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A CONVENIENT SYNTHESIS OF 2-(ALKYL(OR ARYL)SULFANYL)-2*H*-1,4-BENZOTHIAZIN-3(4*H*)-ONE DERIVATIVES

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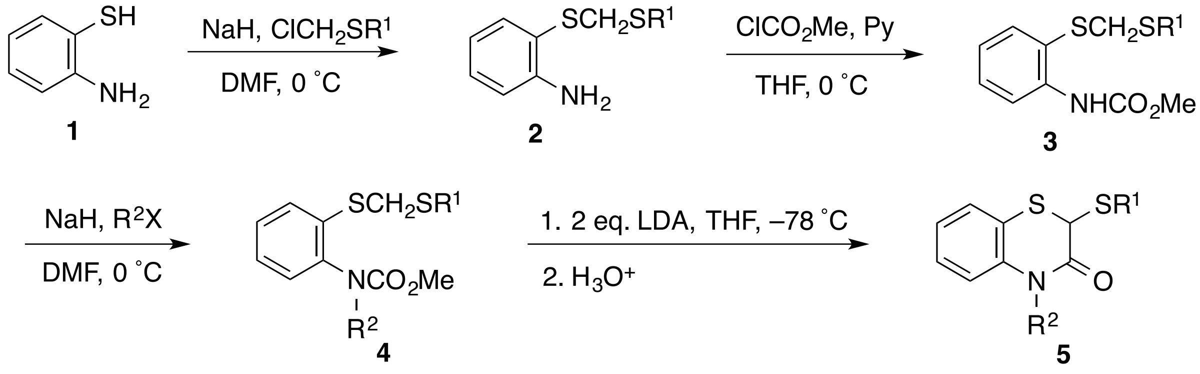
Abstract – A convenient method for the preparation of 2-(alkyl(or aryl)sulfanyl)-2*H*-1,4-benzothiazin-3(4*H*)-one derivatives has been developed. Thus, methyl alkyl(2-{[(alkyl(or aryl)sulfanyl)methyl]sulfanyl}phenyl)carbamates, derived from commercially available 2-aminobenzenethiol by an easily operated three-step sequence, are treated with two equivalents of lithium diisopropylamide (LDA) to generate carbanions stabilized by the adjacent two sulfur atoms, which immediately undergo 2*H*-1,4-benzothiazin-3(4*H*)-one ring formation by intramolecular attack onto the carbamate carbonyl accompanying elimination of methoxide. In addition, direct or stepwise introductions of alkyl groups to the 2-position are reported.

Some compounds having the 2*H*-1,4-benzothiazin-3(4*H*)-one skeleton have been reported to have interesting biological profile,[1] exhibiting, for example, analgesic[1a] and antitubercular[1d] activities. Traditionally, the 2*H*-1,4-benzothiazin-3(4*H*)-one structure has been constructed by the reaction of 2-aminobenzenethiols with α-haloalkanoic acid derivatives in the presence of a variety of mediators.[2] There have been a few reports on the syntheses of 2*H*-1,4-benzothiazin-3(4*H*)-ones in which an alkyl(or aryl)sulfanyl group is attached to the 2-position. This type of 2*H*-1,4-benzothiazin-3(4*H*)-ones are also of biological interest.[3] These derivatives have been conventionally prepared by 2-chlorination of 2*H*-1,4-benzothiazin-3(4*H*)-ones with appropriate chlorinating agents, followed by nucleophilic substitution with thiols.[3] However, these methods suffer from incomplete generality, cumbersome operations, and/or rather harsh reaction conditions. Accordingly, we were interested in developing a new method for the general preparation of 2-sulfanylated 2*H*-1,4-benzothiazin-3(4*H*)-ones. In this paper, we wish to report the results of our investigation, which offer facile route to 2-(alkyl(or aryl)sulfanyl)-2*H*-1,4-benzothiazin-3(4*H*)-ones (**5**). Our method involves formation of the 2*H*-1,4-benzothiazin-3(4*H*)-one structure by intramolecular cyclization of the carbanions stabilized by the adjacent two sulfur atoms of methyl alkyl(2-{[(alkyl(or aryl)sulfanyl)methyl]sulfanyl}phenyl)carbamates (**4**), which are generated on treatment with lithium diisopropylamide (LDA).[4] It is also reported that this strategy can be extended to the preparation of 2-alkylated 2-(alkyl(or aryl)sulfanyl)-2*H*-1,4-benzothiazin-3(4*H*)-ones (**6**) and (**7**). To the best of our knowledge, this is the first report which demonstrates a practical and general preparation of these classes of 2*H*-1,4-benzothiazin-3(4*H*)-ones.

The preparation of precursors (**4**) was achieved from commercially available 2-aminobenzenethiol (**1**) according to the easily operated three-step sequence illustrated in Scheme 1. Thus, successive treatment of compound (**1**) with sodium hydride and chloromethyl sulfides in DMF at 0 °C afforded the corresponding 2-{[(alkyl(or aryl)sulfanyl)methyl]sulfanyl}benzenamines (**2**) in excellent yields. These amines were then *N*-methoxycarbonylated smoothly and cleanly upon treatment with methyl chloroformate in THF in the presence of pyridine at 0 °C to give methyl 2-{[(alkyl(or aryl)sulfanyl)methyl]sulfanyl}phenylcarbamates (**3**) in good yields. *N*-Alkylation of these carbamates (**3**) by successive treatment with sodium hydride and alkyl halides in DMF at 0 °C provided **4** in good to excellent yields. These results are summarized in Table 1.



Scheme 1

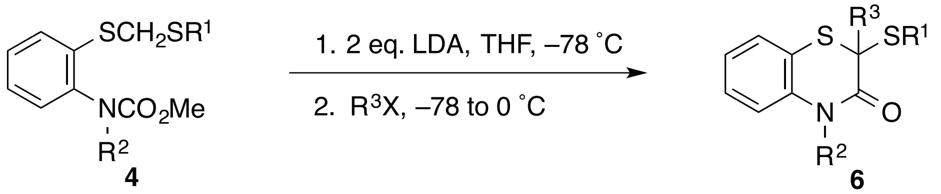
Table 1. Preparation of 2-sulfanylated 2*H*-1,4-benzothiazin-3(4*H*)-ones (**5**)

Entry	R^1	**2**	Yield/%[a]	**3**	Yield/%[a]	R^2X	**4**	Yield/%[a]	**5**	Yield/%[a]
1	Me	**2a**	93	**3a**	94	MeI	**4a**	97	**5a**	91
2						BnBr	**4b**	86	**5b**	77
3	*t*-Bu	**2b**	99	**3b**	77	BnBr	**4c**	82	**5c**	57
4	Ph	**2c**	98	**3c**	88	MeI	**4d**	83	**5d**	94
5	4-ClC_6H_4	**2d**	94	**3d**	79	BnBr	**4e**	95	**5e**	84

[a] Yields of isolated products.

The transformation of **4** into 2-(alkyl(or aryl)sulfanyl)-2*H*-1,4-benzothiazin-3(4*H*)-ones (**5**) is shown in Scheme 1 as well. When compounds (**4**) were treated with two equivalents of LDA in THF at –78 °C, deprotonation of one of the protons of the methylene between the two sulfur atoms followed by attack of the resulting sulfur-stabilized carbanion onto carbamate carbonyl accompanying elimination of methoxide occurred to afford, after aqueous workup and subsequent purification by column chromatography on silica gel, the desired products (**5**) in generally good yields, as compiled in Table 1 too. However, the cyclization of *tert*-butylsulfanyl substrate (**4c**) resulted in the formation of a somewhat complicated mixture of products, and diminished yield of the product (**5c**) was obtained (Entry 3), probably due to bulkier *tert*-butyl substituent. When an equimolar amount of LDA was used, a considerable amount of the starting material was recovered in each case.

As mentioned in the introduction part, 2-alkyl-2-(alkyl(or aryl)sulfanyl)-2*H*-1,4-benzothiazin-3(4*H*)-ones (**6**) and (**7**) could be obtained conveniently. First, the introduction of alkyl groups to the 2-position of the 2-alkyl(or aryl)sulfanyl-2*H*-1,4-benzothiazin-3(4*H*)-ones was envisaged to be achieved by adding alkyl halides prior to aqueous work up after the treatment of **4** with two equivalents of LDA. In practice, alkyl halides listed in Table 2 were used successfully to give **6** directly, as shown in Scheme 2. The table indicates that yields of the products were generally good, though those of **6e** and **6h** (Entries 5 and 8) are somewhat lower than the others. These results may be ascribed to the steric bulkiness of *tert*-butylsulfanyl group and the lower reactivity of ethyl iodide compared to the other alkyl halides, respectively.



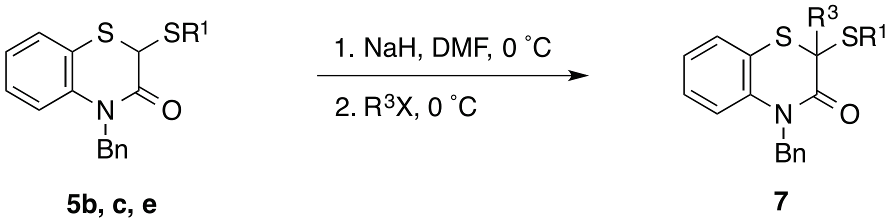
Scheme 2

Table 2. Preparation of 2-sulfanylated 2-alkyl-2*H*-1,4-benzothiazin-3(4*H*)-ones (**6**)

Entry	**4**	R^1	R^2	R^3X	**6**	Yield/%[a]
1	**4a**	Me	Me	MeI	**6a**	85
2	**4a**			CH_2=$CHCH_2Br$	**6b**	86
3	**4a**			BnBr	**6c**	81
4	**4b**	Me	Bn	MeI	**6d**	74
5	**4c**	*t*-Bu	Bn	MeI	**6e**	45
6	**4d**	Ph	Me	MeI	**6f**	70
7	**4d**			BnBr	**6g**	98
8	**4e**	4-ClC_6H_4	Bn	EtI	**6h**	40
9	**4e**			CH_2=$CHCH_2Br$	**6i**	65

[a] Yields of isolated products.

Attempts to obtain the corresponding 2-alkylated products in the same manner from **4** using *n*-butyl bromide, *tert*-butyl 2-bromoacetate, and chloromethyl sulfides proved to be unrewarding, probably due to the reactions of these halides with lithium methoxide formed during the reaction. Fortunately, however, these alkyl substituents could be introduced using a two-step procedure from **4**. Thus, compounds **5** were successively treated with sodium hydride and these halides in DMF at 0 ˚C to afford the desired 2-alkylated products **7**, as shown in Scheme 3. As listed in Table 3, the yields of the products are moderate to good.



Scheme 3

Table 3. Preparation of 2-sulfanylated 2-alkyl-2*H*-1,4-benzothiazin-3(4*H*)-ones (**7**)

Entry	5	R^1	R^3X	7	Yield/%[a]
1	**5b**	Me	$MeSCH_2Cl$	**7a**	86
2	**5b**		*t*-$BuOCOCH_2Br$	**7b**	78
3	**5c**	*t*-Bu	$PhSCH_2Cl$	**7c**	54
4	**5e**	4-ClC_6H_4	*n*-BuBr	**7d**	47
5	**5e**		*t*-$BuSCH_2Cl$	**7e**	52
6	**5e**		*t*-$BuOCOCH_2Br$	**7f**	71

[a] Yields of isolated products.

In conclusion, we have demonstrated that LDA-mediated cyclization of alkyl(2-{[(alkyl(or aryl)sulfanyl)methyl]sulfanyl}phenyl)carbamates opens up facile entry to 2-alkyl(or aryl)sulfanyl-2*H*-1,4-benzothiazin-3(4*H*)-ones and their 2-alkylated derivatives of potential biological interest. In comparison to the previously reported synthesis of 2*H*-1,4-benzothiazin-3(4*H*)-one derivatives, the advantages of the synthesis described here are that the reaction procedure is very simple and the reaction conditions are very mild. Applications of the present process to the synthesis of related heterocyclic derivatives are now in progress in our laboratory.

EXPERIMENTAL

All melting points were obtained on a Laboratory Devices MEL-TEMP II melting apparatus and are uncorrected. IR spectra were recorded with a Perkin–Elmer Spectrum 65 FTIR spectrophotometer. ^1H and ^{13}C NMR spectra were recorded in $CDCl_3$ using TMS as an internal reference with a JEOL ECP500 FT NMR spectrometer operating at 500 and 125 MHz, respectively. High-resolution MS spectra were measured by a Thermo Scientific Exactive spectrometer (ESI and DART, positive) or a JEOL JMS-T100GCV (EI or FI, TOF; 70eV or 2100V, respectively) spectrometer. Elemental analyses were performed with an Elementar Vario EL II instrument. TLC was carried out on Merck Kieselgel 60 PF_{254}. Column chromatography was performed using WAKO GEL C-200E. All of the organic solvents used in this study were dried over appropriate drying agents and distilled prior to use.

Starting Materials. 2-[(Chloromethyl)sulfanyl]-2-methylpropane[5] and 1-chloro-4-[(chloromethyl)sulfanyl]-benzene[6] were prepared according to the appropriate reported procedures. *n*-BuLi was supplied by Asia Lithium Corporation. All other chemicals used in this study were commercially available.

Typical Procedure for the Preparation of 2-[(Sulfanylmethyl)sulfanyl]benzenamines (2). 2-{[(Methylsulfanyl)methyl]sulfanyl}benzenamine (2a).[7] To a stirred suspicion of NaH (60% in mineral oil; 0.40 g, 10 mmol) in DMF (40 mL) at 0 °C was added 2-aminobenzenethiol (**1**) (1.3 g, 10 mmol) dropwise. After evolution of H_2 gas had ceased, $ClCH_2SMe$ (0.97 g, 10 mmol) was added dropwise and stirring was continued at the same temperature for 5 min before addition of saturated aqueous NH_4Cl (80 mL). The resulting mixture was extracted with AcOEt (3 × 30 mL) and the combined extracts were washed with H_2O (3 × 40 mL) and brine (30 mL), and dried (Na_2SO_4). Evaporation of the solvent gave a residue, which was purified by column chromatography on SiO_2 to afford **2a** (1.7 g, 93%): a brown oil; R_f 0.46 (Et_2O/hexane 1:5). The spectral (IR and ^1H NMR) data for this compound were identical to those reported previously.[7]

2-({[(1,1-Dimethylethyl)sulfanyl]methyl}sulfanyl)benzenamine (2b): a brown oil; R_f 0.38 (Et_2O/hexane 1:3); IR (neat) 3457, 3352, 1607 cm^{-1}; ^1H NMR δ 1.35 (s, 9H), 3.88 (s, 2H), 4.38 (br s, 2H), 6.70 (td, J = 7.4, 1.1 Hz, 1H), 6.73 (d, J = 8.0 Hz, 1H), 7.13 (ddd, J = 8.0, 7.4, 1.1 Hz, 1H), 7.43 (dd, J = 7.4, 1.1 Hz, 1H); ^{13}C NMR δ 31.0, 35.0, 43.8, 115.0, 117.9, 118.5, 130.3, 136.2, 148.3. HR-MS (DART). Calcd for $C_{11}H_{18}NS_2$ (M+H): 228.0880. Found: *m/z* 228.0870.

2-{[(Phenylsulfanyl)methyl]sulfanyl}benzenamine (2c): a brown oil; R_f 0.28 (CH_2Cl_2/hexane 1:3); IR (neat) 3458, 3360, 1606 cm^{-1}; ^1H NMR δ 4.19 (s, 2H), 4.29 (br s, 2H), 6.69 (t, J = 7.4 Hz, 1H), 6.71 (d, J = 8.0 Hz, 1H), 7.14 (ddd, J = 8.0, 7.4, 1.1 Hz, 1H), 7.24 (t, J = 7.4 Hz, 1H), 7.31 (t, J = 7.4 Hz, 2H); 7.39 (dd, J = 8.0, 1.1 Hz, 1H), 7.42 (d, J = 7.4 Hz, 2H); ^{13}C NMR δ 40.7, 115.3, 116.6, 118.5, 126.9, 129.0, 130.4, 130.6, 135.1, 136.8, 148.6. HR-MS (EI). Calcd for $C_{13}H_{13}NS_2$ (M): 247.0489. Found: *m/z* 247.0485.

2-({[(4-Chlorophenyl)sulfanyl]methyl}sulfanyl)benzenamine (2d): a brown oil; R_f 0.39 (Et_2O/hexane 1:3); IR (neat) 3459, 3360, 1606 cm^{-1}; ^1H NMR δ 4.16 (s, 2H), 4.29 (br s, 2H), 6.67–6.72 (m, 2H), 7.15 (dd, J = 7.0, 6.9 Hz, 1H), 7.27 (d, J = 8.6 Hz, 2H), 7.33 (d, J = 8.6 Hz, 2H), 7.37 (d, J = 8.0 Hz, 1H); ^{13}C NMR δ 40.7, 115.1, 116.3, 118.6, 129.1, 130.7, 131.8, 133.0, 133.6, 136.8, 148.6. Anal. Calcd for $C_{13}H_{12}ClNS_2$: C, 55.41; H, 4.29; N, 4.97. Found: C, 55.38; H, 4.52; N, 4.94.

Typical Procedure for the Preparation of Methyl Carbamates (3). Methyl (2-{[(Methylsulfanyl)methyl]sulfanyl}phenyl)carbamate (3a). To a stirred solution of **2a** (1.72 g, 9.3 mmol) in THF (25 mL) containing pyridine (0.69 g, 9.3 mmol) at 0 ˚C was added $ClCO_2Me$ (0.88 g, 9.3 mmol) dropwise. After 30 min, saturated aqueous NH_4Cl (30 mL) was added and the resulting mixture was extracted with AcOEt (3 × 25 mL). The combined extracts were washed with H_2O (2 × 20 mL) and brine (20 mL), dried (Na_2SO_4), and concentrated by evaporation. The residue was purified by column chromatography on SiO_2 to afford **3a** (2.1 g, 94%); a pale-yellow oil; R_f 0.25 (CH_2Cl_2/hexane 1:1); IR (neat) 3358, 1738 cm^{-1}; ^1H NMR δ 2.23 (s, 3H), 3.80 (s, 3H), 3.81 (s, 2H), 7.02 (td, *J* = 7.4, 1.1 Hz, 1H), 7.37 (td, *J* = 7.4, 1.1 Hz, 1H), 7.55 (dd, *J* = 7.4, 1.1 Hz, 1H), 8.01 (br s, 1H), 8.17 (d, *J* = 7.4 Hz, 1H); ^{13}C NMR δ 15.5, 42.7, 52.4, 118.6, 120.8, 123.1, 130.5, 136.3, 140.0, 153.8. HR-MS (EI). Calcd for $C_{10}H_{13}NO_2S_2$ (M): 243.0388. Found: *m/z* 243.0380.

Methyl [(2-{[(1,1-Dimethylethyl)sulfanyl]methyl}sulfanyl)phenyl]carbamate (3b): a pale-yellow oil; R_f 0.46 (CH_2Cl_2/hexane 1:4); IR (neat) 3359, 1741 cm^{-1}; ^1H NMR δ 1.35 (s, 9H), 3.80 (s, 3H), 3.86 (s, 2H), 7.02 (td, *J* = 7.4, 1.1 Hz, 1H), 7.35 (dd, *J* = 8.0, 7.4 Hz, 1H), 7.56 (d, *J* = 8.0 Hz, 1H), 8.02 (br s, 1H), 8.16 (d, *J* = 7.4 Hz, 1H); ^{13}C NMR δ 30.9, 36.8, 44.0, 52.3, 118.7, 122.0, 123.2, 130.4, 135.9, 139.9, 153.9. HR-MS (DART). Calcd for $C_{13}H_{20}NO_2S_2$ (M+H): 286.0925. Found: *m/z* 286.0922.

Methyl (2-{[(Phenylsulfanyl)methyl]sulfanyl}phenyl)carbamate (3c): a colorless oil; R_f 0.68 (CH_2Cl_2/hexane 1:4); IR (neat) 3359, 1738 cm^{-1}; ^1H NMR δ 3.76 (s, 3H), 4.17 (s, 2H), 7.00 (t, *J* = 7.4 Hz, 1H), 7.26 (dd, *J* = 7.4, 6.9 Hz, 1H), 7.32 (t, *J* = 7.4 Hz, 2H), 7.36 (t, *J* = 7.4 Hz, 1H), 7.39 (d, *J* = 7.4 Hz, 2H), 7.52 (dd, *J* = 6.9, 1.1 Hz, 1H), 7.87 (br s, 1H), 8.16 (d, *J* = 7.4 Hz, 1H); ^{13}C NMR δ 42.4, 52.3, 118.6, 120.6, 123.2, 127.2, 129.1, 130.5, 130.7, 134.3, 136.4, 140.2, 153.7. HR-MS (EI). Calcd for $C_{15}H_{15}NO_2S_2$ (M): 305.0544. Found: *m/z* 305.0553.

Methyl [2-({[(4-Chlorophenyl)sulfanyl]methyl}sulfanyl)phenyl]carbamate (3d): a white solid; mp 67–69 ˚C (hexane); IR (KBr) 3358, 1737 cm^{-1}; ^1H NMR δ 3.78 (s, 3H), 4.14 (s, 2H), 7.00 (t, *J* = 7.4 Hz, 1H), 7.28–7.32 (m, 4H), 7.36 (dd, *J* = 8.0, 7.4 Hz, 1H), 7.50 (d, *J* = 7.4 Hz, 1H), 7.78 (br s, 1H), 8.16 (d, *J* = 8.0 Hz, 1H); ^{13}C NMR δ 42.5, 52.4, 118.6, 120.3, 123.2, 129.3, 130.8, 131.9, 132.7, 133.4, 136.4, 140.3, 153.6. Anal. Calcd for $C_{15}H_{14}ClNO_2S_2$: C, 53.01; H, 4.15; N, 4.12. Found: C, 52.88; H, 4.25; N, 4.08.

Typical Procedure for *N*-Alkylation of Carbamates (3). Methyl Methyl(2-{[(methylsulfanyl)methyl]sulfanyl}phenyl)carbamate (4a). To a stirred suspension of NaH (60% in mineral oil; 0.18 g, 4.5 mmol) in DMF (20 mL) at 0 ˚C was added a solution of **3a** (1.1 g, 4.5 mmol) in THF (5 mL) dropwise. After evolution of H_2 gas had ceased, MeI (0.64 g, 4.5 mmol) was added dropwise and stirring was continued at the same temperature for 25 min. The resulting mixture was worked up as described for the preparation of **2a**. The crude product was purified by column chromatography on SiO_2

to afford **4a** (1.1 g, 97%); a pale-yellow oil; R_f 0.37 (CH_2Cl_2); IR (neat) 1712 cm^{-1}; ^{1}H NMR δ 2.23 (s, 3H), 3.23 (s, 3H), 3.64 and 3.80 (2s, combined 3H), 3.95 (d, *J* = 13.2 Hz, 1H), 4.01 (d, *J* = 13.2 Hz, 1H), 7.17 (d, *J* = 7.4 Hz, 1H), 7.25 (t, *J* = 7.4 Hz, 1H), 7.30 (t, *J* = 7.4 Hz, 1H), 7.46 (d, *J* = 7.4 Hz, 1H); ^{13}C NMR δ 15.2, 37.3, 38.7, 53.0, 127.3, 128.1, 128.2, 129.8, 134.8, 142.1, 156.2. HR-MS (EI). Calcd for $C_{11}H_{15}NO_2S_2$ (M): 257.0544. Found: *m/z* 257.0622.

Methyl (2-{[(Methylsulfanyl)methyl]sulfanyl}phenyl)(phenylmethyl)carbamate (4b): a colorless oil; R_f 0.44 (AcOEt/hexane 1:1); IR (neat) 1707 cm^{-1}; ^{1}H NMR δ 2.23 (s, 3H), 3.67 (s, 3H), 3.86 (d, *J* = 13.2 Hz, 1H), 3.91 (d, *J* = 13.2 Hz, 1H), 4.32 (d, *J* = 14.3 Hz, 1H), 5.24 (d, *J* = 14.3 Hz, 1H), 6.79 (d, *J* = 7.4 Hz, 1H), 7.09 (t, *J* = 7.4 Hz, 1H), 7.25–7.29 (m, 6H), 7.46 (d, *J* = 7.4 Hz, 1H); ^{13}C NMR δ 15.3, 38.7, 53.2, 55.4, 126.7, 127.5, 128.1, 128.3, 129.0, 129.5, 129.7, 135.1, 137.4, 140.2, 156.4. HR-MS (EI). Calcd for $C_{17}H_{19}NO_2S_2$ (M): 333.0857. Found: *m/z* 333.0852.

Methyl [(2-{[(1,1-Dimethylethyl)sulfanyl]methyl}sulfanyl)phenyl](phenylmethyl)carbamate (4c): a pale-yellow oil; R_f 0.25 (Et_2O/hexane 1:3); IR (neat) 1709 cm^{-1}; ^{1}H NMR δ 1.39 (s, 9H), 3.65 and 3.82 (2s, combined 3H), 4.09 (s, 2H), 4.29 (d, *J* = 14.3 Hz, 1H), 5.23 (d, *J* = 14.3 Hz, 1H), 6.75 (d, *J* = 7.4 Hz, 1H), 7.05 (t, *J* = 7.4 Hz, 1H), 7.23–7.27 (m, 6H), 7.45 (d, *J* = 7.4 Hz, 1H); ^{13}C NMR δ 31.0, 32.6, 44.0, 53.1, 53.3, 126.4, 127.4, 128.2, 128.3 (2 overlapped Cs), 128.9, 129.1, 129.6, 136.1, 137.5, 156.3. HR-MS (DART). Calcd for $C_{20}H_{26}NO_2S_2$ (M+H): 376.1405. Found: *m/z* 376.1390.

Methyl Methyl(2-{[(phenylsulfanyl)methyl]sulfanyl}phenyl)carbamate (4d): a pale-yellow oil; R_f 0.53 (AcOEt/hexane 1:2); IR (neat) 1712 cm^{-1}; ^{1}H NMR δ 3.16 (s, 3H), 3.59 and 3.77 (2s, combined 3H), 4.32 (s, 2H), 7.16 (d, *J* = 7.4 Hz, 1H), 7.25–7.32 (m, 5H), 7.42 (d, *J* = 7.4 Hz, 2H), 7.47 (d, *J* = 7.4 Hz, 1H); ^{13}C NMR δ 37.3, 38.8, 53.0, 60.4, 127.2, 127.5, 128.16, 128.23, 129.0, 129.8, 130.6, 134.8, 142.0, 156.2. HR-MS (EI). Calcd for $C_{16}H_{17}NO_2S_2$ (M): 319.0701. Found: *m/z* 319.0689.

Methyl [(2-{[(4-Chlorophenyl)sulfanyl]methyl}sulfanyl)phenyl](phenylmethyl)carbamate (4e): a pale-yellow oil; R_f 0.26 (Et_2O/hexane 1:3); IR (neat) 1705 cm^{-1}; ^{1}H NMR δ 3.62 and 3.82 (2s, combined 3H), 4.15 (s, 2H), 4.27 (d, *J* = 14.9 Hz, 1H), 5.14 (d, *J* = 14.9 Hz, 1H), 6.81 (d, *J* = 6.9 Hz, 1H), 7.11 (dd, *J* = 7.4, 6.9 Hz, 1H), 7.22–7.29 (m, 8H), 7.35 (d, *J* = 8.0 Hz, 2H), 7.45 (d, *J* = 7.4 Hz, 1H); ^{13}C NMR δ 39.0, 53.0, 53.4, 127.1, 127.4, 128.1, 128.2 (2 overlapped Cs), 129.0, 129.1, 129.6, 130.0, 131.8, 133.2, 134.6, 137.3, 140.3, 156.2. HR-MS (EI). Calcd for $C_{22}H_{20}ClNO_2S_2$ (M): 429.0624. Found: *m/z* 429.0617.

Typical Procedure for the Preparation of Benzothiazinones (5). 4-Methyl-2-(methylsulfanyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (5a). To a stirred solution of LDA (1.6 mmol), generated by the standard method from *n*-BuLi and *i*-Pr_2NH, in THF 6 mL at –78 °C was added a solution of **4a** (0.21 g, 0.80 mmol) in THF (2 mL) dropwise. After 10 min, the mixture was worked up as described for the preparation of **2a**. The crude product was purified by column chromatography on SiO_2 to afford **5a** (0.17 g, 91%); a pale-yellow oil; R_f 0.33 (AcOEt/hexane 1:5); IR (neat) 1663 cm^{-1}; ^{1}H NMR δ 2.21 (s, 3H), 3.49 (s, 3H), 4.52 (s, 1H), 7.07 (td, *J* = 7.4, 1.1 Hz, 1H), 7.11 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.31 (ddd, *J* = 8.0, 7.4, 1.1 Hz, 1H), 7.36 (dd, *J* = 8.0, 1.1 Hz, 1H); ^{13}C NMR δ 15.8, 32.3, 47.7, 117.1, 119.2, 123.6, 127.6, 129.1, 139.4, 163.1. HR-MS (EI). Calcd for $C_{10}H_{11}NOS_2$ (M): 225.0282. Found: *m/z* 225.0286.

2-(Methylsulfanyl)-4-(phenylmethyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (5b): a white solid; mp 71–73 °C (hexane); IR (KBr) 1656 cm^{-1}; ^{1}H NMR δ 2.24 (s, 3H), 4.58 (s, 1H), 4.87 (d, *J* = 16.6 Hz, 1H), 5.62 (d, *J* = 16.6 Hz, 1H), 6.99 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.03 (ddd, *J* = 8.0, 7.4, 1.1 Hz, 1H), 7.17 (ddd, *J* = 8.0, 7.4, 1.1 Hz, 1H), 7.23–7.27 (m, 3H), 7.33 (t, *J* = 7.4 Hz, 2H), 7.36 (dd, *J* = 8.0, 1.1 Hz, 1H); ^{13}C NMR δ 15.8, 47.6, 48.5, 117.5, 119.0, 123.8, 125.8, 127.2, 127.6, 128.8, 129.0, 136.5, 138.9, 162.9. HR-MS (EI). Calcd for $C_{16}H_{15}NOS_2$ (M): 301.0595. Found: *m/z* 301.0595. Anal. Calcd for $C_{16}H_{15}NOS_2$: C, 63.76; H, 5.02; N, 4.65. Found: C, 63.72; H, 5.09; N, 4.54.

2-[(1,1-Dimethylethyl)sulfanyl]-4-(phenylmethyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (5c): a colorless oil; R_f 0.33 (Et_2O/hexane 1:5); IR (neat) 1664 cm^{-1}; ^{1}H NMR δ 1.41 (s, 9H), 4.68 (s, 1H), 4.86 (d, *J* = 16.6 Hz, 1H), 5.58 (d, *J* = 16.6 Hz, 1H), 7.00 (d, *J* = 8.0 Hz, 1H), 7.02 (dd, *J* = 8.0, 7.4 Hz, 1H), 7.15 (ddd, *J* = 8.0, 7.4, 1.1 Hz, 1H), 7.23 (t, *J* = 7.4 Hz, 1H), 7.28 (d, *J* = 7.4 Hz, 2H), 7.32 (t, *J* = 7.4 Hz, 2H), 7.36 (dd, *J* = 8.0, 1.1 Hz, 1H); ^{13}C NMR δ 31.0, 44.3, 46.2, 48.7, 117.7, 119.9, 123.7, 126.1, 127.1, 127.7, 128.7, 129.4, 136.7, 139.3, 164.2. HR-MS (ESI). Calcd for $C_{19}H_{22}NOS_2$ (M+H): 344.1145. Found: *m/z* 344.1128.

4-Methyl-2-(phenylsulfanyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (5d): a white solid; mp 65–67 °C (hexane); IR (neat) 1666 cm^{-1}; ^{1}H NMR δ 3.44 (s, 3H), 4.87 (s, 1H), 7.07–7.11 (m, 2H), 7.28–7.33 (m, 4H), 7.37 (dd, *J* = 6.9, 1.1 Hz, 1H), 7.42–7.45 (m, 2H); ^{13}C NMR δ 32.3, 50.4, 117.2, 119.4, 123.7, 127.7, 128.9, 129.0, 129.2, 132.1, 134.0, 139.6, 162.7. HR-MS (EI). Calcd for $C_{15}H_{13}NOS_2$ (M): 287.0439. Found: *m/z* 287.0429. Anal. Calcd for $C_{15}H_{13}NOS_2$: C, 62.69; H, 4.56; N, 4.87. Found: C, 62.55; H, 4.58; N, 4.87.

2-[(4-Chlorophenyl)sulfanyl]-4-(phenylmethyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (5e): a pale-yellow solid; mp 124–126 °C (hexane/CH_2Cl_2); IR (KBr) 1642 cm^{-1}; ^{1}H NMR δ 4.88 (d, *J* = 16.0 Hz, 1H), 4.92 (s, 1H), 5.53 (d, *J* = 16.0 Hz, 1H), 7.03–7.07 (m, 2H), 7.17–7.27 (m, 6H), 7.31 (dd, *J* = 8.0, 7.4 Hz, 2H), 7.35 (dd, *J* = 7.4, 1.1 Hz, 1H), 7.40 (d, *J* = 8.6 Hz, 2H); ^{13}C NMR δ 48.8, 50.3, 117.8, 119.1, 124.0, 126.1, 127.3, 127.9, 128.8, 129.2, 129.3, 130.7, 134.8, 135.1, 136.4, 139.2, 162.6. HR-MS (EI). Calcd for $C_{21}H_{16}ClNOS_2$ (M): 397.0362. Found: *m/z* 397.0363. Anal. Calcd for $C_{21}H_{16}ClNOS_2$: C, 63.38; H, 4.05; N, 3.52. Found: C, 63.20; H, 4.16; N, 3.48.

Typical Procedure for the Preparation of 2-Alkylated 2*H*-1,4-Benzothiazin-3(4*H*)-ones (6). 2,4-Dimethyl-2-(methylsulfanyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (6a). Compound **2a** (0.21 g, 0.81 mmol) was treated with LDA (1.6 mmol) in THF (6 mL) as described for the preparation of **5a**. Then, MeI (0.11 g, 0.81 mmol) was added at the same temperature. After 30 min, the mixture was worked up as described for the preparation of **2a** and the residue was purified by column chromatography on SiO_2 to afford **6a** (1.7 g, 85%); a colorless oil; R_f 0.24 (AcOEt/hexane 1:10); IR (neat) 1661 cm^{-1}; ^1H NMR δ 1.89 (s, 3H), 2.03 (s, 3H), 3.50 (s, 3H), 7.06 (td, *J* = 7.4, 1.1 Hz, 1H), 7.09 (dd, *J* = 7.4, 1.1 Hz, 1H), 7.30–7.33 (m, 2H); ^{13}C NMR δ 13.3, 23.1, 33.0, 50.8, 116.7, 120.4, 123.3, 127.5, 128.1, 140.0, 165.6. HR-MS (EI). Calcd for $C_{11}H_{13}NOS_2$ (M): 239.0439. Found: *m/z* 239.0434.

4-Methyl-2-(methylsulfanyl)-2-(prop-2-enyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (6b): a pale-yellow oil; R_f 0.32 (AcOEt/hexane 1:7); IR (neat) 1659 cm^{-1}; ^1H NMR δ 2.00 (s, 3H), 3.00 (d, *J* = 6.9 Hz, 2H), 3.50 (s, 3H), 5.23 (d, *J* = 10.3 Hz, 1H), 5.26 (d, *J* = 19.5 Hz, 1H), 5.96–6.03 (m, 1H), 7.05 (t, *J* = 7.4 Hz, 1H), 7.06 (d, *J* = 7.4 Hz, 1H), 7.31 (t, *J* = 7.4 Hz, 1H), 7.32 (d, *J* = 7.4 Hz, 1H); ^{13}C NMR δ 13.6, 32.8, 39.2, 54.2, 116.4, 119.4, 119.7, 123.3, 127.5, 128.4, 132.3, 139.6, 164.8. HR-MS (EI). Calcd for $C_{13}H_{15}NOS_2$ (M): 265.0595. Found: *m/z* 265.0583.

4-Methyl-2-(methylsulfanyl)-2-(phenylmethyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (6c): a colorless viscous oil; R_f 0.29 (AcOEt/hexane 1:10); IR (neat) 1648 cm^{-1}; ^1H NMR δ 2.06 (s, 3H), 3.44 (d, *J* = 14.3 Hz, 1H), 3.50 (s, 3H), 3.68 (d, *J* = 14.3 Hz, 1H), 7.00 (td, *J* = 7.4, 1.1 Hz, 1H), 7.05 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.24 (dd, *J* = 7.4, 1.1 Hz, 1H), 7.26–7.34 (m, 4H), 7.39 (dd, *J* = 8.0, 1.1 Hz, 2H); ^{13}C NMR δ 14.0, 33.0, 40.6, 56.0, 116.3, 119.7, 123.9, 127.4, 127.9 (2 overlapped Cs), 128.4, 131.0, 135.2, 139.4, 165.0. HR-MS (EI). Calcd for $C_{17}H_{17}NOS_2$ (M): 315.0752. Found: *m/z* 315.0749. Anal. Calcd for $C_{17}H_{17}NOS_2$: C, 64.73; H, 5.43; N, 4.44. Found: C, 64.68; H, 5.53; N, 4.35.

2-Methyl-2-(methylsulfanyl)-4-(phenylmethyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (6d): a white solid; mp 90–92 °C (hexane); IR (KBr) 1661 cm^{-1}; ^1H NMR δ 1.92 (s, 3H), 2.06 (s, 3H), 4.84 (d, *J* = 16.6 Hz, 1H), 5.62 (d, *J* = 16.6 Hz, 1H), 6.98 (d, *J* = 8.0 Hz, 1H), 7.03 (t, *J* = 7.4 Hz, 1H), 7.18 (ddd, *J* = 8.0, 7.4, 1.1 Hz, 1H), 7.24–7.26 (m, 3H), 7.31–7.34 (m, 3H); ^{13}C NMR δ 13.1, 22.8, 49.4, 50.6, 117.1, 120.1, 123.5, 125.7, 127.1, 127.6, 128.0, 128.8, 137.0, 139.8, 165.3. HR-MS (FI). Calcd for $C_{17}H_{17}NOS_2$ (M): 315.0752. Found: *m/z* 315.0760.

2-[2-(1,1-Dimethylethyl)sulfanyl]-2-methyl-4-(phenylmethyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (6e): a pale-yellow oil; R_f 0.33 (AcOEt/hexane 1:20); IR (neat) 1660 cm^{-1}; ^1H NMR δ 1.31 (s, 9H), 2.12 (s, 3H), 5.19 (d, *J* = 16.6 Hz, 1H), 5.39 (d, *J* = 16.6 Hz, 1H), 6.99 (ddd, *J* = 8.0, 7.4, 1.1 Hz, 1H), 7.04 (d, *J* = 8.0 Hz, 1H), 7.16 (td, *J* = 7.4, 1.1 Hz, 1H), 7.20 (t, *J* = 7.4 Hz, 1H), 7.23–7.29 (m, 5H); ^{13}C NMR δ 26.4, 31.9, 48.6, 48.9, 51.6, 117.3, 121.4, 123.3, 126.6, 127.1, 127.4, 128.1, 128.6, 136.7, 139.4, 166.7. HR-MS (DART). Calcd for $C_{20}H_{24}NOS_2$ (M+H): 358.1299. Found: *m/z* 358.1285.

2,4-Dimethyl-2-(phenylsulfanyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (6f): a white solid; mp 113–115 °C (hexane); IR (KBr) 1659 cm^{-1}; ^{1}H NMR δ 1.82 (s, 3H), 3.45 (s, 3H), 7.08–7.11 (m, 2H), 7.28–7.38 (m, 7H); ^{13}C NMR δ 24.2, 33.0, 54.5, 116.8, 120.9, 123.3, 127.7, 128.2, 128.7, 129.8, 130.2, 136.7, 140.2, 165.2. HR-MS (EI). Calcd for $C_{16}H_{15}NOS_2$ (M): 301.0595. Found: *m/z* 301.0597. Anal. Calcd for $C_{16}H_{15}NOS_2$: C, 63.76; H, 5.02; N, 4.65. Found: C, 63.54; H, 4.95; N, 4.67.

4-Methyl-2-(phenylmethyl)-2-(phenylsulfanyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (6g): a pale-yellow viscous oil; R_f 0.23 (AcOEt/hexane 1:7); IR (neat) 1661 cm^{-1}; ^{1}H NMR δ 3.37 (s, 3H), 3.41 (d, *J* = 14.3 Hz, 1H), 3.83 (d, *J* = 14.3 Hz, 1H), 7.00–7.04 (m, 2H), 7.26–7.37 (m, 10H), 7.44 (d, *J* = 6.3 Hz, 2H); ^{13}C NMRδ 32.8, 42.4, 60.1, 116.3, 120.4, 123.2, 127.4, 127.5, 127.9, 128.5, 128.7, 129.8, 130.7, 131.1, 135.6, 136.5, 139.5, 164.3. HR-MS (ESI). Calcd for $C_{22}H_{19}NNaOS_2$ (M+Na): 400.0806. Found: *m/z* 400.0802. Anal. Calcd for $C_{22}H_{19}NOS_2$: C, 69.99; H, 5.07; N, 3.71. Found: C, 70.03; H, 5.11; N, 3.64.

2-[(4-Chlorophenyl)sulfanyl]-2-ethyl-4-(phenylmethyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (6h): a colorless oil; R_f 0.36 (AcOEt/hexane 1:30); IR (neat) 1661 cm^{-1}; ^{1}H NMR δ 1.17 (t, *J* = 7.4 Hz, 3H), 2.03–2.10 (m, 1H), 2.23–2.30 (m, 1H), 5.05 (d, *J* = 16.6 Hz, 1H), 5.39 (d, *J* = 16.6 Hz, 1H), 7.03 (t, *J* = 7.4 Hz, 1H), 7.08 (d, *J* = 8.6 Hz, 1H), 7.18 (d, *J* = 8.6 Hz, 2H), 7.21 (d, *J* = 8.6 Hz, 2H), 7.24–7.35 (m, 7H); ^{13}C NMR δ 9.3, 28.8, 49.3, 59.7, 117.3, 119.9, 123.6, 126.6, 127.2, 127.7, 128.5, 128.7, 128.88, 128.92, 135.9, 136.8, 137.3, 139.4, 165.0. HR-MS (DART). Calcd for $C_{23}H_{21}ClNOS_2$ (M+H): 426.0753. Found: *m/z* 426.0735.

2-[(4-Chlorophenyl)sulfanyl]-4-(phenylmethyl)-2-(prop-2-enyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (6i): a colorless oil; R_f 0.34 (AcOEt/hexane 1:20); IR (neat) 1662 cm^{-1}; ^{1}H NMR δ 2.78 (dd, *J* = 14.9, 7.4 Hz, 1H), 3.02 (dd, *J* = 14.9, 6.9 Hz, 1H), 5.04 (d, *J* = 16.6 Hz, 1H), 5.19–5.23 (m, 2H), 5.41 (d, *J* = 16.6 Hz, 1H), 5.98–6.06 (m, 1H), 7.05 (t, *J* = 7.4 Hz, 1H), 7.10 (d, 8.0 Hz, 1H), 7.19 (d, *J* = 8.6 Hz, 2H), 7.22 (d, *J* = 8.6 Hz, 2H), 7.26–7.34 (m, 7H); ^{13}C NMR δ 40.2, 49.4, 57.7, 117.3, 119.8, 120.0, 123.7, 126.6, 127.3, 127.8, 128.5, 128.6, 128.7, 129.0, 132.2, 136.1, 136.7, 137.4, 139.4, 164.6. HR-MS (DART). Calcd for $C_{24}H_{21}ClNOS_2$ (M+H): 438.0753. Found: *m/z* 438.0735.

Typical Procedure for the Preparation of 2-Alkylated 2*H*-1,4-Benzothiazin-3(4*H*)-ones (7). 2-(Methylsulfanyl)-2-[(methylsulfanyl)methyl]-4-(phenylmethyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (7a). To a stirred suspension of NaH (60% in mineral oil; 23 mg, 0.57 mmol) in DMF (4 mL) at 0 °C was added dropwise a solution of **5b** (0.17 g, 0.57 mmol) in DMF (1 mL). After evolution of H_2 gas had ceased, $ClCH_2SMe$ (55 mg, 0.57 mmol) was added and stirring was continued for 5 min at the same temperature. The mixture was worked up as described for the preparation of **2a** and the residue was purified by column chromatography on SiO_2 to afford **7a** (0.18 g, 86%); a yellow oil; R_f 0.48 (AcOEt/hexane 1:5); IR (neat) 1655 cm^{-1}; ^{1}H NMR δ 2.04 (s, 3H), 2.31 (s, 3H), 3.30 (d, *J* = 13.7 Hz, 1H), 3.60 (d, *J* = 13.7 Hz, 1H), 4.86 (d, *J* = 16.6 Hz, 1H), 5.62 (d, *J* = 16.6 Hz, 1H), 6.98 (d, *J* = 8.0 Hz, 1H), 7.04 (t, *J* = 7.4 Hz, 1H), 7.18 (dd, *J* = 8.0, 7.4 Hz, 1H), 7.23–7.26 (m, 3H), 7.32 (dd, *J* = 8.0, 7.4 Hz, 2H), 7.37 (d, *J* = 7.4 Hz, 1H); ^{13}C NMR δ 13.6, 18.5, 40.0, 49.4, 56.8, 117.0, 119.3, 123.7, 125.7, 127.2, 127.6, 128.4, 128.8, 136.8, 139.0, 164.1. HR-MS (FI). Calcd for $C_{18}H_{19}NOS_3$ (M): 361.0629. Found: *m/z* 361.0640.

1,1-Dimethylethyl 2-[2-(Methylsulfanyl)-3-oxo-4-(phenylmethyl)-2*H*-1,4-benzothiazin-2-yl]acetate (7b): a yellow viscous oil; R_f 0.33 (AcOEt/hexane 1:5); IR (neat) 1733, 1660 cm^{-1}; ^{1}H NMR δ 1.50 (s, 9H), 2.06 (s, 3H), 3.18 (d, *J* = 15.5 Hz, 1H), 3.23 (d, *J* = 15.5 Hz, 1H), 4.84 (d, *J* = 12.0 Hz, 1H), 4.87 (d, *J* = 12.0 Hz, 1H), 6.96 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.03 (ddd, *J* = 8.0, 7.4, 1.1 Hz, 1H), 7.16 (ddd, *J* = 8.0, 7.4, 1.7 Hz, 1H), 7.22–7.26 (m, 3H), 7.32 (t, *J* = 7.4 Hz, 2H), 7.36 (dd, *J* = 8.0, 1.7 Hz, 1H); ^{13}C NMR δ 13.9, 28.0, 40.9, 49.4, 51.6, 81.7, 116.9, 119.4, 123.6, 125.7, 125.8, 127.1, 127.5, 128.2, 136.9, 139.0, 163.8, 168.1. HR-MS (ESI). Calcd for $C_{22}H_{25}NNaO_3S_2$ (M+Na): 438.1174. Found: *m/z* 438.1170.

2-[2-(1,1-Dimethylethyl)sulfanyl]-4-(phenylmethyl)-2-[(phenylsulfanyl)methyl]-2*H*-1,4-benzothiazin-3(4*H*)-one (7c): a yellow oil; R_f 0.28 (AcOEt/hexane 1:20); IR (neat) 1652 cm^{-1}; ^{1}H NMR δ 1.30 (s, 9H), 3.99 (d, *J* = 13.7 Hz, 1H), 4.20 (d, *J* = 13.7 Hz, 1H), 5.03 (d, *J* = 16.6 Hz, 1H), 5.62 (d, *J* = 16.6 Hz, 1H), 6.98 (t, *J* = 7.4 Hz, 1H), 7.07 (d, *J* = 8.0 Hz, 1H), 7.16 (dd, *J* = 8.0, 7.4 Hz, 1H), 7.20–7.32 (m, 9H), 7.52 (d, *J* = 8.0 Hz, 2H); ^{13}C NMR δ 31.6, 44.0, 48.2, 49.5, 57.9, 117.4, 121.2, 123.6, 126.6, 126.9, 127.2, 127.3, 128.58, 128.62, 129.0, 130.7, 136.3, 137.2, 138.2, 165.5. HR-MS (ESI). Calcd for $C_{26}H_{27}NNaOS_2$ (M+Na): 488.1153. Found: *m/z* 488.1138.

2-Butyl-2-[(4-chlorophenyl)sulfanyl]-4-(phenylmethyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (7d): a colorless gum; R_f 0.35 (Et_2O/hexane 1:15); IR (neat) 1659 cm^{-1}; ^{1}H NMR δ 0.90 (t, *J* = 7.4 Hz, 3H), 1.25–1.39 (m, 2H), 1.53–1.70 (m, 2H), 1.97–2.03 (m, 1H), 2.17–2.23 (m, 1H), 5.04 (d, *J* = 16.0 Hz, 1H), 5.38 (d, *J* = 16.0 Hz, 1H), 6.99–7.11 (m, 4H), 7.15–7.34 (m, 7H), 7.52 (d, *J* = 8.6 Hz, 2H); ^{13}C NMR δ 13.9, 22.6, 26.9, 35.4, 49.3, 59.2, 117.3, 117.6, 123.9, 126.6, 126.7, 127.4, 127.7, 127.8, 128.7, 128.9, 136.3, 136.5, 137.4, 139.3, 166.4. HR-MS (DART). Calcd for $C_{25}H_{25}ClNOS_2$ (M+H): 454.1066. Found: *m/z* 454.1050.

2-[(4-Chlorophenyl)sulfanyl]-2-{[2-(1,1-dimethylethyl)sulfanyl]methyl}-4-(phenylmethyl)-2*H*-1,4-benzothiazin-3(4*H*)-one (7e): a colorless gum; R_f 0.35 (AcOEt/hexane 1:15); IR (neat) 1659 cm^{-1}; ^{1}H NMR δ 1.33 (s, 9H), 3.24 (d, *J* = 13.2 Hz, 1H), 3.28 (d, *J* = 13.2 Hz, 1H), 5.03 (d, *J* = 16.0 Hz, 1H), 5.41 (d, *J* = 16.0 Hz, 1H), 7.05 (t, *J* = 7.4 Hz, 1H), 7.12 (d, *J* = 8.0 Hz, 1H), 7.18 (d, *J* = 8.6 Hz, 2H), 7.22 (dd, *J* = 8.0, 7.4 Hz, 1H), 7.27–7.31 (m, 3H), 7.31–7.34 (m, 4H), 7.36 (dd, *J* = 7.4, 1.1 Hz, 1H); ^{13}C NMR δ 30.9, 34.3, 42.9, 49.5, 58.6, 117.3, 119.9, 123.8, 126.8, 127.4, 127.8, 128.3, 128.70, 128.73, 129.0, 136.3,

136.7, 137.6, 139.1, 164.4. HR-MS (DART). Calcd for $C_{26}H_{27}ClNOS_3$ (M+H): 500.0943. Found: *m/z* 500.0922.

1,1-Dimethylethyl 2-{2-[(4-Chlorophenyl)sulfanyl]-3-oxo-4-(phenylmethyl)-2*H*-1,4-benzothiazin-2-yl}acetate (7f): a colorless gum; R_f 0.29 (Et_2O/hexane 1:5); IR (neat) 1734, 1663 cm^{-1}; ^1H NMR δ 1.49 (s, 9H), 3.00 (d, *J* = 16.0 Hz, 1H), 3.17 (d, *J* = 16.0 Hz, 1H), 5.06 (d, *J* = 16.6 Hz, 1H), 5.36 (d, *J* = 16.6 Hz, 1H), 7.02 (t, *J* = 7.4 Hz, 1H), 7.10 (d, *J* = 8.0 Hz, 1H), 7.21 (d, *J* = 8.6 Hz, 2H), 7.25–7.36 (m, 9H); ^{13}C NMR δ 28.1, 42.0, 49.4, 55.9, 81.8, 117.3, 120.3, 123.7, 126.8, 127.3, 127.7, 128.3, 128.4, 128.7, 129.1, 136.5, 136.5, 137.9, 139.0, 163.9, 167.9. HR-MS (ESI). Calcd for $C_{27}H_{26}NNaO_3S_2$ (M+Na): 534.0941. Found: *m/z* 534.0919.

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