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# Efficient Synthesis of 2-Substituted Thieno[2,3-*d*]pyrimidin-4(3*H*)-ones via an Iminophosphorane

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ABSTRACT: *The carbodiimides* **4**, *obtained from reactions of iminophosphorane* **3** *with aromatic isocyanates, were reacted with secondary amines to give 2-dialkylamino-5-ethyl-6-methyl-thieno[2,3-*d*]pyrimidin-4(3*H*)-ones* **6** *in the presence of catalytic amount of EtONa. Reactions of* **4** *with phenols or ROH in the presence of the catalytic amount of $K_2CO_3$ or RONa gave 2-aryloxy- or 2-alkoxy-5-ethyl-6-methyl-thieno[2,3-*d*]pyrimidin-4(3*H*)-ones* **6** *in satisfactory yields. The effects of the nucleophiles on cyclization have been investigated.* © 2008 Wiley Periodicals, Inc. Heteroatom Chem 19:266–270, 2008; Published online in Wiley InterScience (www.interscience.wiley.com). DOI 10.1002/hc.20424

## *INTRODUCTION*

The derivatives of heterocycles containing thienopyrimidine system are of great importance because of their remarkable biological activity for use as potential drugs. For example, some 2-alkoxy- or 2-alkyl-substituted thienopyrimidinones show significant antifungal and antibacterial activities [1–7], whereas others exhibited good anticonvulsant and angiotensin or $H_1$ receptor antagonistic activities [8–12]. The chemistry of thienopyrimidinones has also received attention because their starting materials, 2-amino-3-carboxythiophenes, can be conveniently synthesized by the Gewald reaction [13]. Synthetically useful approaches to thienopyrimidinones starting from easily accessible 2-amino-3-carboxythiophenes are, therefore, of great importance. Recently, we have become interested in the preparation of *N*-heteroaryliminophosphoranes because these species are promising building blocks for the synthesis of nitrogen heterocycles [14–18]. Herein, we report an efficient synthesis of various 2-substituted 5-ethyl-6-methyl-thieno[2,3-*d*]pyrimidin-4(3*H*)-ones via iminophosphorane **3**.

## *RESULTS AND DISCUSSION*

Ethyl-2-amino-5-ethyl-6-methyl-thiophene-3-carboxylate **2**, easily obtained by the Gewald method from 3-pentanone **1**, ethyl cyanoacetate, and sulfur in the presence of morpholine, was converted to iminophosphorane **3** by the treatment with triphenylphosphine, hexachloroethane, and

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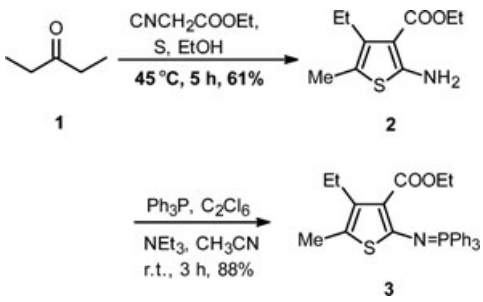
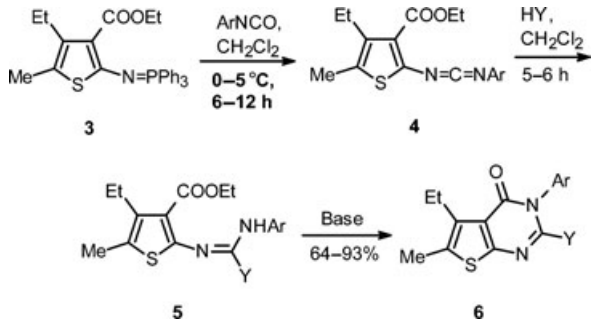
triethylamine in dry acetonitrile (Eq. (1)).




(1)

Iminophosphorane **3** reacted with an equimolecular quantity of the aromatic isocyanates to give the carbodiimides **4**, which were allowed to react with secondary amines to provide guanidine intermediates **5** ($Y = NR^1R^2$). Even in refluxing toluene, the intermediates **5** did not cyclize. However, by treatment with sodium ethoxide in ethanol at room temperature, the intermediates **5** underwent intramolecular heterocyclization to give the expected pyrimidinones **6** in satisfactory yields (Eq. (2)). The results are listed in Table 1. The yields of products **6** are related to the substituents $R^1$ and $R^2$ of the secondary amines. Better yields are obtained as $R^1$ and $R^2$ are small alkyl or cyclic alkyl group (**6a, 6d, 6f, 6h, 6j** in Table 1); however, lower yields are obtained when $R^1$ and $R^2$ are a long-chain alkyl group or one of them is a phenyl group (**6e, 6g** in Table 1).




(2)

The direct reaction of carbodiimide **4** with phenols did not produce 2-aryloxy-thieno[2,3-*d*]pyrimidin-4(3*H*)-ones **6**. However, when carried out in the presence of catalytic amount of potassium carbonate, the reaction gave **6** (Y = OAr) in good yields (Table 1). The formation of **6** can be rationalized in terms of an initial nucleophilic addition of phenoxides to the carbodiimides **4** to give the intermediates **5** that cyclize to give **6**. The yields of products **6** are also related to the substituents of phenols. Better yields are obtained as electron-donating substituents are present in the phenol ring (**6o, 6p** in Table 1). The direct reaction of carbodiimide **4** with ROH gave a complex mixture; however, when the reaction was carried out in the presence of catalytic amount of $RO^-Na^+$, the reaction took place smoothly and 2-alkoxy-thieno[2,

**TABLE 1** Preparation of 2-Substituted Thieno[2,3-*d*]pyrimidin-4(3*H*)-ones **6**

| *No.* | *Ar* | *Y* | *Formula* | *Conditions* | *Yield (%)*[a] | *MP (°C)* |
|---|---|---|---|---|---|---|
| **6a** | Ph | $NEt_2$ | $C_{19}H_{23}N_3OS$ | r.t./6 h | 93 | 144–145 |
| **6b** | Ph | $N(i\text{-}Bu)_2$ | $C_{23}H_{31}N_3OS$ | r.t./6 h | 81 | 123–124 |
| **6c** | Ph | $N(n\text{-}C_5H_{11})_2$ | $C_{25}H_{35}N_3OS$ | r.t./6 h | 85 | 73–74 |
| **6d** | Ph |  | $C_{20}H_{23}N_3OS$ | r.t./6 h | 92 | 128–129 |
| **6e** | Ph | NMePh | $C_{22}H_{21}N_3OS$ | r.t./6 h | 64 | 153–154 |
| **6f** | 4-$MeC_6H_4$ | $NEt_2$ | $C_{20}H_{25}N_3OS$ | r.t./6 h | 88 | 96–97 |
| **6g** | 4-$MeC_6H_4$ | $N(n\text{-}C_5H_{11})_2$ | $C_{26}H_{37}N_3OS$ | r.t./6 h | 64 | 70–71 |
| **6h** | 3-$MeC_6H_4$ | $NEt_2$ | $C_{20}H_{25}N_3OS$ | r.t./6 h | 86 | 103–104 |
| **6i** | 3-$MeC_6H_4$ | $N(n\text{-}Bu)_2$ | $C_{24}H_{33}N_3OS$ | r.t./6 h | 73 | 65–66 |
| **6j** | 3-$MeC_6H_4$ |  | $C_{21}H_{25}N_3OS$ | r.t./6 h | 87 | 157–158 |
| **6k** | 4-$ClC_6H_4$ |  | $C_{19}H_{20}ClN_3O_2S$ | r.t./8 h | 78 | 205–206 |
| **6l** | 4-$MeC_6H_4$ | MeO | $C_{17}H_{18}N_2O_2S$ | r.t./6 h | 82 | 153–154 |
| **6m** | 4-$MeC_6H_4$ | EtO | $C_{18}H_{20}N_2O_2S$ | r.t./6 h | 84 | 158–159 |
| **6n** | 4-$ClC_6H_4$ | MeO | $C_{16}H_{15}ClN_2O_2S$ | r.t./8 h | 77 | 184–185 |
| **6o** | Ph | 4-$MeC_6H_4O$ | $C_{22}H_{20}N_2O_2S$ | r.t./6 h | 83 | 203–204 |
| **6p** | Ph | 4-$MeOC_6H_4O$ | $C_{22}H_{20}N_2O_3S$ | r.t./6 h | 76 | 88–89 |
| **6q** | Ph | 4-$ClC_6H_4O$ | $C_{21}H_{17}ClN_2O_2S$ | r.t./6 h | 74 | 138–139 |

r.t. = Room temperature.
[a]Isolated yields are based on iminophosphorane **3**.

**TABLE 2** The Elemental Analysis and IR Data of Thieno[2,3-*d*]pyrimidin-4(3*H*)-ones **6**

| | *Anal. (Calcd) (%)* | *IR ($cm^{-1}$)* |
|---|---|---|
| **6a** | C, 66.95 (66.83); H, 6.50 (6.79); N, 12.20 (12.31) | 1681, 1592, 1540, 1497, 1469 |
| **6b** | C, 69.52 (69.48); H, 8.06 (7.86); N, 10.54 (10.57) | 1678, 1591, 1525, 1464, 1434 |
| **6c** | C, 70.75 (70.55); H, 8.41 (8.29); N, 9.80 (9.87) | 1692, 1589, 1541, 1497, 1469 |
| **6d** | C, 67.96 (67.96); H, 6.54 (6.56); N, 11.74 (11.89) | 1682, 1591, 1522, 1439, 1364 |
| **6e** | C, 70.10 (70.37); H, 5.85 (5.64); N, 10.92 (11.19) | 1682, 1594, 1529, 1488, 1439 |
| **6f** | C, 67.43 (67.57); H, 7.00 (7.09); N, 11.64 (11.82) | 1681, 1540, 1510, 1467, 1493 |
| **6g** | C, 71.03 (71.03); H, 8.28 (8.48); N, 9.31 (9.56) | 1686, 1587, 1537, 1498, 1469 |
| **6h** | C, 67.28 (67.57); H, 7.23 (7.09); N, 11.79 (11.82) | 1678, 1607, 1541, 1500, 1471 |
| **6i** | C, 69.82 (70.03); H, 8.19 (8.08); N, 10.35 (10.21) | 1686, 1606, 1540, 1493, 1452 |
| **6j** | C, 68.60 (68.63); H, 7.03 (6.86); N, 11.24 (11.43) | 1687, 1532, 1510, 1444, 1365 |
| **6k** | C, 58.35 (58.53); H, 5.44 (5.17); N, 10.62 (10.78) | 1681, 1593, 1584, 1540, 1491 |
| **6l** | C, 64.87 (64.94); H, 5.67 (5.77); N, 8.98 (8.91) | 1684, 1605, 1569, 1552, 1500 |
| **6m** | C, 65.94 (65.83); H, 5.97 (6.14); N, 8.80 (8.53) | 1693, 1551, 1500, 1474, 1439 |
| **6n** | C, 57.44 (57.40); H, 4.78 (4.52); N, 8.58 (8.37) | 1693, 1597, 1574, 1492, 1461 |
| **6o** | C, 70.04 (70.19); H, 5.46 (5.35); N, 7.51 (7.44) | 1693, 1599, 1570, 1549, 1506 |
| **6p** | C, 67.44 (67.33); H, 5.31 (5.14); N, 6.92 (7.14) | 1689, 1570, 1505, 1349, 1304 |
| **6q** | C, 63.46 (63.55); H, 4.43 (4.32); N, 6.97 (7.06) | 1693, 1602, 1572, 1545, 1485 |

3-*d*]pyrimidin-4(3*H*)-ones **6** (Y = OR) were obtained in satisfactory yields (Table 1).

The structure of the synthesized compound **6** was confirmed by their spectral data and elemental analyses (Tables 2 and 3). For example, the IR spectra of **6a** revealed C=O absorption bands at 1681 $cm^{-1}$. The $^1H$ NMR spectral data show the signals of $-NCH_2$ at 3.04 ppm as quartets and signals of $CH_3$ at 2.36, 1.13, and 0.80 ppm as singlets or triplets. The phenyl signals appeared at 7.26–7.50 (m, 5H, Ar-H). The MS spectrum of **6a** shows molecule ion peak ($M^+ + 1$) at *m*/*z* 342.

In conclusion, we have developed an efficient method for the synthesis of 2-substituted thieno[2,3-*d*]pyrimidin-4(3*H*)-ones via a base-catalyzed reaction of functionalized carbodiimides with various secondary amines, phenols, or alcohols. The synthetic approach shows that the aza-Wittig reaction of iminophosphorane affords a general route to the heterocyclic system, containing various substituents in the pyrimidine ring. Owing to the easily accessible and versatile starting material, this method has the potential in the synthesis of many biologically and pharmaceutically active thienopyrimidinone derivatives.

## *EXPERIMENTAL*

Melting points were determined using a X-4 model apparatus (Beijing Taike Company, Beijing, People's Republic of China) and were uncorrected. IR spectra were recorded on a Nicolet 7500 NXR infrared spectrometer (Thermonicolet Company, Waltham, Massachusetts) as KBr pellets with absorption given in $cm^{-1}$. MS were measured on a HP5988A spectrometer (Hewlett-Packard Company, Palo Alto, California). $^1H$ NMR spectra were recorded in $CDCl_3$ on a Varian Mercury Plus 400 (400 Hz) spectrometer (Varian Company, Palo Alto, California), and chemical shifts ($\delta$) are given in ppm using $(CH_3)_4Si$ as an internal reference ($\delta = 0$). Elementary analyses were taken on a Perkin-Elmer CHN2400 elemental analysis instrument (PerkinElmer Company, Waltham, Massachusetts).

### *Preparation of Ethyl-3-ethyl-4-methyl-2-aminothiophene-3-carboxylate (**2**)*

To a stirred mixture of 0.42 g (0.005 mol) of 3-pentanone (**1**), 0.16 g (0.005 mol) of sulfur, and 0.57 g (0.005 mol) of ethyl cyanoacetate in 10 mL of ethanol, 1.2 mL of morpholine was added. After the mixture was stirred at 45°C for 5 h, the solid was filtered and the filtrate was poured into water. The formed yellow solid was separated and recrystallized from methanol to give **2** as light yellow needles, 0.65 g (61%), mp 40–41°C. $^1H$ NMR ($CDCl_3$): $\delta$ 1.02 (t, 3H, $J = 7.2$ Hz, $CH_3$), 1.33 (t, 3H, $J = 7.2$ Hz, $CH_3$), 2.03 (s, 3H, $CH_3$), 2.66 (q, 2H, $J = 7.2$ Hz, $CH_2$), 4.32 (q, 2H, $J = 7.2$ Hz, $OCH_2$), 5.84 (s, 2H, $NH_2$); MS: *m*/*z* (%) 213 ($M^+$, 53%), 183 (47), 107 (100). Anal. Calcd for $C_{10}H_{15}NO_2S$: C, 56.31; H, 7.09; N, 6.57. Found: C, 56.22; H, 7.35; N, 6.71.

### *Preparation of Ethyl-3-ethyl-4-methyl-2-[(triphenylphosphanylidene)amino]thiophene-3-carboxylate (**3**)*

To a mixture of ethyl-3-ethyl-4-methyl-2-aminothiophene-3-carboxylate (**2**; 0.64 g, 3 mmol),

**TABLE 3** The MS and $^1$H-NMR Data of Thieno[2,3-*d*]pyrimidin-4(3*H*)-ones **6**

| | *FAB-MS* | *$^1$H-NMR ($CDCl_3$, $\delta$)* |
|---|---|---|
| **6a** | 342 ($M^+ + 1$) | 0.80 (t, 6H, $J = 7.0$ Hz, $2CH_3$); 1.13 (t, 3H, $J = 6.8$ Hz, $CH_3$); 2.36 (s, 3H, $CH_3$); 2.85 (q, 2H, $J = 7.2$ Hz, $CH_2$); 3.04 (q, 4H, $J = 7.2$ Hz, $2NCH_2$); 7.26–7.50 (m, 5H, Ar-H) |
| **6b** | 398 ($M^+ + 1$) | 0.77 (d, 12H, $J = 6.8$ Hz, $4CH_3$); 1.13 (t, 3H, $J = 7.2$ Hz, $CH_3$); 1.75–1.81 (m, 2H, 2CH); 2.36 (s, 3H, $CH_3$); 2.79–2.86 (m, 6H, $3CH_2$); 7.27–7.51 (m, 5H, Ar-H) |
| **6c** | 425 ($M^+$) | 0.84 (t, 6H, $J = 7.2$ Hz, $2CH_3$); 1.13 (t, 3H, $J = 7.2$ Hz, $CH_3$); 1.17–1.24 (m, 6H, $2CH_2CH_2CH_2$); 2.36 (s, 3H, $CH_3$); 2.85 (q, 2H, $J = 7.2$ Hz, $CH_2$); 2.94 (t, 4H, $J = 7.2$ Hz, $2NCH_2$); 7.26–7.47 (m, 5H, Ar-H) |
| **6d** | 353 ($M^+$) | 1.12 (t, 3H, $J = 7.2$ Hz, $CH_3$); 1.22–1.40 (m, 6H, $3CH_2$); 2.37 (s, 3H, $CH_3$); 2.86 (q, 2H, $J = 7.2$ Hz, $CH_2$); 3.06 (t, 4H, $J = 5.4$ Hz, $2CH_2$); 7.27–7.49 (m, 5H, Ar-H) |
| **6e** | 376 ($M^+ + 1$) | 1.13 (t, 3H, $J = 7.2$ Hz, $CH_3$); 2.41 (s, 3H, $CH_3$); 2.86 (q, 2H, $J = 7.2$ Hz, $CH_2$); 3.25 (s, 3H, $NCH_3$); 6.58–7.26 (m, 10H, Ar-H) |
| **6f** | 356 ($M^+ + 1$) | 0.82 (t, 6H, $J = 7.2$ Hz, $2CH_3$); 1.12 (t, 3H, $J = 6.4$ Hz, $CH_3$); 2.36 (s, 3H, $CH_3$); 2.40 (s, 3H, $CH_3$); 2.85 (q, 2H, $J = 6.8$ Hz, $CH_2$); 3.05 (t, 4H, $J = 7.2$ Hz, $2NCH_2$); 7.15–7.28 (m, 4H, Ar-H) |
| **6g** | 440 ($M^+ + 1$) | 0.84 (t, 6H, $J = 7.2$ Hz, $2CH_3$); 1.12 (t, 3H, $J = 7.2$ Hz, $CH_3$); 1.16–1.24 (m, 12H, $2CH_2CH_2CH_2$); 2.36 (s, 3H, $CH_3$); 2.39 (s, 3H, $CH_3$); 2.84 (q, 2H, $J = 7.2$ Hz, $CH_2$); 2.95 (t, 4H, $J = 7.2$ Hz, $2CH_2$); 7.28–7.13 (m, 4H, Ar-H) |
| **6h** | 356 ($M^+ + 1$) | 0.81 (t, 6H, $J = 7.2$ Hz, $2CH_3$); 1.13 (t, 3H, $J = 7.2$ Hz, $CH_3$); 2.36 (s, 3H, $CH_3$); 2.39 (s, 3H, $CH_3$); 2.86 (q, 2H, $J = 7.2$ Hz, $CH_2$); 3.05 (q, 4H, $J = 7.2$ Hz, $2NCH_2$); 7.07–7.38 (m, 4H, Ar-H) |
| **6i** | 411 ($M^+$) | 0.82 (t, 6H, $J = 6.8$ Hz, $2CH_3$); 1.10–1.22 (m, 11H, $2CH_2CH_2$, and $CH_3$); 2.36 (s, 3H, $CH_3$); 2.39 (s, 3H, $CH_3$); 2.85 (q, 2H, $J = 7.2$ Hz, $CH_2$); 2.96 (t, 4H, $J = 7.2$ Hz, $2NCH_2$); 7.06–7.38 (m, 4H, Ar-H) |
| **6j** | 368 ($M^+ + 1$) | 1.12 (t, 3H, $J = 6.8$ Hz, $CH_3$); 1.23–1.41 (m, 6H, $3CH_2$); 2.36 (s, 3H, $CH_3$); 2.40 (s, 3H, $CH_3$); 2.85 (q, 2H, $J = 6.8$ Hz, $CH_2$); 3.07 (t, 4H, $J = 4.8$ Hz, $2NCH_2$); 7.19–7.28 (m, 4H, Ar-H) |
| **6k** | 390 ($M^+ + 1$) | 1.12 (t, 3H, $J = 7.2$ Hz, $CH_3$); 2.38 (s, 3H, $CH_3$); 2.84 (q, 2H, $J = 7.2$ Hz, $CH_2$); 3.08 (t, 4H, $J = 4.8$ Hz, $2NCH_2$); 3.46 (t, 4H, $J = 4.8$ Hz, $2OCH_2$); 7.27–7.49 (m, 4H, Ar-H) |
| **6l** | 315 ($M^+ + 1$) | 1.12 (t, 3H, $J = 7.2$ Hz, $CH_3$); 2.37 (s, 3H, $CH_3$); 2.41 (s, 3H, $CH_3$); 2.86 (q, 2H, $J = 7.2$ Hz, $CH_2$); 3.91 (s, 3H, $OCH_3$); 7.10–7.31 (m, 4H, Ar-H) |
| **6m** | 329 ($M^+ + 1$) | 1.12 (t, 3H, $J = 7.2$ Hz, $CH_3$); 1.24 (t, 3H, $J = 7.2$ Hz, $CH_3$); 2.37 (s, 3H, $CH_3$); 2.41 (s, 3H, $CH_3$); 2.86 (q, 2H, $J = 7.2$ Hz, $CH_2$); 4.41 (q, 2H, $J = 7.2$ Hz, $OCH_2$); 7.08–7.30 (m, 4H, Ar-H) |
| **6n** | 334 ($M^+$) | 1.12 (t, 3H, $J = 7.2$ Hz, $CH_3$); 2.38 (s, 3H, $CH_3$); 2.85 (q, 2H, $J$ =7.2 Hz, $CH_2$); 3.92 (s, 3H, $OCH_3$); 7.16–7.48 (m, 4H, Ar-H) |
| **6o** | 377 ($M^+ + 1$) | 1.14 (t, 3H, $J = 7.2$ Hz, $CH_3$); 2.35 (s, 3H, $CH_3$); 2.36 (s, 3H, $CH_3$); 2.88 (q, 2H, $J = 7.2$ Hz, $CH_2$); 6.98–7.56 (m, 9H, Ar-H) |
| **6p** | 393 ($M^+ + 1$) | 1.14 (t, 3H, $J = 7.2$ Hz, $CH_3$); 2.36 (s, 3H, $CH_3$); 2.88 (q, 2H, $J = 7.2$ Hz, $CH_2$); 3.80 (s, 3H, $OCH_3$); 6.87–7.56 (m, 9H, Ar-H) |
| **6q** | 396 ($M^+$) | 1.14 (t, 3H, $J = 7.2$ Hz, $CH_3$); 2.37 (s, 3H, $CH_3$); 2.88 (q, 2H, $J = 7.2$ Hz, $CH_2$); 7.05–7.57 (m, 9H, Ar-H) |

triphenylphosphine (2.36 g, 9 mmol), and hexachloroethane (2.13 g, 9 mmol) in dry acetonitrile (10 mL), triethylamine (1.84 g, 18 mmol) was added dropwise in a nitrogen atmosphere. The mixture was stirred for 3 h at room temperature. After the reaction mixture was poured into cold water (200 mL), the precipitate obtained was recrystallized from ethanol to give the desired iminophosphorane **3** in 88% yield with mp 106–107°C. $^1$H NMR ($CDCl_3$): $\delta$ 1.04 (t, 3H, $J = 7.2$ Hz, $CH_3$); 1.35 (t, 3H, $J = 7.2$ Hz, $CH_3$), 2.04 (s, 3H, $CH_3$), 2.66 (q, 2H, $J = 7.2$ Hz, $CH_2$), 4.29 (q, 2H, $J = 7.2$ Hz, $OCH_2$), 7.84–7.47 (m, 15H, Ar-H); MS: *m/z* (%) 473 ($M^+$, 100%), 262 (78), 183 (74), 107 (63). IR (KBr, $cm^{-1}$): 1664, 1470, 1437, 1398, 1329. Anal. Calcd for $C_{28}H_{28}NO_2PS$: C, 71.02; H, 5.96; N, 2.96. Found: C, 70.24; H, 6.19; N, 2.93.

### *General Preparation of 2-Dialkylamino-5-ethyl-6-methyl-thieno[2,3-d]pyrimidin-4(3H)-ones (**6a–6k**)*

To a solution of iminophosphorane **3** (0.95 g, 2 mmol) in anhydrous $CH_2Cl_2$ (10 mL), aromatic isocyanate (2 mmol) was added under nitrogen atmosphere at room temperature. After the reaction mixture was left unstirred for 6–12 h at 0–5°C, the iminophosphorane **3** had disappeared (TLC monitored). The solvent was removed under reduced

pressure, and $Et_2O$/petroleum ether (1:2, 20 mL) was added to precipitate triphenylphosphine oxide. Removal of the solvent gave carbodiimides **4**, which were used directly without further purification. To the solution of **4** in dichloromethane (10 mL), dialkylamine (2 mmol) was added. After the reaction mixture was left unstirred for 5–6 h, the solvent was removed and anhydrous EtOH (10 mL) with several drops of EtONa in EtOH was added. The mixture was stirred for 6–12 h at room temperature. The solution was condensed, and the residue was recrystallized from EtOH to give the expected cyclic compounds **6a–6k** in good yields.

### *General Preparation of 2-Alkoxy-5-ethyl-6-methyl-thieno[2,3-d]pyrimidin-4(3H)-ones (**6l–6n**)*

To the solution of **4** prepared as mentioned above in ROH (10 mL), several drops of RONa in ROH were added. The mixture was stirred for 6 h at room temperature. The solution was condensed, and the residue was recrystallized from dichloromethane–petroleum ether to give 2-alkoxy-5-ethyl-6-methyl-thieno[2,3-*d*]pyrimidin-4(3*H*)-ones **6l–6n**.

### *General Preparation of 2-Aryloxy-5-ethyl-6-methyl-thieno[2,3-d]pyrimidin-4(3H)-ones (**6o–6q**)*

To the solution of **4** prepared as mentioned above in dry acetonitrile (10 mL), substituted phenol (2 mmol) and cat. solid $K_2CO_3$ (0.14 g, 10 mmol) were added. The mixture was stirred for 6 h at room temperature and filtered. The filtrate was condensed, and the residue was recrystallized from dichloromethane–petroleum ether to give 2-arlyoxy-5-ethyl-6-methyl-thieno[2,3-*d* ]pyrimidin-4(3*H*)-ones **6o–6q**.

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