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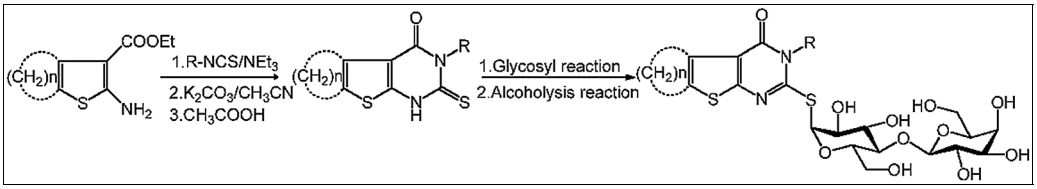
Received April 22, 2012
DOI 10.1002/jhet.1794
Published online 25 March 2014 in Wiley Online Library (wileyonlinelibrary.com).



The title compounds substituted 2-lactosylthiothieno[2,3-*d*]pyrimidin-4-ones **6** were synthesized by the glycosyl reaction and alcoholysis reaction of substituted 2-thioxo-thieno[2,3-*d*]pyrimidin-4-ones **4**,which is formed by the base catalytic and acetic acidify reaction of amino esters **2** with alkyl or arylisothiocyanates and hepta-*O*-acetyl-lactosyl bromide in good yields. All of the compounds were confirmed by NMR, ESI-MS, and elemental analysis.

J. Heterocyclic Chem., **51**, 1390 (2014).

INTRODUCTION

The derivatives of heterocycles containing thienopyrimidine system are of great significance as their remarkable biological activities [1]. For instance, some 2-alkyl/2-alkoxy/2-methylthio substituted thienopyrimidinones show important antimicrobial [2,3], antitumor [4], analgesic [5], antitrichinellosis, and antiprotozoal [6] activities, whereas others exhibited good anticonvulsant and angiotensin or H_1 receptor antagonistic activities [7–9].The new intermediates substituted 2-thioxo-thieno[2,3-d]pyrimidin-4-ones **4** were synthesized from easily accessible materials ethyl 2-amino-3-carboxythiophenes, which were synthesized by the Gewald reaction [10]. Recently, there are considerable interest in the preparation of *S*/*N*-glycoside analogs [11,12] as these species are promising building blocks for the synthesis of glycosyl heterocyclic compounds.

Recent years, our work has been concerned on the discovery and development of the synthesis of new heterocyclic compounds containing thienopyrimidine moiety in order to find new pharmacological or biologically active compounds. Our group has previously reported about the synthesis of novel tricyclic ring systems, containing the thienopyrimidine skeleton, with antibacterial and antifungal activity [13]. As a continuation of our study, the synthesis of some substituted 2-thioxo-thieno[2,3-d]pyrimidin-4-ones and their *S*-glycoside analogs was reported here.

RESULTS AND DISCUSSION

Amino esters **2** were obtained by means of a modified Gewald method from cyclopentanone or cyclohexanone **1**, ethyl 2-cyanoacetate, and sulfur in the presence of trithylamine (Scheme 1).

Compounds **2** were easily converted to thioureas **3** by treatment with ethyl/phenyl/naphthyl isothiocyanates in dry triethylamine solution in good yields [14,15].Intermediates **3** were changed to substituted 2-thioxo-thieno[2,3-*d*] pyrimidin-4-ones **4** after the base catalytic reaction and acetic acidify reaction in acetonitrile solution (Scheme 2).

Hepta-*O*-acetyl-lactosyl bromide was synthesized from the starting materials lactose according to the reference [16].We promoted the isolated yield from 52.5% to 87.6% by decreasing the reaction temperature to 0–5°C and increasing the reaction time.

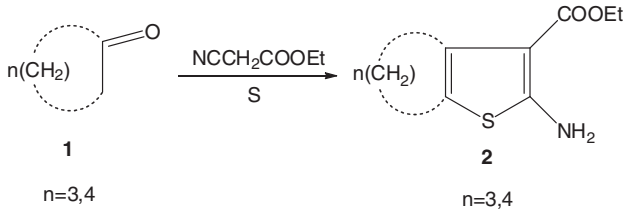
The thienopyrimidin-4-ones **4** reacted with hepta-*O*-acetyl-lactosyl bromide to give the protected glycosyl heterocyclic compounds **5** (Scheme 3) in acetonitrile solution with the catalyst of potassium carbonate. As the lager molecular weight and special space configuration of naphthyl and hepta-*O*-acetyl-lactosyl moiety, there were rotamer present in **5ac** and **5fc**, but that phenomenon has disappeared when the acetyl esters were alcoholysis.

When the compounds **5** undergone alcoholysis in methyl alcohol with equivalent ammonia water [17], the target precipitations **6** appeared. As many hydroxy found in the molecular structure, the splittings of ^{1}H NMR were not perfect. The peaks of the hydrogens in sugar ring except the hydroxy were between 3.0 and 4.0 ppm near the peeks of DMSO-d_6 solution. And we confirmed the accuracy by ^{13}C NMR, ESI-MS, and elemental analysis. What is more, we choose one of the compounds **6fb** to further verify by HSQC. The synthetic route to target compounds **6** was shown in Scheme 4.

EXPERIMENTAL

Measurements. Melting points were determined with an uncorrected X-4 Digital melting point apparatus (Beijing Tech

Scheme 1



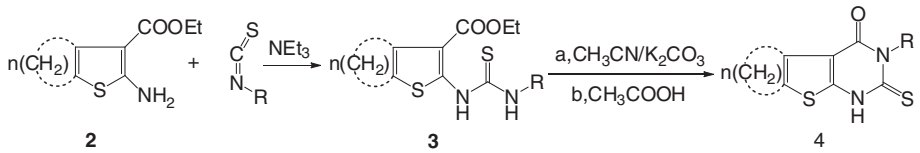
Instrument Co.,LTD. Beijing, China). NMR spectra were recorded in $CDCl_3$ or DMSO-d_6 on Bruker UltrashiedTM 400MHz (Bruker, Germany) or Varian Mercury 600MHz (Varian, USA) spectrometer, and resonances were given in ppm (δ) relative to TMS, and various 2D techniques and DEPT experiments were used to establish the structures and assign the signals. MS were measured on Finnigan Trace MS (EI-MS, 70eV, Finnigan, USA) or Bruker amaZon X&ETD MS (ESI-MS, Bruker, Germany) spectrometer. The purity of the compounds was confirmed by thin layer chromatography on silica gel HF254 (Merck).Unless otherwise noted, all reagents and materials were purchased from commercial suppliers and used without further purification. The solvents for the reactions were dried and distilled immediately before use.

Preparation of the thiourea intermediates 3. General procedure. A mixture of amino ester **2**(2 mmol) and isothiocyanate (2 mmol) in triethylamine (20 mL) was stirred at 70°C for 3 h, and then cooled to room temperature. The precipitate formed was collected and washed with ethanol to afford the thiourea intermediates **3** as an analytically pure crystalline solid.

Ethyl 2-(3-ethylthioureido)-5,6-dihydro-4H-cyclopenta[b] thiophene-3-carboxylate (3aa). This compound was obtained as brown crystals, mp 198–200°C; ^{1}H NMR (600 MHz, DMSO-d_6):δ 1.14 (s, 3H, CH_3), 1.30 (t, J = 12 Hz, 3H, CH_3), 2.28 (t, J = 12 Hz, 2H, CH_2), 2.76 (s, 2H, CH_2), 2.82 (s, 2H, CH_2), 3.41 (s, 2H, CH_2), 4.24–4.28 (m, 2H, CH_2), 9.42 (s, 1H, NH), 11.19 (s, 1H, NH); MS (EI, 70 eV): *m/z* (%) 299.4 (100), 298.1 (32), 210.7 (37), 165.6 (71), 164.2 (100), 104.2 (10). *Anal*. Calcd for $C_{13}H_{18}N_2O_2S_2$: C, 52.32; H, 6.08; N, 9.39. Found C, 52.18; H, 6.10; N, 9.40.

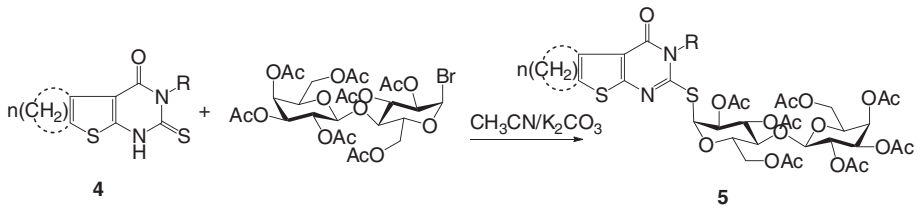
Ethyl 2-(3-phenylthioureido)-5,6-dihydro-4H-cyclopenta[b] thiophene-3-carboxylate (3ab). This compound was obtained as light yellow crystals, mp 173–174°C; ^{1}H NMR (600 MHz, DMSO-d_6): δ 1.27 (t, J = 18 Hz, 3H, CH_3), 2.28–2.33 (m, 2H, CH_2), 2.79 (t, J = 18 Hz, 2H, CH_2), 7.22–7.49 (m, 5H, 5CH),

Scheme 2



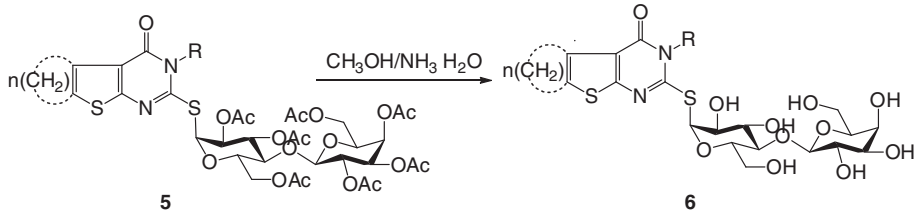
3aa,n=3,R=ethyl;3ab,n=3,R=phenyl;3ac,n=3,R=naphthyl.
3fa,n=4,R=ethyl;3fb,n=4,R=phenyl;3fc,n=4,R=naphthyl.
4aa,n=3,R=ethyl;4ab,n=3,R=phenyl;4ac,n=3,R=naphthyl.
4fa,n=4,R=ethyl;4fb,n=4,R=phenyl;4fc,n=4,R=naphthyl.

Scheme 3



5aa,n=3,R=ethyl;5ab,n=3,R=phenyl;5ac,n=3,R=naphthyl.
5fa,n=4,R=ethyl;5fb,n=4,R=phenyl;5fc,n=4,R=naphthyl.

Scheme 4



6aa,n=3,R=ethyl;6ab,n=3,R=phenyl;6ac,n=3,R=naphthyl.
6fa,n=4,R=ethyl;6fb,n=4,R=phenyl;6fc,n=4,R=naphthyl.

11.01 (s, 1H, NH), 11.57 (s, 1H, NH). *Anal*. Calcdfor $C_{17}H_{18}N_2O_2S_2$: C, 58.93; H, 5.24; N, 8.09. Found C, 59.11; H, 5.22; N, 8.06.

Ethyl 2-(3-(naphthalen-2-yl)thioureido)-5,6-dihydro-4H-cyclopenta[b]thio phene-3-carboxylate (3ac). This compound was obtained as light yellow crystals, mp 181–183°C; ^{1}H NMR (600 MHz, DMSO-d_6): δ 1.16 (m, 3H, CH_3), 2.27 (m, 2H, CH_2), 2.78–3.29 (m, 4H, $2CH_2$), 3.35–4.04 (m, 2H, CH_2), 7.56–7.61 (m, 4H, 4CH), 7.86–8.02 (m, 3H, 3CH), 11.05 (s, 1H, NH), 11.48 (s, 1H, NH); MS (EI, 70 eV): *m/z* (%) 396.4 (3), 211.2 (33), 185.2 (87), 165.2 (100), 127.2 (54), 77.3(60). *Anal*. Calcd for $C_{21}H_{20}N_2O_2S_2$: C, 63.01; H, 5.08; N, 7.01. Found C, 63.42; H, 5.09; N, 7.08.

Ethyl 2-(3-(naphthalen-2-yl)thioureido)-4,5,6,7-tetrahydrobenzo [b]thiophene-3-carboxylate (3fc). This compound was obtained as white crystals, mp 197–199°C; ^{1}H NMR (600 MHz, DMSO-d_6): δ 1.13 (s, 3H, CH_3), 1.66–1.70 (m, 4H, $2CH_2$), 2.50–2.63 (m, 4H, $2CH_2$), 4.01 (s, 2H, CH_2), 7.54–7.60 (m, 4H, 4CH), 7.86 (t, J = 9.6 Hz, 1H, CH), 7.97–8.02 (m, 2H, 2CH), 11.03 (s, 1H, NH), 11.73 (s, 1H, NH); MS (EI, 70 eV): *m/z* (%) 411.4 (8), 410.3 (36), 225.2 (89), 179.2 (100), 151.0 (48), 127.2 (29), 77.2 (17). *Anal*. Calcd for $C_{22}H_{22}N_2O_2S_2$: C, 64.36; H, 5.40; N, 6.82. Found C, 64.51; H, 5.41; N, 6.80.

Preparation of the substituted 2-thioxo-thieno[2,3-*d*] pyrimidin-4-ones 4. General procedure. A mixture of thiourea **3**(2 mmol) and potassium carbonate (0.28 g,2 mmol) in methanol solution(25 mL) was refluxed at 70°C for 2–3 h until the solid disappeared, and then cooled to room temperature. About 5 mL of acetic acid was added to the reaction mixture to precipitation completely. The precipitated crystals were filtered off, washed with water and ethanol, and dried to give intermediates **4**.

3-Ethyl-2-thioxo-2,3,6,7-tetrahydro-1H-cyclopenta[4,5]thieno [2,3-d]pyrimidin-4-one (4aa). This compound was obtained as gray crystals, mp 242–243°C; ^{1}H NMR (600 MHz, DMSO-d_6): δ 1.19 (t, J = 18 Hz, 3H, CH_3), 2.36 (d, J = 12 Hz, 2H, CH_2), 2.82 (s, 4H, $2CH_2$), 4.83 (d, J = 12 Hz, 2H, CH_2), 13.60 (s, 1H, NH); MS (EI, 70 eV): *m/z* (%) 253.3 (8), 252.2 (55), 165.1 (100), 109.2 (18), 104.2 (20). *Anal*. Calcd for $C_{11}H_{12}N_2OS_2$: C, 52.35; H, 4.79; N, 11.10. Found C, 52.51; H, 4.80; N, 11.08.

3-Phenyl-2-thioxo-2,3,6,7-tetrahydro-1H-cyclopenta[4,5]thieno [2,3-d]pyrimidin-4-one (4ab). This compound was obtained as white crystals, mp 241–242°C; ^{1}H NMR (600 MHz, DMSO-d_6): δ 2.36–2.39 (m, 2H, CH_2), 2.80 (t, J = 18 Hz, 2H, CH_2), 2.81 (t, J = 18 Hz, 2H, CH_2), 7.21–7.47 (m, 5H, 5CH), 13.70 (s, 1H, NH); MS (EI, 70 eV): *m/z* (%) 301.3 (7), 300.0 (49), 165.1 (100), 109.2 (24), 104.2 (21), 77.2 (95). *Anal*. Calcd for $C_{15}H_{12}N_2$ OS_2: C, 59.97; H, 3.95; N, 9.43. Found C, 60.12; H, 3.92; N, 9.40.

3-(Naphthalen-2-yl)-2-thioxo-2,3,6,7-tetrahydro-1H-cyclopenta [4,5]thieno[2,3-d]pyrimidin-4-one (4ac). This compound was obtained as white crystals, mp 250–252°C; ^{1}H NMR (600 MHz, DMSO-d_6): δ 2.38 (t, J = 12 Hz, 2H, CH_2), 2.79 (t, J = 12 Hz, 2H, CH_2), 2.79 (t, J = 12 Hz, 2H, CH_2), 2.87 (t, J = 12 Hz, 2H, CH_2), 7.45–7.61 (m, 5H, 5CH), 8.00 (t, J = 12 Hz, 2H, 2CH), 13.84 (s, 1H, NH); MS (EI, 70 eV): *m/z* (%) 351.3 (12), 350.1 (65), 185.2 (15), 165.1 (100), 127.2 (39), 77.2 (17). *Anal*. Calcd for $C_{19}H_{14}N_2OS_2$: C, 65.12; H, 4.03; N, 7.99. Found C, 64.98; H, 4.04; N, 7.97.

3-(Naphthalen-2-yl)-2-thioxo-2,3,5,6,7,8-hexahydrobenzo[4,5] thieno[2,3-d]pyrimidin-4-one (4fc). This compound was obtained as light yellow crystals, mp 258–259°C; ^{1}H NMR (600 MHz, DMSO-d_6): δ 1.70 (t, J = 8.4 Hz, 2H, CH_2), 1.78–1.80 (m, 2H, CH_2), 2.70–2.71 (d, J = 5.4 Hz, 4H, $2CH_2$), 7.44–7.61 (m, 5H, 5CH), 7.89–8.01 (m, 2H, 2CH), 13.80 (s, 1H, NH); MS (EI, 70 eV): *m/z* (%) 365.3 (19), 364.2 (100), 179.1 (71), 151.0 (25), 127.1 (12), 77.2 (6). *Anal*. Calcd for $C_{20}H_{16}N_2OS_2$: C, 65.91; H, 4.42; N, 7.69. Found C, 65.78; H, 4.41; N, 7.71.

Preparation of the substituted 2-hepta-*O*-acetyl-lactosylthio-thieno[2,3-*d*] pyrimidin-4(3*H*)-ones 5. General procedure. A mixture of intermediates **4**(2 mmol) and potassium carbonate (2 mmol) in acetonitrile solution (25 mL) was refluxed at 80°C for 2–3 h until the solid disappeared. If the solid does not disappear, add 2–3 drops of water dropwise. Then, hepta-*O*-acetyl-lactosyl bromide (1.54 g, 2.2 mmol) was added to the reaction system; another reflux of about 2–3 h was needed to complete the reaction. The solvent was evaporated under reduced pressure at 40°C, and the crude product was filtered off and washed with distilled water and ethanol to remove the formed KBr to give the products **5**.

3-Ethyl-2-(hepta-O-acetyl-lactosylthio)-2,3,6,7-tetrahydro-1H-cyclopenta[4,5]thieno[2,3-d]pyrimidin-4(3H)-one (5aa). This compound was obtained as gray crystals, mp 188–189°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.32 (t, 3H, J = 14 Hz, CH_3), 1.97 (s, 3H, CH_3), 2.03 (s, 3H, CH_3), 2.04 (s, 3H, CH_3), 2.07 (s, 3H, CH_3), 2.08 (s, 6H, $2CH_3$), 2.17 (s, 3H, CH_3), 2.41–2.48 (m, 2H, CH_2), 2.94 (t, 2H, J = 13.6 Hz, CH_2), 3.04 (t, 2H, J = 13.6 Hz, CH), 4.04–4.17 (m, 5H), 4.46 (d, 1H, J = 8.4 Hz, CH), 4.48 (d, 1H, J = 4.8 Hz, CH), 4.96 (dd, 1H, J = 7.2 Hz, 13.6 Hz, CH), 5.11–5.20 (m, 2H, 2CH), 5.32–5.38 (m, 2H, 2CH), 5.80 (d, 1H, J = 10.8 Hz, CH). ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.33, 170.12, 170.03, 169.75, 169.59, 169.14 [$(CH_3)\underline{C{=}O}$], 166.39 (C═O), 157.90 (C-S), 151.65, 140.13, 137.50, 117.12 (C, carbons of the thiophene), 101.07, 82.40, 77.13, 75.98, 73.79, 70.94, 70.70, 69.11, 69.00, 66.57 (CH, carbons of the sugar ring), 62.05, 60.80, 39.61, 29.52, 28.86, 27.87 (CH_2), 20.80, 20.73, 20.63, 20.46 [$(C{=}O)\underline{CH_3}$], 13.22 (CH_3); MS (ESI): *m/z* 871.2 $(M+H)^+$. *Anal*. Calcd for $C_{37}H_{46}N_2O_{18}S_2$: C, 51.03; H, 5.32; N, 3.22. Found C, 50.86; H, 5.34; N, 3.21.

3-Phenyl-2-(hepta-O-acetyl-lactosylthio)-2,3,6,7-tetrahydro-1H-cyclopenta[4,5]thieno[2,3-d]pyrimidin-4(3H)-one (5ab). This compound was obtained as white crystals, mp 202–203°C; ^{1}H NMR (400 MHz, $CDCl_3$):δ 1.96 (s, 6H, $2CH_3$), 2.02 (s, 3H, CH_3), 2.04 (s, 3H, CH_3), 2.05 (s, 3H, CH_3), 2.07 (s, 3H, CH_3), 2.15 (s, 3H, CH_3), 2.41–2.48 (m, 2H, CH_2), 2.96 (t, 2H, J = 16.8 Hz, CH_2), 3.00 (t, 2H, J = 15.6 Hz, CH_2), 3.74–3.82 (m, 2H, CH_2), 3.85 (t, 1H, J = 14 Hz, CH), 4.04–4.14 (m, 3H), 4.44–4.47 (m, 2H, 2CH), 4.92–4.99 (m, 2H, 2CH), 5.10 (dd, 1H, J = 2.4 Hz, 18 Hz, CH), 5.28 (t, 1H, J = 17.6 Hz, CH), 5.34 (d, 1H, J = 3.6 Hz, CH), 5.67 (d, 1H, J = 10.8 Hz, CH), 7.16–7.19 (m, 1H, CH), 7.29–7.32 (m, 1H, CH), 7.46–7.52 (m, 3H, 3CH), 7.29–7.32 (m, 1H, CH), 7.46–7.52 (m, 3H, 3CH). ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.33, 170.31, 170.10, 170.02, 169.63, 169.40, 169.13 [$(CH_3)\underline{C{=}O}$], 166.75 (C═O), 158.26 (C-S), 135.07 (C-N), 130.30, 129.80, 129.75, 129.16, 128.65 (CH, carbons of the benzene), 153.15, 140.55, 137.71, 117.40 (C, carbons of the thiophene), 101.04, 82.23, 77.11, 75.89, 73.93, 70.95, 70.68, 69.13, 69.04, 66.59 (CH, carbons of the sugar ring), 62.06, 60.79, 29.57, 28.82, 27.89, (CH_2), 20.82, 20.71, 20.60, 20.52, 20.45 [$(C{=}O)\underline{CH_3}$]; MS (ESI): *m/z* 919.2 $(M+H)^+$. *Anal*. Calcd for $C_{41}H_{46}N_2O_{18}S_2$: C, 53.59; H, 5.05; N, 3.05. Found C, 53.48; H, 5.07; N,3.06.

3-(Naphthalen-2-yl)-2-(hepta-O-acetyl-lactosylthio)-2,3,6,7-tetrahydro-1H-cyclopenta[4,5]thieno[2,3-d]pyrimidin-4(3H)-one (5ac). This compound was obtained as white crystals, mp 236–237°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.96 (s, 3H, CH_3),

1.97 (s, 3H, CH_3), 2.00 (s, 3H, CH_3), 2.04 (s, 3H, CH_3), 2.07 (s, 3H, CH_3), 2.09 (s, 3H, CH_3), 2.15 (s, 3H, CH_3), 2.43–2.49 (m, 2H, CH_2), 2.98–3.03 (m, 4H, $2CH_2$), 3.71–3.84 (m, 3H), 4.06–4.11 (m, 3H), 4.41–4.44 (m, 2H, 2CH), 4.77–4.96 (m, 2H, 2CH), 5.08–5.13 (m, 1H, CH), 5.22–5.29 (m, 1H, CH), 5.33 (t, 1H, $J = 2.4$ Hz, CH), 5.59–5.69 (m, 1H, CH), 7.38 (d, 1H, $J = 7.6$ Hz, CH), 7.34–7.59 (m, 4H, 4CH), 7.93 (d, 1H, $J = 7.6$ Hz, CH), 8.02 (d, 1H, $J = 8.4$ Hz, CH). ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.37, 170.31, 170.24, 170.10, 170.03, 169.65, 169.60, 169.36, 169.18, 169.11 (C═O), 158.15 (C-S), 134.46 (C-N), 131.79, 131.46, 131.10, 131.02, 129.64, 128.78, 128.57, 128.04, 127.95, 127.61, 127.49, 126.86, 126.59, 125.44, 125.31, 121.75, 121.24 (CH, carbons of the naphthlene), 153.81, 140.68, 137.90, 117.39 (C, carbons of the thiophene), 101.05, 100.96, 82.71, 75.88, 75.78, 73.86, 73.67, 70.90, 70.63, 69.06, 69.01, 68.84, 66.54 (CH, carbons of the sugar ring), 61.79, 60.73, 29.60, 28.85, 27.92 (CH_2), 20.88, 20.73, 20.64, 20.59, 20.46, 20.04 [(C═O)$\underline{CH_3}$]; MS (ESI): *m/z* 969.2 $(M + H)^+$. *Anal*. Calcd for $C_{45}H_{48}N_2O_{18}S_2$: C, 55.78; H, 4.99; N, 2.89. Found C, 56.01; H, 4.98; N, 2.88.

***3-Ethyl-2-(hepta-O-acetyl-lactosylthio)-2,3,5,6,7,8-hexahydrobenzo[4,5]thieno[2,3-d]pyrimidin-4(3H)*-one (5fa)**. This compound was obtained as gray crystals, mp 251–252°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.30 (t, 3H, $J = 14$ Hz, CH_3), 1.82–1.88 (m, 4H, $2CH_2$), 1.98 (s, 3H, CH_3), 2.05 (s, 6H, $2CH_3$), 2.07 (s, 3H, CH_3), 2.08 (s, 6H, $2CH_3$), 2.17 (s, 3H, CH_3), 2.75 (s, 2H, CH_2), 2.97 (d, 2H, $J = 5.6$ Hz, CH_2), 3.85 (d, 2H, $J = 5.2$ Hz, CH_2), 3.89 (t, 1H, $J = 13.6$ Hz, CH), 4.04–4.18 (m, 5H), 4.44–4.49 (m, 2H, 2CH), 4.96 (dd, 1H, $J = 6.8$ Hz, 14 Hz, CH), 5.11–5.20 (m, 2H, 2CH), 5.34–5.38 (m, 2H, 2CH), 5.80 (d, 1H, $J = 10.4$ Hz, CH). ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.37, 170.16, 170.07, 169.79, 169.63, 169.16 [(CH_3) $\underline{C═O}$], 161.46 (C═O), 158.06 (C-S), 151.97, 132.24, 131.39, 119.51 (C, carbons of the thiophene), 101.10, 82.41, 77.15, 76.01, 73.83, 70.99, 70.74, 69.17, 69.04, 66.62 (CH, carbons of the sugar ring), 62.09, 60.86, 39.51, 25.48, 25.14, 22.94, 22.25 (CH_2), 20.86, 20.78, 20.68, 20.52 [(C═O)$\underline{CH_3}$], 13.28 (CH_3); MS (ESI): *m/z* 885.2 $(M + H)^+$. *Anal*. Calcd for $C_{38}H_{48}N_2O_{18}S_2$: C, 51.58; H, 5.47; N, 3.17. Found C, 51.42; H, 5.49; N, 3.18.

3-Phenyl-2-(hepta-\O-acetyl-lactosylthio)-2,3,5,6,7,8-hexahydrobenzo[4,5]thieno[2,3-d]pyrimidin-4(3H)-one (5fb). This compound was obtained as white crystals, mp 228–229°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 1.81 (t, 2H, $J = 12.4$ Hz, CH_2), 1.88 (d, 2H, $J = 5.6$ Hz, CH_2), 1.97 (s, 6H, $2CH_3$), 2.03 (s, 3H, CH_3), 2.06 (s, 6H, $2CH_3$), 2.08 (s, 3H, CH_3), 2.16 (s, 3H, CH_3), 2.78 (s, 2H, CH_2), 2.93 (d, 2H, $J = 5.6$ Hz, CH_2), 3.75–3.82 (m, 2H, CH_2), 3.87 (t, 1H, $J = 14$ Hz, CH), 4.05–4.15 (m, 3H), 4.44–4.48 (m, 2H, 2CH), 4.93–4.99 (m, 2H, 2CH), 5.11 (dd, 1H, $J = 2.4$ Hz, 18.4 Hz, CH), 5.27–5.31 (m, 1H, CH), 5.35 (d, 1H, $J = 3.2$ Hz, CH), 5.69 (d, 1H, $J = 10.4$ Hz, CH), 7.18–7.19 (m, 1H, CH), 7.28–7.31 (m, 1H, CH), 7.48–7.53 (m, 3H, 3CH). ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.38, 170.36, 170.15, 170.06, 169.68, 169.44, 169.16 [(CH_3)$\underline{C═O}$], 161.86 (C═O), 158.46 (C-S), 135.15 (C-N), 130.29, 129.84, 129.81, 129.23, 128.74 (CH, carbons of the benzene), 153.44, 132.50, 131.79, 119.77 (C, carbons of the thiophene), 101.05, 82.20, 77.28, 75.89, 73.94, 70.97, 70.69, 69.14, 69.04, 66.61 (CH, carbons of the sugar ring), 62.08, 60.83, 25.35, 25.13, 22.95, 22.23 (CH_2), 20.89, 20.77, 20.68, 20.65, 20.58, 20.51 [(C═O)$\underline{CH_3}$]; MS (ESI): *m/z* 933.2 $(M + H)^+$. *Anal*. Calcd for $C_{42}H_{48}N_2O_{18}S_2$: C, 54.07; H, 5.19; N, 3.00. Found C, 54.21; H, 5.18; N, 3.01.

3-(Naphthalen-2-yl)-2-(hepta-O-acetyl-lactosylthio)-2,3,5,6,7,8-hexahydrobenzo[4,5]thieno[2,3-d]pyrimidin-4(3H)-one (5fc). This compound was obtained as white crystals, mp 233–234°C; ^{1}H NMR (400 MHz,$CDCl_3$): δ 1.81 (t, 2H, $J = 5.6$ Hz, CH_2), 1.89 (d, 2H, $J = 4$ Hz, CH_2), 1.96–2.15 (m, 21H, $7CH_3$), 2.81 (s, 2H, CH_2), 2.93 (s, 2H, CH_2), 3.68–3.85 (m, 3CH), 4.03–4.12 (m, 3H), 4.41–4.50 (m, 2H, 2CH), 4.76–4.88 (m, 1H, CH), 4.91–4.95 (m, 1H, CH), 5.08–5.12 (m, 1H, CH), 5.21–5.29 (m, 1H, CH), 5.33 (d, 1H, $J = 2$ Hz, CH), 5.59–5.69 (m, 1H, CH), 7.38 (d, 1H, $J = 9.2$ Hz, CH), 7.43–7.59 (m, 4H, 4CH), 7.93 (d, 1H, $J = 7.6$ Hz, CH), 8.01 (d, 1H, $J = 8.4$ Hz ,CH). ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.38, 170.34, 170.27, 170.20, 170.15, 170.08, 169.99, 169.61, 169.57, 169.34, 169.13, 169.08, 169.05 [(CH_3)$\underline{C═O}$], 162.11 (C═O), 158.27 (C-S), 134.45, 134.39 (C-N), 131.89, 131.85, 131.51, 131.03, 130.93, 129.68, 129.61, 128.85, 128.55, 128.07, 127.90, 127.56, 127.52, 126.83, 126.56, 125.44, 125.31, 121.78, 121.26 (CH, carbons of the naphthalene),154.46, 132.63, 131.87, 119.66 (C, carbons of the thiophene), 101.01, 100.93, 82.63, 82.10, 77.08, 76.88, 75.86, 75.75, 73.84, 73.67, 70.92, 70.59, 69.06, 68.97, 68.84, 66.53, 66.07 (CH, carbons of the sugar ring), 62.06, 61.77, 60.77, 60.73, 25.30, 25.12, 22.90, 22.16 (CH_2), 20.88, 20.72, 20.69, 20.67, 20.63, 20.58, 20.45, 20.04 [(C═O)$\underline{CH_3}$]; MS (ESI): *m/z* 983.2 $(M + H)^+$. *Anal*. Calcd for $C_{46}H_{50}N_2O_{18}S_2$: C, 56.20; H, 5.13; N, 2.85. Found C, 56.42; H, 5.10; N, 2.89.

Preparation of the substituted 2-lactosylthiothieno[2,3-*d*] pyrimidine-4(3*H*)-ones 6. General procedure. Treating intermediates **5**(2 mmol) and a small amount of ammonia water to a vigorously stirred solution of methanol at room temperature about 7–8 h to the precipitation is not increased. Then, the turbid liquid was filtered off and gave the target compounds **6**.

3-Ethyl-2-lactosylthio-2,3,6,7-tetrahydro-1H-cyclopenta[4,5]thieno[2,3-d]pyrimidin-4(3H)-one (6aa). This compound was obtained as white crystals, mp 193–195°C; ^{1}H NMR (400 MHz, DMSO-d_6): δ 1.24 (t, 3H, $J = 13.6$ Hz, CH_3), 2.38 (t, 2H, $J = 12$ Hz, CH_2), 2.90 (t, 4H, $J = 13.6$ Hz, $2CH_2$), 2.41–2.65 (m, 12H), 4.07 (t, 2H, $J = 6.4$ Hz, CH_2), 4.24 (d, 1H, $J = 6.8$ Hz, CH), 4.49–4.52 (m, 2H, 2OH), 4.63 (s, 1H, OH), 4.75 (d, 1H, $J = 4.4$ Hz, OH), 4.86 (s, 1H, OH), 5.06 (d, 1H, $J = 3.2$ Hz, OH), 5.46 (d, 1H, $J = 10.6$ Hz, CH), 5.66 (d, 1H, $J = 6.4$ Hz, OH). ^{13}C NMR (100 MHz, DMSO-d_6): δ 166.08 (C═O), 156.90 (C-S), 154.00, 139.33, 136.48, 115.97 (C, carbons of the thiophene), 103.74, 85.00, 79.78, 79.55, 76.53, 75.54, 73.16, 71.35, 70.56, 68.14 (CH, carbons of the sugar ring), 60.42, 59.96, 39.15, 29.03, 28.62, 27.33, (CH_2), 12.97 (CH_3); MS (ESI): *m/z* 621.4 $(M + 2Na - H)^+$. *Anal*. Calcd for $C_{23}H_{32}N_2O_{11}S_2$: C, 47. 91; H, 5.59; N, 4.86. Found C, 48.06; H, 5.57; N, 4.87.

3-Phenyl-2-lactosylthio-2,3,6,7-tetrahydro-1H-cyclopenta[4,5]thieno[2,3-d]pyrimidin-4(3H)-one (6ab). This compound was obtained as white crystals, mp 235–237°C; ^{1}H NMR (400 MHz, DMSO-d_6): δ 2.35–2.42 (m, 2H, CH_2), 2.87 (t, 2H, $J = 13.2$ Hz, CH_2), 2.93 (t, 2H, $J = 13.2$ Hz, CH_2), 3.11–3.64 (m, 12H), 4.20 (d, 1H, $J = 6.8$ Hz, CH), 4.54–4.57 (m, 2H, 2OH), 4.64–4.67 (m, 1H, OH), 4.81 (d,2H, $J = 1.6$ Hz, 2OH), 5.10 (d, 1H, $J = 4$ Hz, OH), 5.31 (d, 1H, $J = 10.4$ Hz, CH), 5.58 (d, 1H, $J = 6.4$ Hz, OH), 7.36–7.42 (m, 2H, 2CH), 7.56–7.58 (m, 3H, 3CH). ^{13}C NMR (100 MHz, DMSO-d_6): δ 166.47 (C═O), 157.28 (C-S), 135.56 (C-N), 130.30, 129.99, 129.66, 129.56, 129.27 (C, carbons of the benzene), 155.22, 139.62, 136.50, 116.42 (C, carbons of the thiophene), 103.73, 84.56, 79.76, 79.45, 76.54, 75.52, 73.16, 71.06, 70.55, 68.13 (CH, carbons of the sugar ring), 60.41, 59.93,

29.07, 28.63, 27.38 (CH_2); MS (ESI): *m/z* 669.4 $(M + 2Na - H)^+$. *Anal*. Calcd for $C_{27}H_{32}N_2O_{11}S_2$: C, 51.91; H, 5.16; N, 4.48. Found C, 51.78; H, 5.18; N, 4.49.

3-(Naphthalen-2-yl)-2-lactosylthio-2,3,6,7-tetrahydro-1H-cyclopenta[4,5]thieno[2,3-d]pyrimidin-4(3H)-one (6ac). This compound was obtained as white crystals, mp 230–231°C; ^{1}H NMR (400 MHz, DMSO-d_6): δ 2.36–2.43 (m, 2H, CH_2), 2.88 (t, 2H, *J* = 13.6 Hz, CH_2), 2.96 (t, 2H, *J* = 14 Hz, CH_2), 3.27–3.59 (m, 12H), 4.17 (d, 1H, *J* = 7.2 Hz, CH), 4.47 (t, 1H, *J* = 11. Hz, OH), 4.52 (d, 1H, *J* = 4.4 Hz, OH), 4.63 (t, 1H, *J* = 9.6 Hz, OH), 4.79 (d, 2H, *J* = 4.8 Hz, 2OH), 5.08 (d, 1H, *J* = 4 Hz, OH), 5.33 (d, 1H, *J* = 10.4 Hz, CH), 5.53 (d, 1H, *J* = 6.4 Hz, OH), 7.48 (d, 1H, *J* = 8.4 Hz, CH), 7.57–7.69 (m, 4H, 4CH), 8.10 (d, 1H, *J* = 7.6 Hz, CH), 8.16 (dd, 1H, *J* = 4.8 Hz, 9.2 Hz, CH). ^{13}C NMR (100 MHz, DMSO-d_6): δ 166.70 (C═O), 157.26 (C-S), 139.58, 136.68, 133.78, 129.19, 128.41, 128.07, 127.79, 126.71, 125.75, 121.76 (carbons of the naphthalene), 155.58, 132.02, 130.43, 116.30 (C, carbons of the thiophene), 103.64, 84.49, 79.80, 79.36, 76.39, 75.39, 73.04, 70.95, 70.44, 68.01 (CH, carbons of the sugar ring), 60.28, 59.96, 29.01, 28.55, 27.32 (CH2); MS (ESI): *m/z* 719.4 $(M + 2Na - H)^+$. *Anal*. Calcd for $C_{31}H_{34}N_2O_{11}S_2$: C, 55.18; H, 5.08; N, 4.15. Found C, 54.96; H, 5.10; N, 4.16.

3-Ethyl-2-lactosylthio-2,3,5,6,7,8-hexahydrobenzo[4,5]thieno[2,3-d]pyrimidin-4(3H)-one (6fa). This compound was obtained as white crystals, mp 183–185°C; ^{1}H NMR (400 MHz, DMSO-d_6): δ 1.23 (t, 3H, *J* = 14 Hz, CH_3), 1.76–1.81 (m, 4H, $2CH_2$), 2.72 (s, 2H, CH_2), 2.85 (s, 2H, CH_2), 3.31–3.64 (m, 12H), 4.02–4.08 (m, 2H, CH_2), 4.23 (d, 1H, *J* = 7.2 Hz, CH), 4.56–4.60 (m, 2H, 2OH), 4.69 (t, 1H, *J* = 7.2 Hz, OH), 4.83 (d, 1H, *J* = 5.2 Hz, OH), 4.89 (d, 1H, *J* = 1.6 Hz, OH), 5.13 (d, 1H, *J* = 4 Hz, OH), 5.45 (d, 1H, *J* = 10.4 Hz, CH), 5.73 (d, 1H, *J* = 6.4 Hz, OH); ^{13}C NMR (100 MHz, DMSO-d_6): δ 161.04 (C═O), 157.15 (C-S), 154.30, 131.25, 130.62, 118.32 (C, carbons of the thiophene), 103.76, 84.99, 79.78, 79.57, 76.55, 75.58, 73.20, 71.38, 70.60, 68.18 (CH, carbons of the sugar ring), 60.47, 59.99, 25.21, 24.46, 22.47, 21.77 (CH_2), 13.02 (CH_3); MS (ESI): *m/z* 635.4 $(M + 2Na - H)^+$. *Anal*. Calcd for $C_{24}H_{34}N_2O_{11}S_2$: C, 48.80; H, 5.80; N, 4.74. Found C, 48.98; H, 5.78; N, 4.75.

3-Phenyl-2-lactosylthio-2,3,5,6,7,8-hexahydrobenzo[4,5]thieno[2,3-d]pyrimidin-4(3H)-one (6fb). This compound was obtained as white crystals, mp 223–225°C; ^{1}H NMR (400 MHz, DMSO-d_6): δ 1.78 (t, 4H, *J* = 18 Hz, $2CH_2$), 2.75 (s, 2H, CH_2), 2.81 (s, 2H, CH_2), 3.09–3.64 (m, 12H), 4.21 (d, 1H, *J* = 6.4 Hz, CH), 4.49 (s, 2H, 2OH), 4.62 (s, 1H, OH), 4.75 (d, 1H, *J* = 3.6 Hz, OH), 4.79 (s, 1H, OH), 5.05 (d, 1H, *J* = 2.4 Hz, OH), 5.31 (d, 1H, *J* = 10.4 Hz, CH), 5.58 (d, 1H, *J* = 6 Hz, OH), 7.38 (t, 2H, *J* = 9.2 Hz, 2CH), 7.57 (t, 3H, *J* = 6 Hz, 3CH). ^{13}C NMR (100 MHz, DMSO-d_6): δ 161.33 (C═O), 157.40 (C-S), 135.49 (C-N), 129.85, 129.56, 129.45, 129.21 (CH, carbons of the benzene), 155.37, 131.19, 130.78, 118.61 (C, carbons of the thiophene), 103.62, 84.40, 79.64, 79.34, 76.44, 75.42, 73.06, 70.97, 70.46, 68.04 (CH, carbons of the sugar ring), 60.32, 59.58, 25.06, 24.34, 22.78, 21.64 (CH_2); MS (ESI): *m/z* 683.4 $(M + 2Na - H)^+$. *Anal*. Calcd for $C_{28}H_{34}N_2O_{11}S_2$: C, 52.65; H, 5.37; N, 4.39. Found C, 52.78; H, 5.35; N, 4.38.

3-(Naphthalen-2-yl)-2-lactosylthio-2,3,5,6,7,8-hexahydro benzo[4,5]thieno[2,3-d]pyrimidin-4(3H)-one (6fc). This compound was obtained as white crystals, mp 213–214°C; ^{1}H NMR (400 MHz, DMSO-d_6): δ 1.76–1.84 (m, 4H, $2CH_2$), 2.79 (d, 4H, *J* = 5.6 Hz, $2CH_2$), 3.03–3.64 (m, 12H), 4.18 (d, 1H, *J* = 7.2 Hz, CH), 4.36 (t, 1H, *J* = 11.6 Hz, OH), 4.41 (s, 1H, OH), 4.54 (s, 1H, OH), 4.66 (s, 1H, OH), 4.73 (s, 1H, OH), 4.98 (s, 1H, OH), 5.32 (d, 1H, *J* = 10.4 Hz, CH), 5.42 (d, 1H, *J* = 5.6 Hz, OH), 7.47 (d, 1H, *J* = 8 Hz, CH),7.54–7.69 (m, 4H, 4CH), 8.08 (d, 1H, *J* = 8 Hz, CH), 8.14 (d, 1H, *J* = 8 Hz, CH). ^{13}C NMR (100 MHz, DMSO-d_6): δ 161.68 (C═O), 157.44 (C-S), 133.81, 132.14, 130.33, 129.29, 128.37, 128.05, 127.71, 126.65, 125.69, 121.78 (carbons of the naphthalene), 155.89, 131.45, 130.88, 118.63 (C, carbons of thiophene), 103.14, 84.57, 79.86, 79.43, 76.45, 75.45, 73.14, 71.08, 70.54, 68.09 (CH, carbons of the sugar ring), 60.35, 60.18, 25.08, 24.42, 22.41, 21.67 (CH_2); MS (ESI): *m/z* 733.4 $(M + 2Na - H)^+$. *Anal*. Calcd for $C_{32}H_{36}N_2O_{11}S_2$: C, 55.80; H, 5.27; N, 4.07. Found C, 55.98; H, 5.28; N, 4.08.

Acknowledgments. We gratefully acknowledge the financial support of this work by the Science Foundation of Hubei Province Education Department, China (Project No. D20091301), Excellent Fund for Scientific Research, and Special Projects in China Three Gorges University, China (Project No. 2011CX088).

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