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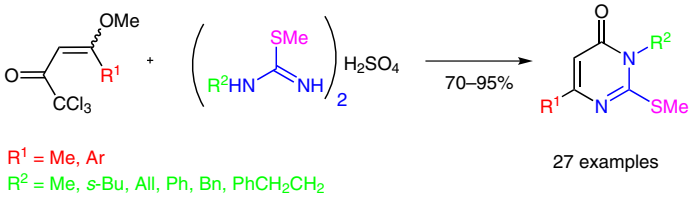
Highly Regioselective Synthesis of 3,6-Disubstituted 2-(Methylsulfanyl)pyrimidin-4(3*H*)-ones

Josiane M. dos Santos
Alessandra S. da Silveira
Laura A. Souza
Marcio M. Lobo
Helio G. Bonacorso
Marcos A. P. Martins
Nilo Zanatta*

Núcleo de Química de Heterociclos (NUQUIMHE), Departamento de Química, Universidade Federal de Santa Maria, 97105-900, Santa Maria, Brazil
nilo.zanatta@ufsm.br



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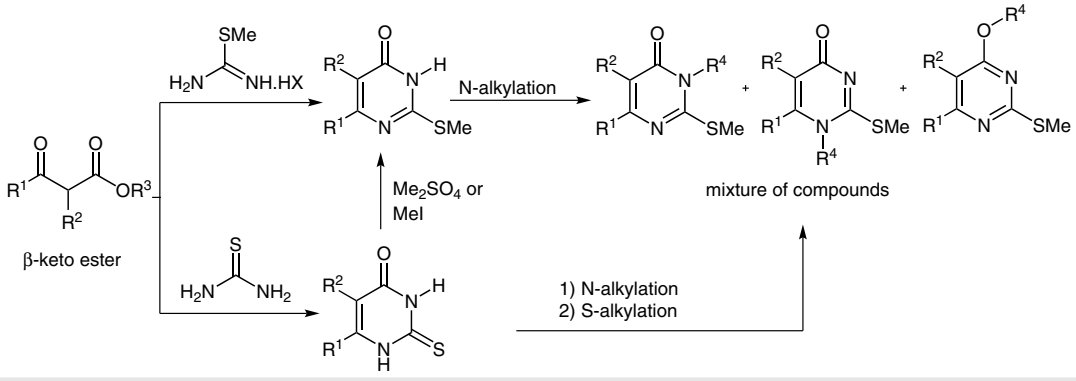
Abstract This study reports a simple and highly regioselective synthesis of a new series of 3,6-disubstituted 2-(methylsulfanyl)pyrimidin-4(3*H*)-ones, in which the 6-substituents are methyl or aryl groups and the 3-substituents are alkyl, allyl, phenyl, benzyl, or 2-phenylethyl groups. The products are obtained in good yields by cyclocondensation of the appropriate 4-substituted 4-methoxy-1,1,1-trichloroalk-3-en-2-ones with nonsymmetric 1-substituted 2-methylisothiourea sulfates under mild basic conditions.

Key words pyrimidines, cyclocondensations, thio ethers, regioselectivity, enones

The synthesis of 3,6-disubstituted 2-(methylsulfanyl)pyrimidin-4(3*H*)-ones is of considerable practical interest because of the important biological activities shown by such compounds, which has been discovered mainly over the last two decades. For example, some pyrimidine derivatives are potent calcium-channel blockers.[1,2] 6-Benzyl- and 6-(cyclohexylmethyl)-2-(alkylsulfanyl)pyrimidin-4(3*H*)-ones exhibit significant anti-HIV activities.[3–6] N-Substituted 6-phenyl-2-(methylsulfanyl)pyrimidinones have shown hypotensive and antiinflammatory activities.[7] 2-Sulfanyl-4(3*H*)-quinazolinone derivatives have exhibited protein tyrosine phosphatase 1B inhibition, which makes them potential therapeutic targets, particularly for the treatment of type 2 diabetes.[8] 5,6-Disubstituted 2-(alkylsulfanyl)pyrimidin-4(3*H*)-ones exhibit an interesting antimicrobial profile, with dual antibacterial and antifungal effects against *Staphylococcus aureus* and *Candida albicans*, respectively.[9]

In a search of the literature, we found four methods for preparing 3,6-disubstituted 2-(methylsulfanyl)pyrimidin-4(3*H*)-ones. The most widely reported method involves the cyclocondensation reaction of a β-keto ester with 2-methylisothiourea, followed by N-alkylation; alternatively, the compounds can be prepared by the reaction of β-keto esters with thiourea followed by S- and N-alkylation (Scheme 1). This is a simple method, but has the disadvantage of giving mixtures of N[1]-, N[3]-, and O-alkylated products.[1,7,10–16]

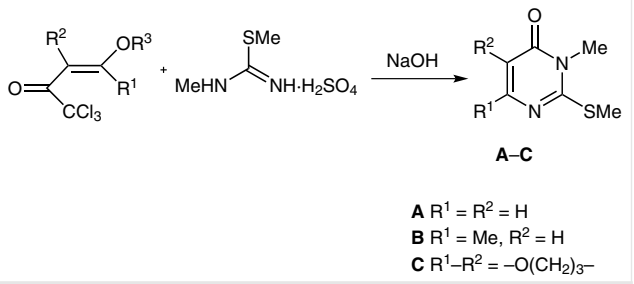


Scheme 1 Synthesis of N-substituted 2-(methylsulfanyl)pyrimidin-4(3*H*)-ones by alkylation methods

An attractive method for the regioselective synthesis of N^3-substituted 2-(methylsulfanyl)pyrimidin-4(3*H*)-ones, reported by Mahajan and co-workers, involves a [4+2] cycloaddition reaction of 1,3-diazabuta-1,3-dienes with ketenes.[17–19] Recently, Meslin and co-workers made use of a similar cycloaddition method by treating 1,3-diazadienes with acid chlorides instead of ketenes to prepare a series of N^3-substituted 2-(methylsulfanyl)pyrimidin-4(3*H*)-ones.[20]

Gupta et al. reported an interesting method for the synthesis of 6-substituted 3-aryl-2-(alkylsulfanyl)pyrimidin-4(3*H*)-ones by cyclocondensation of 2-(alkylsulfanyl)-1-arylisothioureas with alkynoates.[21,22] This method, however, does not permit the introduction of substituents at the 5-position of the pyrimidine ring.

The fourth method, which originated from our group and was published in 2010, is a synthesis that relies on the cyclocondensation reaction of 4-alkoxy-1,1,1-trichloroalk-3-en-2-ones (trichloromethylated enones) with 1,2-dimethylisothiourea sulfate.[23] This reaction showed high regioselectivity and gave excellent yields, but the reaction was not well explored because only three pyrimidines were synthesized by using the trichloromethylated enones, and these pyrimidines only support very small groups, such as *N*-methyl and 6-H, 6-methyl, or 6-*O*-alkyl groups (Scheme 2).



Scheme 2 Regioselective synthesis of N^3-methyl-2-(methylsulfanyl)pyrimidin-4(3*H*)-ones

We therefore investigated a wider scope of substrates with larger substituents at both the 6- and the N^3-positions to obtain clear evidence of the steric and electronic effects that govern the regioselectivity in the synthesis of the title compounds. For this study, we prepared a series of N-substituted 2-methylisothiourea sulfates, as well as a series of 4-substituted 4-alkoxy-1,1,1-trichloroalk-3-en-2-ones. The combination of these two series of starting materials gave 27 compounds, of which 21 were new compounds.

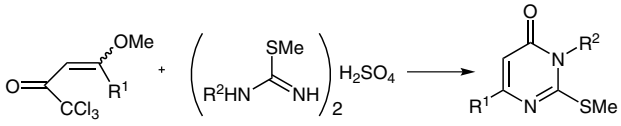
The 3,6-disubstituted 2-(methylsulfanyl)pyrimidin-4(3*H*)-ones **8**–**13** were synthesized by the cyclocondensation reactions of the appropriate 4-substituted 4-alkoxy-1,1,1-trichloroalk-3-en-2-ones **1a**–**f** with the nonsymmetric 1-substituted 2-methylisothiourea sulfates **2**–**7** in the presence of a 1 M aqueous solution of sodium carbonate at room temperature (Table 1). Vigorous stirring was necessary to ensure complete mixing of the reactants, because two phases were formed as a result of the insolubility of the enones **1a**–**f** in the aqueous medium. The reaction was considered to be complete when the formation of a precipitate or oil was observed at the bottom of the flask. (We also tested an alternative approach based on a method developed previously by our research group,[23] in which a 1 M aqueous solution of sodium hydroxide was used instead of the 1 M solution of sodium carbonate, but this reaction produced more impurities and gave lower yields.) The reaction, which proceeds through the base-assisted elimination of the trichloromethyl group, gave the N^3-substituted 2-(methylsulfanyl)pyrimidin-4-ones exclusively. Base-assisted eliminations of trichloromethyl groups in cyclocondensation reactions have been reported elsewhere.[23,24] Solid products were purified by recrystallization from a chloroform–methanol mixture, and oily products were purified by column chromatography. The yields ranged from 70 to 95% (Table 1).

The 4-substituted 4-methoxy-1,1,1-trihalo-alk-3-en-2-ones **1a**–**f** were prepared by the reported method.[25] The 1-substituted 2-methylisothioureas sulfates **2**–**4** were obtained by S-methylation of the corresponding commercially available thioureas by refluxing them in water and dimethyl sulfate, in accordance with the reported method.[26] The 1-substituted 2-methylisothiourea sulfates **5**–**7** were prepared by the reaction of benzoyl isothiocyanate with benzylamine, phenethylamine, or *sec*-butylamine, respectively, followed by *S*-methylation of the resulting thiourea in accordance with the reported method.[27] 1,2-Dimethylisothiourea sulfate is commercially available.

All compounds were fully analyzed by GC/MS and by ^{1}H- and ^{13}C-NMR spectroscopy, and their regiochemistry was unequivocally assigned by means of two-dimensional HMBC NMR experiments and confirmed by X-ray diffraction analysis of compound **11a** (Figure 1). The strategy for the assignment of the correct position of the N-substituent group in 2-(methylsulfanyl)pyrimidines, based on two-dimensional HMBC NMR experiments, has been reported for related compounds,[23,28,29] and is shown in Figure 2. In this experiment, when the N-substituent group is at the N^1-position, two cross-peaks between the N^1-α-hydrogens and C2 and C6 atoms should be observed (Figure 2; structure **I**). When the N-substituent group is at the N^3-position, two cross-peaks between the N-α-hydrogens and the C2 and C4 carbon atoms should be observed (Figure 2; structure **II**). The cross-peak between the hydrogens of the thiomethyl group and the C2 assigns this carbon in both structures **I** and **II**. The N-substituent was located at the N^3-position in all the compounds synthesized in this study, and the formation of the N^1-substituted regioisomer was not observed in any of the reactions.

A proposed mechanism for the synthesis of pyrimidines **8**–**13** by the cyclocondensation reaction of 4-alkoxy-1,1,1-trichloroalk-3-en-2-ones with nonsymmetric 1-substituted

Table 1 Optimized Reaction Conditions and Yields for the Synthesis Pyrimidines **8**–**13**



1a–f **2–7** **8–13**

Enone	R^1	Isothiourea	R^2	Time[a] (h)	Product	Yield[b] (%)	Ref
1a	Me	**2**	Me	2.4	**8a**	95	23
1b	Ph	**2**	Me	2.0	**8b**	86	7
1c	4-Tol	**2**	Me	3.0	**8c**	91	
1d	4-$MeOC_6H_4$	**2**	Me	3.0	**8d**	80	
1e	4-FC_6H_4	**2**	Me	3.5	**8e**	82	
1f	4-BrC_6H_4	**2**	Me	3.0	**8f**	90	
1a	Me	**3**	All	3.0	**9a**	91	10b
1b	Ph	**3**	All	2.0	**9b**	81	
1c	4-Tol	**3**	All	3.5	**9c**	80	
1d	4-$MeOC_6H_4$	**3**	All	3.0	**9d**	90	
1e	4-FC_6H_4	**3**	All	3.0	**9e**	82	
1f	4-BrC_6H_4	**3**	All	4.0	**9f**	85	
1a	Me	**4**	Ph	4.0	**10a**	70	21
1b	Ph	**4**	Ph	3.5	**10b**	80	22
1e	4-FC_6H_4	**4**	Ph	3.5	**10e**	75	
1a	Me	**5**	Bn	4.0	**11a**	88	
1b	Ph	**5**	Bn	4.0	**11b**	90	
1e	4-FC_6H_4	**5**	Bn	4.0	**11e**	86	
1a	Me	**6**	$(CH_2)_2Ph$	3.0	**12a**	86	
1b	Ph	**6**	$(CH_2)_2Ph$	2.0	**12b**	91	
1e	4-FC_6H_4	**6**	$(CH_2)_2Ph$	2.0	**12e**	78	
1a	Me	**7**	*s*-Bu	0.6	**13a**	91	
1b	Ph	**7**	*s*-Bu	2.0	**13b**	88	
1e	4-Tol	**7**	*s*-Bu	2.0	**13c**	83	
1c	4-$MeOC_6H_4$	**7**	*s*-Bu	1.0	**13d**	85	
1e	4-FC_6H_4	**7**	*s*-Bu	1.2	**13e**	90	
1f	4-BrC_6H_4	**7**	*s*-Bu	2.0	**13f**	81	

[a] Reaction conditions: 1 M aq Na_2CO_3, r.t.
[b] Yield of isolated products.

2-methylisothiourea sulfates is outlined in Scheme 3. Presumably, the reaction starts with the Michael addition of the least-hindered amino group of the 2-methylisothiourea to the β-carbon of the enone to give structure **I**, which is in equilibrium with its tautomer **II** (Scheme 3). The hemiaminal group of the structures **I** and **II** is stable under basic conditions. After the addition of the least-substituted nitrogen of the 2-methylisothiourea to the β-carbon of the enone, the carbonyl becomes activated because it is attached to a highly electron-withdrawing trichloromethyl group and is no longer conjugated to a carbon–carbon double bond. Therefore, the addition of the second nitrogen should be a fast reaction step, furnishing the tetrahydropyrimidine **III**; this compound has previously been isolated for the case when R^1 = H.[23] The base-assisted elimination of the trichloromethyl group leads to structure **IV**, which further eliminates a methanol molecule and furnishes the products **8**–**13**.

In conclusion, we have developed a simple and highly regioselective synthesis of a new series of 3,6-disubstituted 2-(methylsulfanyl)pyrimidin-4(3*H*)-ones in good yields by

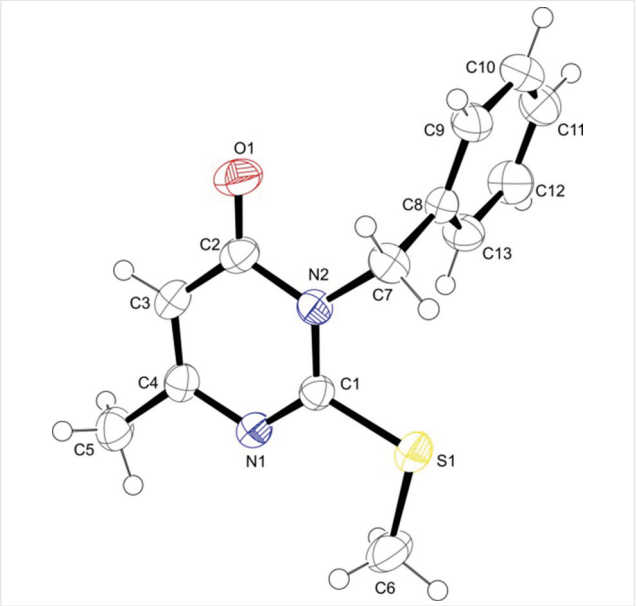


Figure 1 ORTEP diagram for compound **11a**; CCDC no. 1423129

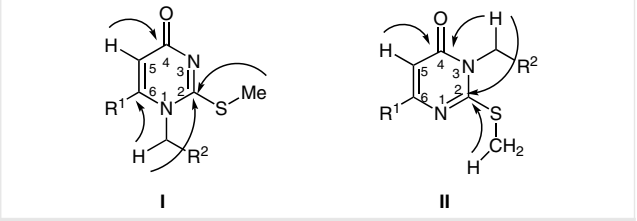


Figure 2 Strategy used for assigning the regioisomers of the products by two-dimensional HMBC NMR

the cyclocondensation reaction of 4-alkoxy-1,1,1-trichloroalk-3-en-2-ones with nonsymmetric 1-substituted 2-methylisothiourea sulfates under mild basic conditions. The reaction proceeds with the elimination of the trichloromethyl group assisted by the base, and it was observed that in all the pyrimidines obtained the regiochemistry of the reaction gave the N^3-substituted 2-(methylsulfanyl)pyrimidin-4-one exclusively.

The 4-alkoxy-1,1,1-trichloromethyl-alk-3-en-2-ones **1a**–**f** were prepared by the reported method.[25] The 1-substituted 2-methylisothioureas sulfates **2**–**4** were obtained by S-methylation of the corresponding commercially available thioureas by refluxing in H_2O and Me_2SO_4 as previously described.[26] 1-Benzylthiourea, 1-(2-phenylethyl)thiourea and 1-(*sec*-butyl)thiourea were synthesized by the reaction of benzoyl isothiocyanate with $BnNH_2$, $Ph(CH_2)_2NH_2$, and *s*-$BuNH_2$, respectively,[27] followed by S-methylation with Me_2SO_4. The 1-substituted 2-methylisothioureas sulfates **2**–**7** were obtained by S-methylation of the corresponding thioureas by refluxing in water and Me_2SO_4 according to the reported method.[26]

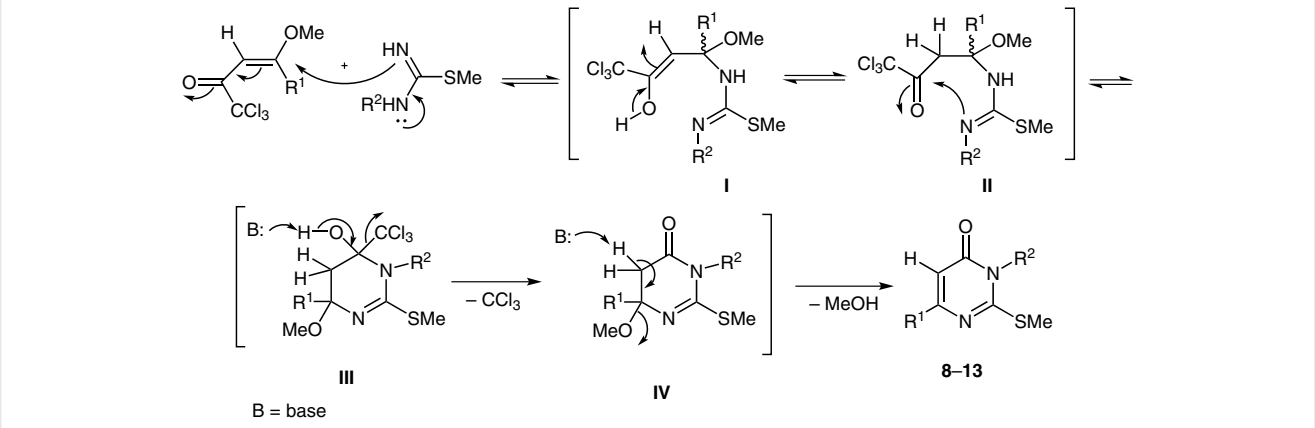
Melting points were determined on a Kofler Reichert Thermovar or a MQAPF-301 apparatus and are uncorrected. High-resolution mass spectra were recorded on a Bruker QTOF spectrometer operated in the ESI mode. GC/MS spectra were obtained by using a HP 5973 MSD connected to a HP 6890 GC. ^1H and ^{13}C NMR spectra were acquired on a Bruker DPX200 or DPX400 spectrometer with $CDCl_3$ or DMSO-d_6 as solvent and TMS as the internal reference. Crystallographic measurements were made on a Bruker Kappa Apex II CCD area detector, with graphite-monochromated Mo Kα radiation (λ = 0.71073 Å). The structure was solved by direct methods (SHELXS-97) and additional atoms were located in the difference Fourier map and refined on *F*2 (SHELXL-97).

*N*³-Substituted 2-(Methylsulfanyl)pyrimidin-4(3*H*)-ones 8–13; General Procedure

A 1.0 M aqueous solution of Na_2CO_3 (2.0 mmol) and the appropriate 2-methylisothiourea sulfate **2**–**7** (2 mmol) were added with vigorous magnetic stirring to the enone **1a**–**f** (1.0 mmol). The mixture was stirred at r.t. until the reaction was complete and then extracted with $CHCl_3$ (3 × 15 mL). The organic layer was dried (Na_2SO_4), filtered, and concentrated. The products were purified by recrystallization or column chromatography.

3,6-Dimethyl-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (8a)

This compound was prepared by the reported method.[23]



Scheme 3 Proposed mechanism for the synthesis of compounds **8**–**13**

3-Methyl-2-(methylsulfanyl)-6-phenylpyrimidin-4(3*H*)-one (8b)[7]

Brown solid; yield: 199 mg (86%); mp 117–119 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.98–7.96 (m, 2 H, Ar), 7.44–7.42 (m, 3 H, Ar), 6.64 (s, 1 H, H–5), 3.53 (s, 3 H, NMe), 2.69 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.8 (C-2), 162.5 (C-4), 158.8 (C-6), 136.5, 130.4, 128.6, 126.8 (C-Ar), 103.9 (C-5), 30.0 (NMe), 15.1 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 232 (79) [M$^+$], 217 (9), 195 (12), 187 (66), 145 (23), 102 (16), 83 (100).

Anal. Calcd for $C_{12}H_{12}N_2OS$: C, 62.04; H, 5.21; N, 12.06. Found: C, 61.97; H, 5.18; N, 11.71.

3-Methyl-2-(methylsulfanyl)-6-(4-tolyl)pyrimidin-4(3*H*)-one (8c)

Brown solid; yield: 224 mg (91%); mp 97–99 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.87 (d, *J* = 8.3 Hz, 2 H, Ar), 7.24 (d, *J* = 7.8 Hz, 2 H, Ar), 6.62 (s, 1 H, H-5), 3.53 (s, 3 H, NMe), 2.68 (s, 3 H, SMe), 2.39 (s, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.0 (C-2), 162.3 (C-4), 158.8 (C-6), 140.8 (C-Ar), 133.5 (C-Ar), 129.3 (CH-Ar), 126.7 (CH-Ar), 103.2 (C-5), 29.6 (NMe), 21.3 (Me), 15.1 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 246 (100) [M$^+$], 201 (54), 159 (13), 115 (13), 83 (36).

Anal. Calcd for $C_{13}H_{14}N_2OS$: C, 63.39; H, 5.73; N, 11.37. Found: C, 62.99; H, 5.36; N, 11.05.

6-(4-Methoxyphenyl)-3-methyl-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (8d)

Brown solid; yield: 209 mg (89%); mp 135–138 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.95 (d, *J* = 8.0 Hz, 2 H, Ar), 6.96 (d, *J* = 8.0 Hz, 2 H, Ar), 6.54 (s, 1 H, H–5), 3.84 (s, 3 H, OMe), 3.51 (s, 3 H, NMe), 2.67 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.8 (C-2), 162.2 (C-4), 161.8 (C-Ar), 158.4 (C-6), 128.8 (C-Ar), 128.4 (C-Ar), 114.1 (C-Ar), 102.4 (C-5), 55.3 (OMe), 29.9 (NMe), 15.0 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 262 (100) [M$^+$], 216 (56), 176 (15), 115 (14), 84 (38).

Anal. Calcd for $C_{13}H_{14}N_2O_2S$: C, 59.52; H, 5.38; N, 10.68. Found: C, 59.43; H, 5.24; N, 10.32.

6-(4-Fluorophenyl)-3-methyl-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (8e)

Brown solid; yield: 205 mg (82%); mp 152–155 °C.

^{1}H NMR (200 MHz, $CDCl_3$): δ = 7.98–7.95 (m, 2 H, Ar), 7.11 (t, J_{H-H} = 8.5 Hz, 3 H, Ar), 6.58 (s, 3 H, H–5), 3.53 (s, 3 H, NMe), 2.68 (s, 3 H, SMe).

^{13}C NMR (50 MHz, $CDCl_3$): δ = 165.6 (C-2), 163.1 (C-Ar), 162.7 (C-4), 157.8 (C-6), 131.6 (d, J_{C-H} = 3.3 Hz, C-Ar), 128.9 (d, J_{C-H} = 8.5 Hz, CH-Ar), 115.6 (d, J_{C-H} = 21.8 Hz, CH-Ar), 103.6 (C-5), 30.0 (NMe), 15.1 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 250 (100) [M$^+$], 205 (65), 163 (15), 134 (17), 120 (16), 83 (49).

Anal. Calcd for $C_{12}H_{11}FN_2OS$: C, 57.58; H, 4.43; N, 11.19. Found: C, 57.52; H, 4.25; N, 11.19.

6-(4-Bromophenyl)-3-methyl-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (8f)

Beige solid; yield: 280 mg (90%); mp 190–192 °C.

^{1}H NMR (200 MHz, $CDCl_3$): δ = 7.81 (d, *J* = 8.4 Hz, 2 H, Ar), 7.55 (d, *J* = 8.4 Hz, 2 H, Ar), 6.58 (s, 1 H, H–5), 3.52 (s, 3 H, NMe), 2.67 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.8 (C-2), 162.5 (C-4), 157.6 (C-6), 131.9 (C-Ar), 128.3 (2 C, C-Ar), 125.0 (C-Ar), 104.0 (C-5), 30.0 (NMe), 15.1 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 295 (4) [M – 15], 239 (100), 185 (13), 157 (8), 116 (25), 101 (18), 89 (18), 59 (25).

Anal. Calcd for $C_{12}H_{11}BrN_2OS$: C, 46.31; H, 3.56; N, 9.00. Found: C, 46.18; H, 3.44; N, 8.97.

3-Allyl-6-methyl-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (9a)[10b]

Reddish brown oil; yield: 178 mg (91%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.05 (s, 1 H, H–5), 5.82–5.90 (m, 1 H, =CH), 5.20–5.25 (m, 2 H, $=CH_2$), 4.65–4.67 (m, 2 H, NCH_2), 2.55 (s, 3 H, SMe), 2.22 (s, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.4 (C-2), 162.0 (C-4), 161.5 (C-6), 130.3 (=CH), 118.4 ($=CH_2$), 107.6 (C-5), 45.8 (NCH_2), 23.6 (Me), 14.9 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) 196 (36) [M], 181 (100), 163 (8), 149 (37), 126 (28), 109 (12), 67 (8).

HRMS (ESI): *m/z* [M + Na] calcd for $C_9H_{12}N_2NaOS$: 219.0568; found: 219.0566.

3-Allyl-2-(methylsulfanyl)-6-phenylpyrimidin-4(3*H*)-one (9b)

Brown oil; yield: 209 mg (81%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.01–7.96 (m, 2 H, Ar), 7.47–7.44 (m, 3 H, Ar), 6.67 (s, 1 H, H–5), 5.88–5.95 (m, 1 H, =CH), 5.26–5.30 (m, 2 H, $=CH_2$), 4.72–4.73 (m, 2 H, NCH_2), 2.69 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.5 (C-2), 161.0 (C-4), 158.8 (C-6), 136.2 (C-Ar), 130.5 (C-Ar), 130.1 (=CH), 128.6 (CH-Ar), 126.8 (CH-Ar), 118.6 ($=CH_2$), 104.2 (C-5), 46.0 (NCH_2), 15.2 (Me).

GC-MS (EI, 70 eV): *m/z* (%) 258 (53) [M$^+$], 243 (100), 211 (42), 188 (17), 19 (7), 102 (11).

HRMS (ESI): *m/z* [M + Na] calcd for $C_{14}H_{14}N_2NaOS$: 281.0725; found: 281.0724.

3-Allyl-2-(methylsulfanyl)-6-(4-tolyl)pyrimidin-4(3*H*)-one (9c)

Yellow solid; yield: 218 mg (80%); mp 75–77 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.88 (d, *J* = 8.1 Hz, 2 H, Ar), 7.25 (d, *J* = 8.1 Hz, 2 H, Ar), 6.63 (s, 1 H, H–5), 5.84–5.95 (m, 1 H, =CH), 5.25–5.30 (m, 2 H, $=CH_2$), 4.71–4.72 (m, 2 H, NCH_2), 2.68 (s, 3 H, SMe), 2.40 (s, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.6 (C-2), 161.9 (C-4), 158.9 (C-6), 140.9 (C-Ar), 133.3 (=CH), 130.2 (C-Ar), 129.3 (CH-Ar), 126.7 (CH-Ar), 118.5 ($=CH_2$), 103.5 (C-5), 46.0 (NCH_2), 21.3 (Me), 15.1 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 272 (57) [M$^+$], 257 (100), 243 (9), 25 (48), 202 (19), 143 (9), 115 (18).

Anal. Calcd for $C_{15}H_{16}N_2OS$: C, 66.15; H, 5.92; N, 10.29. Found: C, 66.15; H, 6.06; N, 9.94.

3-Allyl-6-(4-methoxyphenyl)-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (9d)

Beige solid; yield: 260 mg (90%); mp 96–98 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.95 (d, *J* = 8.8 Hz, 2 H, Ar), 6.96 (d, *J* = 8.9 Hz, 2 H, Ar), 6.57 (s, 1 H, H–5), 5.94–5.87 (m, 1 H, =CH), 5.30–5.24 (m, 2 H, $=CH_2$), 4.71 (m, 2 H, NCH_2), 3.85 (s, 3 H, OMe), 2.67 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.5 (C-2), 161.8 (C-Ar), 161.7 (C-4), 158.5 (C-6), 130.4 (=CH), 128.7 (C-Ar), 128.5 (CH-Ar), 118.6 ($=CH_2$), 114.0 (CH-Ar), 102.8 (C-5), 55.4 (OMe), 46.0 (NCH_2), 15.2 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 288 (57) [M^+], 273 (100), 241 (47), 207 (34), 159 (14), 133 (12), 109 (24), 89 (11).

Anal. Calcd for $C_{15}H_{16}N_2O_2S$: C, 62.48; H, 5.59; N, 9.71. Found: C, 62.12; H, 5.44; N, 10.05.

3-Allyl-6-(4-fluorophenyl)-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (9e)

Brown hygroscopic solid; yield: 202 mg (82%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.96–8.00 (m, 2 H, Ar), 7.13 (t, *J* = 8.6 Hz, 2 H, Ar), 6.60 (s, 1 H, H–5), 5.83–5.97 (m, 1 H, =CH), 5.23–5.31 (m, 2 H, $=CH_2$), 4.69–4.72 (m, 2 H, NCH_2), 2.67 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 165.5 (C-2), 163.0 (C-4), 162.3 (C-Ar), 157.7 (C-6), 132.3 (d, *J* = 3.0 Hz, C-Ar), 130.1 (=CH), 128.8 (d, *J* = 8.4 Hz, CH-Ar), 118.7 ($=CH_2$), 115.6 (d, *J* = 21.6 Hz, CH-Ar), 103.8 (C-5), 46.0 (NCH_2), 15.1 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 276 (51) [M^+], 261 (100), 29 (41), 106 (23), 120 (15).

Anal. Calcd for $C_{14}H_{13}FN_2OS$: C, 60.85; H, 4.74; N, 10.14. Found: C, 60.71; H, 4.91; N, 10.15.

3-Allyl-6-(4-bromophenyl)-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (9f)

Salmon-colored solid; yield: 286 mg (85%); mp 131–134 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85 (d, *J* = 8.5 Hz, 2 H, CH-Ar), 7.58 (d, *J* = 8.5 Hz, 2 H, CH-Ar), 6.64 (s, 1 H, H–5), 5.87–5.96 (m, 1 H, =CH), 5.30–5.31 (m, 1 H, $=CH_2$), 5.27 (m, 2 H, $=CH_2$), 4.71–4.74 (m, 2 H, NCH_2), 2.68 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.5 (C-2), 162.3 (C-4), 157.7 (C-6), 135.2 (CH-Ar), 131.9 (CH-Ar), 130.0 (=CH), 128.4 (CH-Ar), 125.1 (C-Ar), 118.8 ($=CH_2$), 104.3 (C-5), 46.1 (NCH_2), 15.2 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 337.9 (43) [M^+], 322.9 (100), 289.0 (36), 265.9 (16), 207.0 (16), 182 (11), 101.1 (12).

Anal. Calcd for $C_{14}H_{13}BrN_2OS$: C, 49.86; H, 3.89; N, 8.31. Found: C, 49.51; H, 3.71; N, 8.37.

6-Methyl-2-(methylsulfanyl)-3-phenylpyrimidin-4(3*H*)-one (10a)[21]

Yellow solid; yield: 162 mg (70%); 135–138 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.51–7.48 (m, 3 H, Ar), 7.25–7.22 (m, 2 H, Ar), 6.14 (s, 1 H, H–5), 2.42 (s, 3 H, SMe), 2.28 (s, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.9 (C-2), 162.5 (C-4), 162.3 (C-6), 135.7 (C-Ar), 129.8 (CH-Ar), 129.6 (CH-Ar), 128.6 (CH-Ar), 108.2 (C-5), 23.8 (Me), 15.3 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 232 (71) [M^+], 217 (13), 199 (23), 185 (100), 145 (29), 77 (29).

Anal. Calcd for $C_{12}H_{12}N_2OS$: C, 62.04; H, 5.21; N, 12.30. Found: C, 61.76; H, 5.17; N, 12.01.

2-(Methylsulfanyl)-3,6-diphenylpyrimidin-4(3*H*)-one (10b)[22]

Brown solid; yield: 235 mg (80%); mp 148–150 °C (Lit.[22] 150 °C).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.06–8.09 (m, 2 H, Ar), 7.56–7.57 (m, 3 H, Ar), 7.50–7.52 (m, 3 H, Ar), 7.33–7.35 (m, 2 H, Ar), 6.80 (s, 1 H, H–5), 2.60 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.2 (C-2), 162.9 (C-4), 159.4 (C-6), 136.3 (C-Ar), 135.7 (C-Ar), 130.6 (CH-Ar), 130.0 (CH-Ar), 129.7 (CH-Ar), 128.7 (CH-Ar), 128.6 (CH-Ar), 126.9 (CH-Ar), 104.9 (C-5), 15.6 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 294 (1.6) [M^+], 281 (11), 264 (100), 207 (33), 145 (98), 119 (24), 104 (51).

Anal. Calcd for $C_{17}H_{14}N_2OS$: C, 69.36; H, 4.79; N, 9.52. Found: C, 69.12; H, 4.74; N, 9.75.

6-(4-Fluorophenyl)-2-(methylsulfanyl)-3-phenylpyrimidin-4(3*H*)-one (10e)

Salmon-colored solid; yield: 234 mg (75%); mp 177–180 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.02–8.05 (m, 2 H, Ar), 7.52–7.54 (m, 3 H, Ar), 7.28–7.31 (m, 2 H, Ar), 7.13–7.17 (m, 2 H, Ar), 6.70 (s, 1 H, H–5), 2.55 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 165.6 (C-Ar), 163.4 (C-2), 162.7 (C-4), 158.3 (C-6), 135.6 (C-Ar), 132.4 (d, J_{C-F} = 3.02 Hz, C-Ar), 130.0 (CH-Ar), 129.7 (CH-Ar), 129.0 (d, J_{C-F} = 8.5 Hz, CH-Ar), 128.5 (CH-Ar), 115.7 (d, J_{C-F} = 21.7 Hz, CH-Ar), 104.5 (C-5), 15.5 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 312 (100) [M^+], 297 (11), 279 (26), 265 (62), 145 (86), 77 (34).

Anal. Calcd for $C_{17}H_{13}N_2OSF$: C, 65.37; H, 4.19; N, 8.97. Found: C, 64.97; H, 4.25; N, 9.28.

3-Benzyl-6-methyl-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (11a)

Yellow solid; yield: 216 mg (88%); mp 97–100 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.26–7.31 (m, 5 H, Ar), 6.11 (s, 1 H, H–5), 5.27 (s, 2 H, NCH_2), 2.50 (s, 3 H, SMe), 2.23 (s, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.5 (C-2), 162.4 (C-4), 161.9 (C-6), 135.0 (C-Ar), 128.5 (CH-Ar), 127.6 (CH-Ar), 127.5 (CH-Ar), 107.6 (C-5), 46.7 (NCH_2), 23.7 (Me), 15.1 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 246 (100) [M^+], 231 (21), 199 (29), 172 (38), 148 (19), 126 (41), 91 (80), 65 (21).

Anal. Calcd for $C_{13}H_{14}N_2OS$: C, 63.39; H, 5.73; N, 11.37. Found: C, 63.34; H, 5.64; N, 11.38.

3-Benzyl-2-(methylsulfanyl)-6-phenylpyrimidin-4(3*H*)-one (11b)

Yellow solid; yield: 277 mg (90%); mp 137–140 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.00–7.97 (m, 2 H, Ar), 7.47–7.43 (m, 3 H, Ar), 7.34–7.28 (m, 5 H, Ar), 6.73 (s, 1 H, H–5), 5.33 (s, 2 H, NCH_2), 2.63 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.9 (C-2), 162.5 (C-4), 158.7 (C-6), 136.1 (C-Ar), 134.9 (C-Ar), 130.6 (CH-Ar), 128.6 (CH-Ar), 128.5 (CH-Ar), 127.7 (CH-Ar), 127.6 (CH-Ar), 126.8 (CH-Ar), 104.2 (C-5), 45.9 (NCH_2), 15.4 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 308 (100) [M^+], 293 (21), 261 (33), 234 (20), 207 (66), 188 (26), 148 (15), 91 (56).

Anal. Calcd for $C_{18}H_{16}N_2OS$: C, 70.10; H, 5.23; N, 9.08. Found: C, 69.71; H, 5.13; N, 9.05.

3-Benzyl-6-(4-fluorophenyl)-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (11e)

Beige solid; yield: 280 mg (86%); mp 125–127 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.95–8.03 (m, 2 H, Ar), 7.29–7.36 (m, 5 H, Ph), 7.13 (t, J_{H-F} = 8.7 Hz, 2 H, Ar), 6.67 (s, 1 H, H–5), 5.33 (s, 2 H, NCH_2), 2.63 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 165.6 (C-Ar), 162.8 (C-2), 162.7 (C-4), 154.7 (C-6), 134.9 (C-Ar), 132.3 (C-Ar), 128.9 (d, J_{C-F} = 8.6 Hz, CH-Ar), 128.5 (CH-Ar), 127.7 (CH-Ar), 127.6 (CH-Ar), 115.6 (d, J_{C-F} = 21.7 Hz, CH-Ar), 103.9 (C-5), 47.0 (NCH_2), 15.3 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 326 (100) [M$^+$], 311 (17), 279 (27), 252 (24), 206 (26), 148 (12), 91 (38).

Anal. Calcd for $C_{18}H_{15}FN_2OS$: C, 66.24; H, 4.63; N, 8.58. Found: C, 65.88; H, 4.55; N, 8.41.

6-Methyl-2-(methylsulfanyl)-3-(2-phenylethyl)pyrimidin-4(3*H*)-one (12a)

Brown hygroscopic solid; yield: 223 mg (86%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.31 (s, 5 H, Ph), 6.06 (s, 1 H, H–5), 4.18–4.22 (m, 2 H, NCH_2), 2.97–3.02 (m, 2 H, CH_2Ar), 2.57 (s, 3 H, SMe), 2.22 (s, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.3 (C-2), 162.1 (C-4), 161.1 (C-6), 137.8 (C-Ar), 128.8 (CH-Ar), 128.6 (CH-Ar), 126.7 (C-Ar), 107.8 (C-5), 45.7 (NCH_2), 33.6 (CH_2Ar), 23.6 (Me), 14.9 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 260 (3) [M$^+$], 245 (6), 156 (100), 104 (51), 91 (8), 77 (10).

Anal. Calcd for $C_{14}H_{16}N_2OS$: C, 64.58; H, 6.19; N, 10.76. Found: C, 64.58; H, 6.03; N, 10.46.

2-(Methylsulfanyl)-6-phenyl-3-(2-phenylethyl)pyrimidin-4(3*H*)-one (12b)

Brown hygroscopic solid; yield: 293 mg (91%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.0 (s, 2 H, Ar), 7.45 (s, 3 H, Ar), 7.25–7.33 (m, 5 H, Ar), 6.70 (s, 1 H, H–5), 4.25–4.29 (m, 2 H, NCH_2), 3.03–3.07 (m, 2 H, CH_2Ar), 2.71 (s, 3 H, SMe).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 162.6 (C-2), 161.7 (C-4), 158.8 (C-6), 137.6 (C-Ar), 136.2 (C-Ar), 130.5 (CH-Ar), 128.8 (CH-Ar), 128.6 (CH-Ar), 126.8 (CH-Ar), 126.7 (CH-Ar), 104.4 (C-5), 45.8 (NCH_2), 33.5 (CH_2Ar), 15.1 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 322 (8) [M$^+$], 218 (100), 172 (25), 104 (32), 77 (17).

Anal. Calcd for $C_{19}H_{18}N_2OS$: C, 70.78; H, 5.63; N, 8.69. Found: C, 70.71; H, 5.56; N, 8.31.

6-(4-Fluorophenyl)-2-(methylsulfanyl)-3-(2-phenylethyl)pyrimidin-4(3*H*)-one (12e)

Yellow solid; yield: 265 mg (78%); mp 167–169 °C.

^{1}H NMR (400 MHz, DMSO-d_6): δ = 8.15–8.18 (m, 2 H, Ar), 7.27–7.34 (m, H, Ar), 6.76 (s, 1 H, H–5), 4.17–4.21 (m, 2 H, NCH_2), 2.96–3.00 (m, 2 H, CH_2Ar), 2.70 (s, 3 H, SMe).

^{13}C NMR (100 MHz, DMSO-d_6): δ = 164.4 (C-2), 162.8 (C-4), 162.2 (C-Ar), 160.8 (C-6), 156.1 (C-Ar), 137.1 (C-Ar), 132.0 (C-Ar), 129.0 (d, J_{C-F} = 8.7 Hz, CH-Ar), 128.3 (CH-Ar), 126.4 (CH-Ar), 115.1 (d, J_{C-F} = 21.7 Hz, CH-Ar), 102.9 (C-5), 44.6 (NCH_2), 32.3 (CH_2Ar), 14.3 (SMe).

GC-MS (EI, 70 eV): *m/z* (%) = 340 (3) [M$^+$], 236 (100), 207 (12), 190 (10), 120 (11), 104 (29).

Anal. Calcd for $C_{19}H_{17}FN_2OS$: C, 67.04; H, 5.03; N, 8.23. Found: C, 66.71; H, 4.89; N, 8.19.

3-*sec*-Butyl-6-methyl-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (13a)

Brown oil; yield: 192 mg (91%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.95 (s, 1 H, H–5), 4.22–4.29 (m, 1 H, NCH), 2.52 (s, 3 H, SMe), 2.30–2.37 (m, 1 H, CH_2), 2.19 (s, 3 H, Me), 1.81–1.95 (m, 1 H, CH_2), 1.55 (d, *J* = 6.7 Hz, 3 H, Me), 0.86 (t, *J* = 7.5 Hz, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.1 (C-2), 161.6 (C-4), 161.2 (C-6), 109.2 (C-5), 59.2 (N–CH), 25.9 (CH_2), 23.2 (Me), 17.3 (CH_2), 15.6 (SMe), 11.2 (Me).

GC-MS (EI, 70 eV): *m/z* (%) = 212 (2) [M$^+$], 197 (49), 156 (100), 126 (9), 110 (27).

HRMS (ESI): *m/z* [M + Na] calcd for $C_{10}H_{16}N_2NaOS$: 235.0781; found: 235.0786.

3-*sec*-Butyl-2-(methylsulfanyl)-6-phenylpyrimidin-4(3*H*)-one (13b)

Yellow solid; yield: 241 mg (88%); mp 93–94 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.96–8.01 (m, 2 H, Ar), 7.43–7.46 (m, 3 H, Ar), 6.57 (s, 1 H, H–5), 4.30–4.34 (m, 1 H, NCH), 2.67 (s, 3 H, SMe), 2.31–2.42 (m, 1 H, CH_2), 1.86–1.99 (m, 1 H, CH_2), 1.61 (d, *J* = 6.6 Hz, 3 H, Me), 0.90 (t, *J* = 7.4 Hz, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.5 (C-2), 162.4 (C-4), 157.7 (C-6), 136.2 (C-Ar), 130.4 (C-Ar), 128.6 (CH-Ar), 126.7 (CH-Ar), 105.9 (C-5), 59.5 (N–CH), 26.0 (Me), 17.3 (CH_2), 15.8 (SMe), 11.3 (Me).

GC-MS (EI, 70 eV): *m/z* (%) = 274 (2) [M$^+$], 259 (40), 218 (100), 172 (17), 102 (8).

Anal. Calcd for $C_{15}H_{18}N_2OS$: C, 65.66; H, 6.61; N, 10.21. Found: C, 66.01; H, 6.29; N, 9.89.

3-*sec*-Butyl-2-(methylsulfanyl)-6-(4-tolyl)pyrimidin-4(3*H*)-one (13c)

Yellow solid; yield: 239 mg (83%); mp 69–71 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.87 (d, *J* = 8.1 Hz, 2 H, Ar), 7.24 (d, *J* = 7.9 Hz, 2 H, Ar), 6.52 (s, 1 H, H–5), 4.29–4.31 (m, 1 H, NCH), 2.65 (s, 3 H, SMe), 2.39 (s, 3 H, Me; 1 H, CH_2), 1.88–1.95 (m, 1 H, CH_2), 1.60 (d, *J* = 6.5 Hz, 3 H, Me), 0.89 (t, *J* = 7.4 Hz, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.6 (C-2), 162.2 (C-4), 157.7 (C-6), 140.7 (C-Ar), 133.4 (C-Ar), 129.3 (CH-Ar), 126.7 (CH-Ar), 105.2 (C-5), 59.4 (NCH), 26.0 (Me), 21.3 (M), 17.3 (CH_2), 15.9 (SMe), 11.3 (Me).

GC-MS (EI, 70 eV): *m/z* (%) = 288 (1) [M$^+$], 273 (34), 232 (100), 186 (18), 115 (20).

Anal. Calcd for $C_{16}H_{20}N_2OS$: C, 66.63; H, 6.99; N, 9.71. Found: C, 66.37; H, 6.73; N, 9.58.

3-*sec*-Butyl-6-(4-methoxyphenyl)-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (13d)

Brown solid; yield: 258 mg (85%); mp 108–110 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.93 (d, *J* = 8.9 Hz, 2 H, Ar), 6.94 (d, *J* = 8.8 Hz, 2 H, Ar), 6.47 (s, 1 H, H–5), 4.29–4.30 (m, 1 H, CH_2), 3.85 (s, 3 H, OMe), 2.65 (s, 3 H, SMe), 2.33–2.36 (m, 1 H, CH_2), 1.88–1.95 (m, 1 H, CH_2), 1.60 (d, *J* = 6.6 Hz, 3 H, Me), 0.89 (t, *J* = 7.4 Hz, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.3 (C-2), 161.7 (C-Ar), 161.2 (C-6), 157.1 (C-6), 128.3 (C-Ar), 128.0 (CH-Ar), 113.7 (CH-Ar), 104.1 (C-5), 59.1 (NCH), 55.0 (OMe), 25.7 (Me), 17.1 (CH_2), 15.5 (SMe), 11.01 (Me).

GC-MS (EI, 70 eV): *m/z* (%) = 304 (6) [M$^+$], 289 (49), 248 (100), 218 (12), 202 (17), 133 (14), 89 (7).

Anal. Calcd for $C_{16}H_{20}N_2O_2S$: C, 63.13; H, 6.62; N, 9.20. Found: C, 62.97; H, 6.38; N, 9.20.

3-*sec*-Butyl-6-(4-fluorophenyl)-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (13e)

Brown oil; yield: 263 mg (90%).

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.95–7.99 (m, 2 H, Ar), 7.12 (t, *J* = 8.7 Hz, 2 H, Ar), 6.50 (s, 1 H, H–5), 4.32–4.33 (m, 1 H, NCH), 2.66 (s, 3 H, SMe), 2.32–2.37 (m, 1 H, CH_2), 1.90–1.97 (m, 1 H, CH_2), 1.60 (d, *J* = 6.7 Hz, 3 H, Me), 0.90 (t, *J* = 7.4 Hz, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 164.2 (d, *J* = 250.9 Hz, C-Ar), 163.4 (C-2), 162.5 (C-4), 156.8 (C-6), 132.4 (d, *J* = 2.9 Hz, C-Ar), 128.7 (d, *J* = 8.6 Hz, CH-Ar), 115.6 (d, *J* = 21.6 Hz, CH-Ar), 105.5 (C-5), 59.6 (NCH), 26.0 (Me), 17.3 (CH_2), 15.8 (SMe), 11.3 (Me).

GC-MS (EI, 70 eV): *m/z* (%) = 292 (1) [M$^+$], 277 (27), 236 (100), 190 (19), 120 (18).

HRMS (ESI): *m/z* [M + Na] calcd for $C_{15}H_{17}FN_2NaOS$: 315.0944; found: 315.0948.

6-(4-Bromophenyl)-3-*sec*-butyl-2-(methylsulfanyl)pyrimidin-4(3*H*)-one (13f)

Beige solid; yield: 286 mg (81%); mp 97–98 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 (d, *J* = 8.6 Hz, 2 H, Ar), 7.57 (d, *J* = 8.6 Hz, 2 H, Ar), 6.53 (s, 1 H, H–5), 4.31–4.33 (m, 1 H, NCH), 2.65 (s, 3 H, SMe), 2.34–2.39 (m, 1 H, CH_2), 1.89–1.96 (m, 1 H, CH_2), 1.61 (d, *J* = 6.6 Hz, 3 H, Me), 0.90 (t, *J* = 7.4 Hz, 3 H, Me).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.3 (C-2), 162.7 (C-4), 156.7 (C-6), 135.2 (C-Ar), 131.8 (CH-Ar), 128.3 (CH-Ar), 124.9 (C-Ar), 105.9 (C-5), 59.6 (NCH), 26.0 (Me), 17.3 (CH_2), 15.9 (Me), 11.3 (Me).

GC-MS (EI, 70 eV): *m/z* (%) = 352 (1) [M$^+$], 339 (36), 296 (100), 252 (11), 182 (7).

Anal. Calcd for $C_{15}H_{17}BrN_2OS$: C, 51.00; H, 4.85; N, 7.93. Found: C, 51.32; H, 4.45; N, 8.13.

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