, m.p. 109-110°C.

IR (KBr) : 1580, 1550, 1500, 1430, 1400, 1370, 1310, 1280, 1230, 1200, 1160, 1125, 1060, 910, 850, 770 cm⁻¹

2-Benzyl-4-chloro-5,6,7,8-tetrahydrobenzo[b]thieno[2,3-d]-pyrimidine (274).

A mixture of 2-benzyl-5,6,7,8-tetrahydrobenzo[b]-thieno[2,3-d]pyrimidin-4(3H)-one ³⁰⁹ (5.92 g; 0.02 mole) and phosphorous oxychloride (40 ml) was treated according to the procedure described for 270. (Method I). Recrystallization from petroleum-ether (60-80) yielded 1.9 g (30%) of crystalline compound, m.p. 98-102°C.

Analysis : C₁₇H₁₅N₅SCl(314.82) Requires C, 64.85; H, 4.80%
Found C, 65.11; H, 5.12%

IR (Nujol) : 1525, 1420, 1375, 1340, 1270, 1205, 1150, 1090, 1035, 990, 890 cm⁻¹

UV (C₂H₅OH) : 245 nm (log ε 4.57), 288 (3.74)
2-Benzyl-4-chloro-5,6-dimethylthieno(2,3-d)pyrimidine (275).

A mixture of 2-benzyl-5,6-dimethylthieno(2,3-d)pyrimidin-4(3H)one 309 (5.4g; 0.02 mole) and phosphorous oxychloride (40ml) was treated according to the procedure described for 270, (Method I). Recrystallization from petroleum-ether (60-80)-benzene yielded 2.4g (41%) of crystalline product, m.p. 114-115°C.

Analysis: C_{15}H_{13}N_{2}Cl (288.79) Requires C, 62.38; H, 4.54%

Found C, 61.90; H, 4.99%

IR (Nujol): 1550, 1470, 1430, 1400, 1350, 1260, 1180, 950, 860, 840, 760, 720 cm^{-1}

2-Benzyl-4-chloro-5-phenylthieno(2,3-d)pyrimidine (276).

A mixture of 2-benzyl-5-phenylthieno(2,3-d)pyrimidin-4(3H)one 309 (6.36g; 0.02 mole) and phosphorous oxychloride (40ml) was treated according to the procedure described for 270, (Method I). Recrystallization from petroleum-ether (60-80)-benzene yielded 2.7g (40%) of crystalline product, m.p. 114-115°C.

IR (Nujol): 1470, 1410, 1380, 1330, 1300, 1230, 1150, 1025, 995, 950, 860, 840, 765, 730 cm^{-1}
4-Chloro-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidine (277).

Phosphorous oxychloride (10ml) was added to an ice-cold suspension of 5,6,7,8-tetrahydrobenzo(b)thieno-(2,3-d)pyrimidin-4(3H)-one (2.06g; 0.01 mole) in dimethylformamide (30ml) and stirred at 0-5°C for 15-20 minutes. The reaction mixture was allowed to stand at room temperature for 12 hours, poured into crushed ice and neutralized with sodium bicarbonate. The solid obtained was filtered, washed with water and dried. Recrystallization from petroleum-ether (60-80) yielded 1.8g (80%) of crystalline product, m.p. 108-110°C. Reported m.p. 108-111°C. 268

Phosphorous oxychloride (10ml) was added to an ice-cold suspension of 5,6-dimethylthieno(2,3-d)pyrimidin-4(3H)-one (1.80g; 0.01 mole) in dimethylformamide (30ml) and stirred at 0-5°C for 15-20 minutes. The reaction mixture was further treated according to the procedure described for 277. Recrystallization from petroleum-ether (60-80) yielded 1.2g (60%) of crystalline product, m.p. 112-113°C. 225

4-Chloro-5,6-dimethylthieno(2,3-d)pyrimidine (278).
Analysis: \( C_{8}H_{7}N_{2}SCl(196.67) \) Requires C, 48.36%; H, 3.55%

| Found | C, 48.22% | H, 3.84% |

IR (KBr): 1560, 1535, 1490, 1420, 1385, 1365, 1260, 1225, 1145, 1045, 950, 840, 805, 770 cm\(^{-1}\)

4-Chloro-5-phenylthieno(2,3-d)pyrimidine (279).

A mixture of 5-phenylthieno(2,3-d)pyrimidin-4(3H)-one (4.56g, 0.02 molar) and phosphorous oxychloride (40ml) was treated according to the procedure described for 270 (Method I). Recrystallization from petroleum-ether (60-80) yielded 3.0g (61%) of crystalline product, m.p. 132-133°C.

Analysis: \( C_{12}H_{7}N_{2}SCl(246.71) \) Requires C, 50.42%; H, 2.06%

| Found | C, 50.39% | H, 2.75% |

IR (KBr): 1540, 1510, 1490, 1415, 1350, 1220, 1205, 1155, 1025, 935, 860, 620, 755 cm\(^{-1}\)

4-Chloro-6-ethylthieno(2,3-d)pyrimidine (280).

A mixture of 6-ethylthieno(2,3-d)pyrimidin-4(3H)-one (3.6g, 0.02 molar) and phosphorous oxychloride (40ml) was treated according to the procedure described for 270 (Method I). Recrystallization from petroleum-ether (60-80) yielded 2.1g (53%) of crystalline product, m.p. 48-50°C. Reported m.p. 47-48°C.
4-Chloro-2-phenyl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidine (281).

A mixture of 2-phenyl-5,6,7,8-tetrahydrobenzo(b)-thieno(2,3-d)pyrimidin-4(3H)-one$^{309}$ (5.64g; 0.02 mole) and phosphorous oxychloride (40ml) was treated according to the procedure described for 270, (Method I). Recrystallization from petroleum-ether (60-80) yielded 4.0g (66%) of crystalline product, m.p. 171-173°C. Reported m.p. 171-172°C.$^{339}$

4-Chloro-5,6-dimethyl-2-phenyl(2,3-d)pyrimidine (282).

Method I: Phosphorus oxychloride (10ml) was added to a cold suspension of 5,6-dimethyl-2-phenylthieno(2,3-d)-pyrimidin-4(3H)-one$^{309}$ (2.56g; 0.01 mole) in dimethylformamide (30ml) and stirred at 0-5°C for 15-20 minutes. The reaction mixture was further treated according to the procedure described for 277. Recrystallization from petroleum-ether (60-80)-benzene yielded 1.5g (55%) of crystalline product, m.p. 156-158°C.

IR (Nujol): 1530, 1480, 1460, 1445, 1410, 1370, 1350, 1265, 1120, 1045, 955, 930, 850, 810, 770 cm$^{-1}$.
Method II: A mixture of 5,6-dimethyl-2-phenylthieno-(2,3-d)pyrimidin-4(3H)-one (5.12g; 0.02 mole) and phosphorous oxychloride (40ml) was treated according to the procedure described for 270, (Method I). Recrystallization from petroleum-ether (60-80)-benzene yielded 1.9g (35%) of crystalline product, m.p. 156-158°C, identical (mmp, TLC) with the compound obtained by method I.

4-Chloro-2,5-diphenylthieno(2,3-d)pyrimidine (283).

A mixture of 2,5-diphenylthieno(2,3-d)pyrimidin-4(3H)-one (6.08g; 0.02 mole) and phosphorous oxychloride (40ml) was treated according to the procedure described for 270, (Method I). Recrystallization from petroleum-ether (60-80)-benzene yielded 2.0g (43%) of crystalline product, m.p. 145-147°C.

4-Chloro-2-styryl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)-pyrimidine (284).

Phosphorous oxychloride (10ml) was added to an ice-cold suspension of 2-styryl-5,6,7,8-tetrahydrobenzo(b)-thieno(2,3-d)pyrimidin-4(3H)-one (505) (3.08g; 0.01 mole) in dimethylformamide (30ml) and stirred at 0-5°C for 15-20 minutes. The reaction mixture was further treated
according to the procedure described for 277. Recrystallization from petroleum-ether (60-80)-benzene yielded 2.5g (77%) of yellow crystalline product, m.p. 138-140°C.

Analysis : C, H, N, S (326.83) Requires C, 66.14; H, 4.63%
          18 15 2
          Found C, 66.40; H, 4.99%

IR (Nujol) : 1580, 1530, 1480, 1460, 1440, 1400, 1315,
            1200, 1140, 990, 965 (CH, trans), 850,
            790, 750 cm⁻¹

4-Hydrazino-2-methyl-5,6,7,3-tetrahydrobenzo(b)thieno(2,3-d)-pyrimidine (286).

To a warm solution of 4-chloro-2-methyl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidine (270) (2.39g, 0.01 mole) in ethanol (15ml) was added dropwise, a solution of hydrazine hydrate (5ml, 98%) in ethanol (7ml). The reaction mixture was refluxed on a steam bath for 2 hours. On cooling, the solid obtained was filtered, washed with ethanol and dried. Recrystallization from ethanol yielded 2.0g (65%) of crystalline product, m.p. 201-203°C.

Analysis : C, H, N, S (234.31) Requires C, 56.38; H, 6.02; N, 23.91%
           11 14 4
           Found C, 56.52; H, 6.24; N, 24.18%

IR (KBr) : 3300 (NH), 1625, 1400, 1280, 1255, 1235,
          1175, 1155, 1075, 1020, 1000, 960, 880,
          825, 800, 780 cm⁻¹

UV (CH₃OH) : 220, 280nm
4-Hydrazino-2,5,6-trimethylthieno(2,3-d)pyrimidine (287).

To a warm solution of 4-chloro-2,5,6-trimethylthieno(2,3-d)pyrimidine (271) (2.13g; 0.01 mole) in ethanol (15ml) was added dropwise, a solution of hydrazine hydrate (5ml; 98%) in ethanol (7ml). The reaction mixture was further treated according to the procedure described for 286. Recrystallization from methanol-chloroform yielded 1.7g (82%) of crystalline product, m.p. 220-221°C.

Analysis: C₉H₁₂N₄S (208.28) Requires C, 51.90; H, 5.81%

Found C, 51.67; H, 6.10%

IR (Nujol): 3280, 3160 (NH), 1620, 1560, 1400, 1370, 1350, 1260, 1200, 990, 900, 800, 750 cm⁻¹

4-Hydrazino-2-methyl-5-phenylthieno(2,3-d)pyrimidine (288).

To a warm solution of 4-chloro-2-methyl-5-phenylthieno(2,3-d)pyrimidine (272) (2.61g; 0.01 mole) in ethanol (15ml) was added dropwise, a solution of hydrazine hydrate (5ml; 98%) in ethanol (7ml). The reaction mixture was further treated according to the procedure described for 286. Recrystallization from methanol yielded 1.1g (43%) of crystalline product, m.p. 152-153°C.
Analysis : C₁₃H₁₂N₈ (256.32) Requires C, 60.91; H, 4.72%  
            Found C, 61.12; H, 4.68%  
IR (Nujol) : 3280, 3200, 3100 (NH), 1530, 1495, 1455,  
            1370, 1300, 1270, 1160, 1110, 950, 930,  
            875, 830, 780 cm⁻¹  
UV (C₂H₅OH) : 293nm (log ε 4.24)  

7-Benzyl-4-hydrazino-2-methyl-5,6,7,8-tetrahydropyrido-  
(4',3':4,5)thieno(2,3-d)pyrimidine (289)  

To a warm solution of 7-benzyl-4-chloro-2-methyl-  
5,6,7,8-tetrahydropyrido(4',3':4,5)thieno(2,3-d)pyrimidine  
(273) (3.3g; 0.01 mole) in ethanol (20ml) was added drop-  
wise, a solution of hydrazine hydrate (5ml; 98%) in  
ethanol (7ml). The reaction mixture was further treated  
according to the procedure described for 286. Recry-  
stallization from ethanol yielded 3.0g (92%) of crystalline  
product, m.p. 184-186°C.  

IR (KBr) : 3300, 3180 (NH), 1550, 1510, 1420, 1350,  
            1300, 1235, 1140, 1075, 1010, 955,  
            880, 850, 770 cm⁻¹
2-Benzyl-4-hydrazino-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)-pyrimidine (290).

To a warm solution of 2-benzyl-4-chloro-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidine (274) (3.15g; 0.01 mole) in ethanol (20ml) was added dropwise, a solution of hydrazine hydrate (5ml; 98%) in ethanol (7ml). The reaction mixture was further treated according to the procedure described for 286. Recrystallization from methanol–chloroform yielded 2.7g (87%) of crystalline product, m.p. 158–160°C.

Analysis: C₁₇H₁₈N₄S (310.41) Requires C, 65.78; H, 5.85; N, 18.05%

Found C, 65.47; H, 5.86; N, 17.62%

IR (Nujol): 3340, 3110 (NH), 1570, 1450, 1360, 1285, 1175, 1130, 1070, 935, 890, 800, 760 cm⁻¹

UV (CHCl₃): 282 nm (log ε 3.79)

2-Benzyl-4-hydrazino-5,6-dimethylthieno(2,3-d)pyrimidine (291).

To a warm solution of 2-benzyl-4-chloro-5,6-dimethylthieno(2,3-d)pyrimidine (275) (2.89g; 0.03 mole) in ethanol (20ml) was added dropwise, a solution of hydrazine hydrate (5ml; 98%) in ethanol (7ml). The reaction mixture was further treated according to the procedure described.
Recrystallization from methanol-chloroform yielded 2.0g (70%) of crystalline product, m.p. 214-216°C.

**Analysis**

\[ \text{C}_{15}\text{H}_{16}\text{N}_4\text{S} \] (284.37) Requires C, 63.35; H, 5.67%

\[ \text{Found C, 63.64; H, 5.95%} \]

**IR (Nujol)**

3360 (NH), 1550, 1480, 1440, 1350, 1200, 970, 890, 770, 730, 700 cm\(^{-1}\)

2-Benzyl-4-hydrazino-5-phenylthieno(2,3-d)pyrimidine (292).

To a warm solution of 2-benzyl-4-chloro-5-phenylthieno(2,3-d)pyrimidine (276) (3.37g; 0.01 mole) in ethanol (20ml) was added, dropwise, a solution of hydrazine hydrate (5ml; 98%) in ethanol (7ml). The reaction mixture was further treated according to the procedure described for 286. Recrystallization from methanol-chloroform yielded 2.9g (87%) of crystalline product, m.p. 182-185°C.

**IR (Nujol)**

3300, 3200 (NH), 1510, 1450, 1410, 1370, 1315, 1290, 1160, 1075, 940, 875, 785 cm\(^{-1}\)

**UV (CHCl\(_3\))**

288nm (log\(\varepsilon\) 4.04)
4-Hydrazino-5, 6, 7, 8-tetrahydrobenzo (b) thieno (2, 3- d) pyrimidine (293).

To a warm solution of 4-chloro-5, 6, 7, 8-tetrahydrobenzo (b) thieno (2, 3- d) pyrimidine (277) (2.25 g; 0.01 mole) in ethanol (15 ml) was added dropwise, a solution of hydrazine hydrate (5 ml; 98%) in ethanol (7 ml). The reaction mixture was further treated according to the procedure described for 286. Recrystallization from ethanol-chloroform yielded 1.2 g (55%) of crystalline product, m.p. 189-190°C. Reported m.p. 189°C.268 180-181°C.225

4-Hydrazino-5, 6-dimethylthieno (2, 3- d) pyrimidine (294).

To a warm solution of 4-chloro-5, 6-dimethylthieno (2, 3- d) pyrimidine (278) (1.99 g; 0.01 mole) in ethanol (15 ml) was added a solution of hydrazine hydrate (5 ml; 98%) in ethanol (7 ml). The reaction mixture was further treated according to the procedure described for 286. Recrystallization from ethanol-chloroform yielded 1.6 g (82%) of crystalline compound, m.p. 214-216°C.

IR (KBr) : 3400, 3300 (NH), 1550, 1500, 1465, 1360, 1290, 1245, 1170, 1095, 1045, 925, 900, 810, 780 cm⁻¹
4-Hydrazino-5-phenylthieno(2,3-d)pyrimidine (295).

To a warm solution of 4-chloro-5-phenylthieno-(2,3-d)pyrimidine (279) (2.47g; 0.01 mole) in ethanol (15ml) was added dropwise a solution of hydrazine hydrate (5ml; 96%) in ethanol (7ml). The reaction mixture was further treated according to the procedure described for 286. Recrystallization from ethanol-chloroform yielded 2.1g (87%) of crystalline product, m.p. 173-174°C.

IR (KBr) : 3220, 3190(NH), 1550, 1500, 1480, 1350, 1300, 1250, 1155, 1100, 1005, 905, 835, 770, 750 cm⁻¹

6-Ethyl-4-hydrazinothieno(2,3-d)pyrimidine (296).

To a warm solution of 4-chloro-6-ethylthieno(2,3-d)pyrimidine (280) (1.99g; 0.01 mole) in ethanol (15ml) was added dropwise a solution of hydrazine hydrate (5ml; 96%) in ethanol (7ml). The reaction mixture was further treated according to the procedure described for 286. Recrystallization from ethanol-chloroform yielded 1.5g (77%) of crystalline product, m.p. 180-181°C.

IR (KBr) : 3320, 3240(NH), 1580, 1550, 1520, 1450, 1380, 1350, 1305, 1140, 1100, 890, 870, 835, 780 cm⁻¹
4-Hydrazino-2-phenyl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)-pyrimidine (297).

To a warm solution of 4-chloro-2-phenyl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidine (281) (3.11g; 0.01 mole) in ethanol (20ml) was added dropwise a solution of hydrazine hydrate (5ml; 98%) in ethanol (7ml). The reaction mixture was further treated according to the procedure described for 286. Recrystallization from methanol-chloroform yielded 2.0g (67%) of crystalline product, m.p. 224-226°C.

Analysis: C₁₆H₁₆N₄S (296.38) Requires C, 64.84; H, 5.44%

Found: C, 64.52; H, 5.23%

IR (Nujol): 3310, 3140 (NH), 1625, 1530, 1490, 1450, 1400, 1385, 1365, 1270, 1230, 1140, 1000, 950, 915, 825 cm⁻¹

4-Hydrazino-2,5-diphenylthieno(2,3-d)pyrimidine (298).

To a warm solution of 4-chloro-2,5-diphenylthieno-(2,3-d)pyrimidine (203) (3.23g; 0.01 mole) in ethanol (20ml) was added dropwise a solution of hydrazine hydrate (5ml; 98%) in ethanol (7ml). The reaction mixture was further treated according to the procedure described for 286.
Recrystallization from methanol–chloroform yielded 2.0g (63%) of crystalline product, m.p. 192-195°C.

**Analysis**

C<sub>10</sub>H<sub>14</sub>N<sub>4</sub>S (318.36) Requires C, 67.90; H, 4.43%

Found C, 67.80; H, 4.71%

**IR (Nujol):** 3300, 3200 (NH), 1500, 1480, 1430, 1360, 1300, 1280, 1220, 1150, 1060, 1025, 995, 925, 755 cm<sup>-1</sup>

**UV (CHCl₃):** 322 nm (log ε 4.0)

4-Hydrazo-5,6-dimethyl-2-phenylthieno(2,3-d)pyrimidine (299).

To a warm solution of 4-chloro-5,6-dimethyl-2-phenylthieno(2,3-d)pyrimidine (282) (2.75g; 0.01 mole) in ethanol (15ml) was added dropwise a solution of hydrazine hydrate (5ml; 98%) in ethanol (7ml). The reaction mixture was then treated according to the procedure described for 286. Recrystallization from ethanol–chloroform yielded 1.9g (70%) of crystalline product, m.p. 241-243°C.

**Analysis**

C<sub>14</sub>H<sub>14</sub>N<sub>4</sub>S (270.34) Requires C, 62.19; H, 5.22%

Found C, 61.95; H, 5.49%

**IR (KBr):** 3330, 3150 (NH), 1625, 1575, 1430, 1340, 1280, 1180, 1060, 910, 875, 805, 765 cm<sup>-1</sup>
4-Hydrazino-2-styryl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)-pyrimidine (300).

To a warm solution of 4-chloro-2-styryl-5,6,7,8-tetrahydrobenzo(b)thieno(2,3-d)pyrimidine (284) (3.27g; 0.01 mole) in ethanol (20ml) was added dropwise, a solution of hydrazine hydrate (5ml; 98%) in ethanol (7ml). The reaction mixture was further treated according to the procedure described for 286. Recrystallization from ethanol yielded 2.0g (62%) of crystalline product, m.p. 208-210°C.

Analysis : C_{18}H_{18}N_8 (322.42) Requires C, 67.05; H, 5.63%
           Found   C, 66.81; H, 5.47%

IR (KBr) : 3300(NH), 1640, 1550, 1505, 1410, 1400,
           1290, 1250, 1165, 1030, 965(CH=CH, trans),
           935, 860, 770 cm^{-1}