Discovery of 5,6-diaryl-1,2,4-triazines hybrids as potential apoptosis inducers

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•Structure confirmation of 5,6-diaryl-1,2,4-triazines 10A-10C

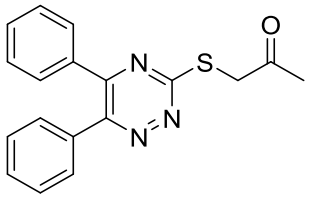
•Synthetic method and structure confirmation of azides 11a-11l

•Structure confirmation of 5,6-diaryl-1,2,4-triazine-triazole derivatives 11A-11L

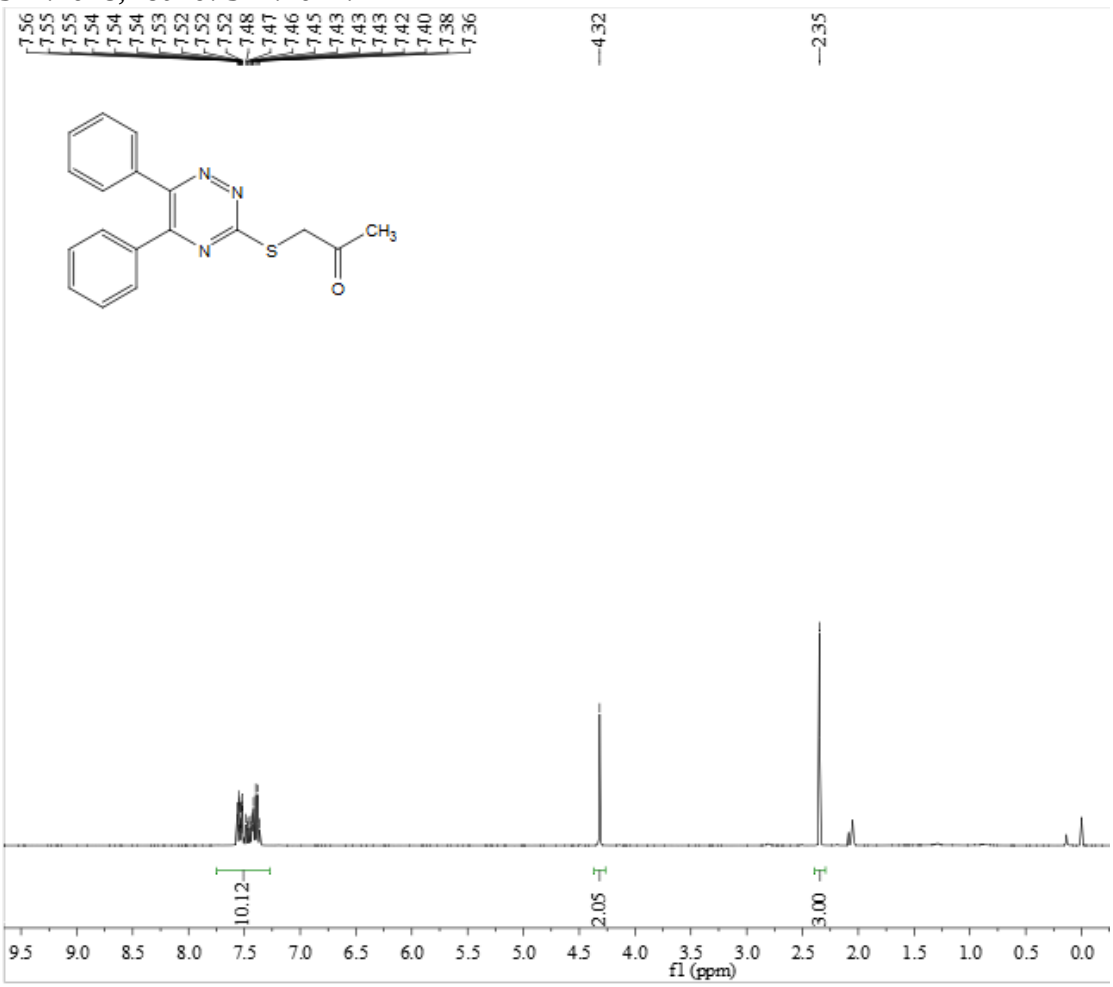
•References

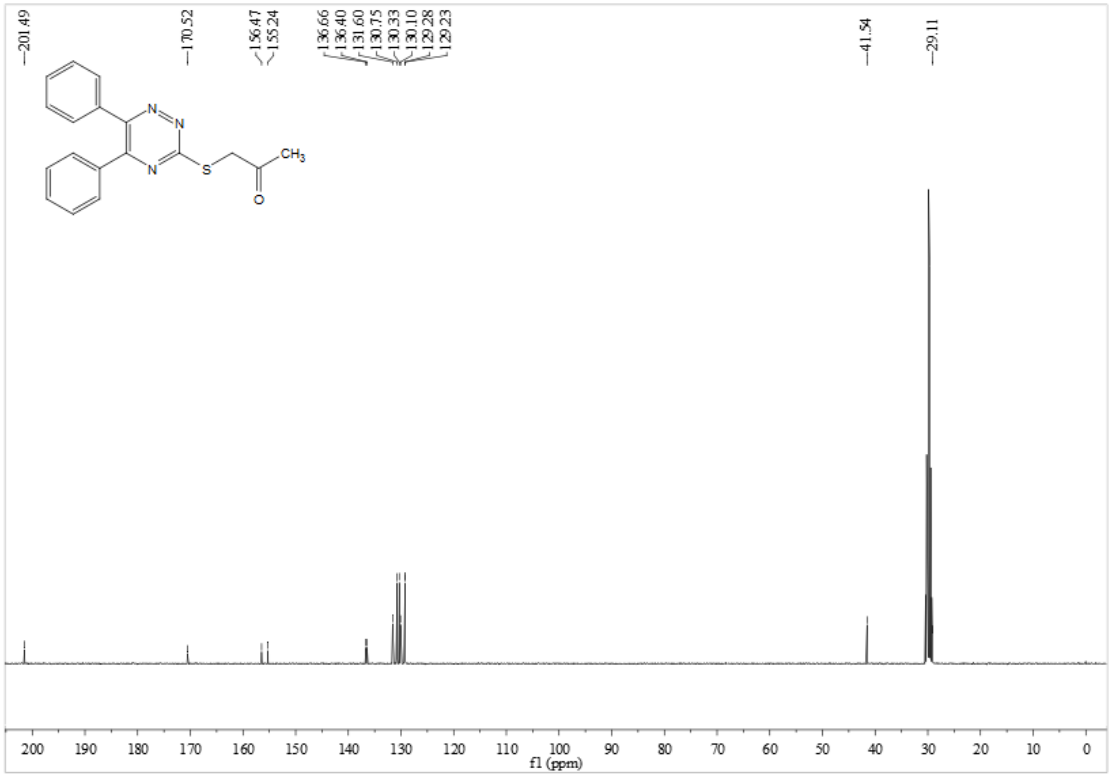
•Structure confirmation of 5,6-diaryl-1,2,4-triazines 10A-10C

1-((5,6-diphenyl-1,2,4-triazin-3-yl)thio)propan-2-one (**10A**)

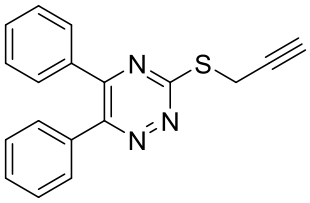


Light yellow solid; Mp:102~104 ^{0}C; Yield: 35%. ^{1}H NMR (400 MHz, Acetone-d^{6}) δ 7.75 – 7.27 (m, 10H), 4.32 (s, 2H), 2.35 (s, 3H). ^{13}C NMR (100 MHz, DMSO-d^{6}) δ 201.49, 170.52, 156.47, 155.24, 136.66, 136.40, 131.60, 130.75, 130.33, 130.10, 129.28, 129.23, 41.54, 29.11. HR-MS (ESI): Calcd. $C_{18}H_{16}N_3OS$, $[M+H]^+$m/z: 322.1018, found: 322.1014.

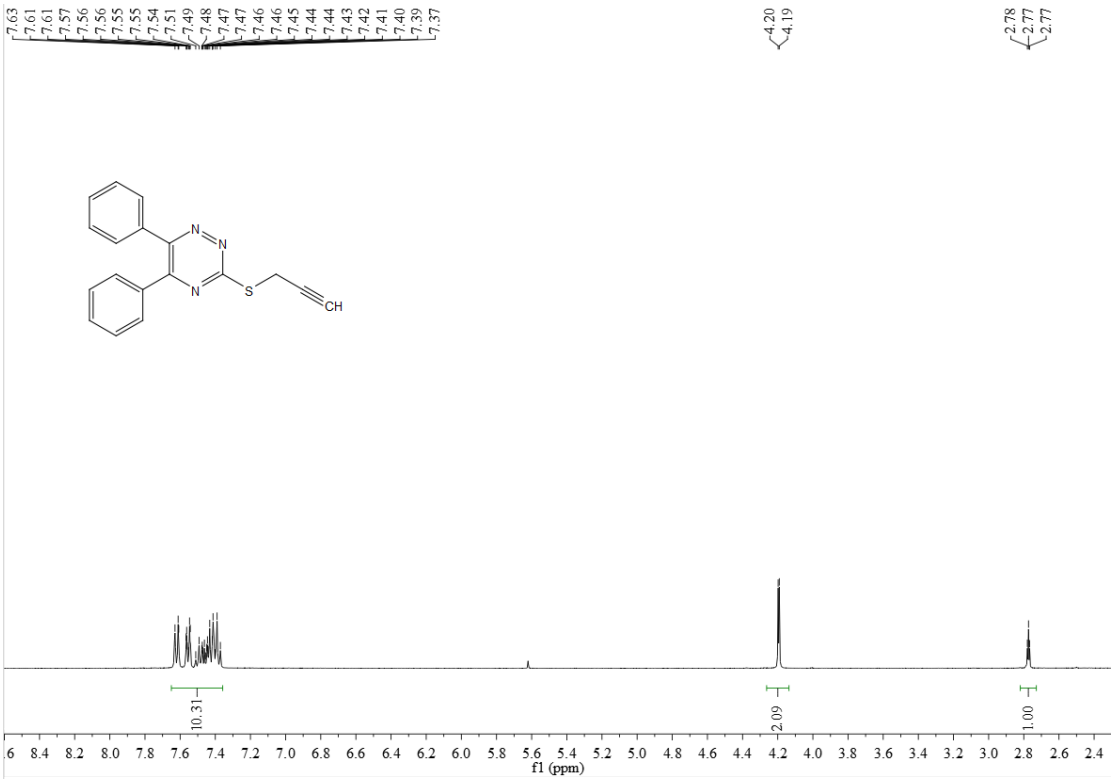


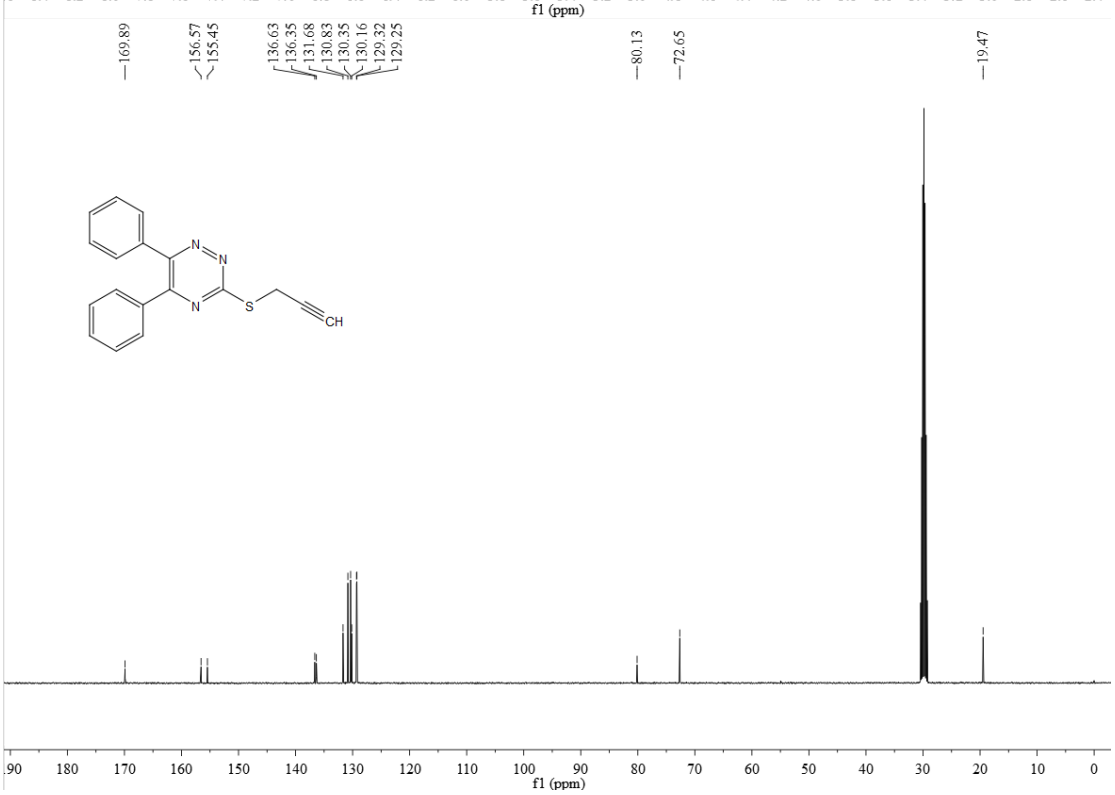


5,6-diphenyl-3-(prop-2-yn-1-ylthio)-1,2,4-triazine (**10B**)

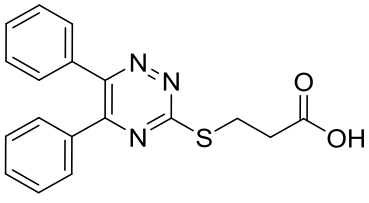


Yellow solid; Mp:96~99 ^{0}C; Yield: 63%. ^{1}H NMR (400 MHz, Acetone-d^{6}) δ 7.65 – 7.36 (m, 10H), 4.19 (d, *J* = 2.6 Hz, 2H), 2.77 (t, *J* = 2.6 Hz, 1H). ^{13}C NMR (100 MHz, Acetone-d^{6}) δ 169.89, 156.57, 155.45, 136.63, 136.35, 131.68, 130.83, 130.35, 130.16, 129.32, 129.25, 80.13, 72.65, 19.47. HR-MS (ESI): Calcd. $C_{18}H_{14}N_3S$, $[M+H]^+$m/z: 304.0909, found: 304.0908.

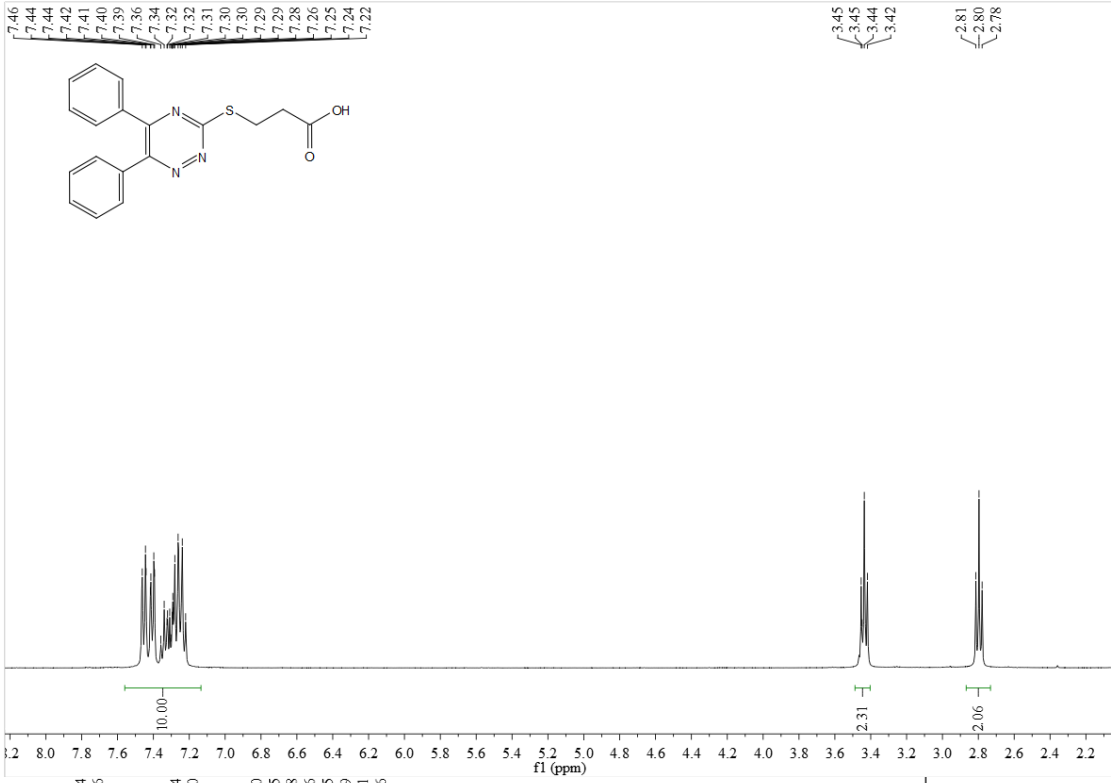


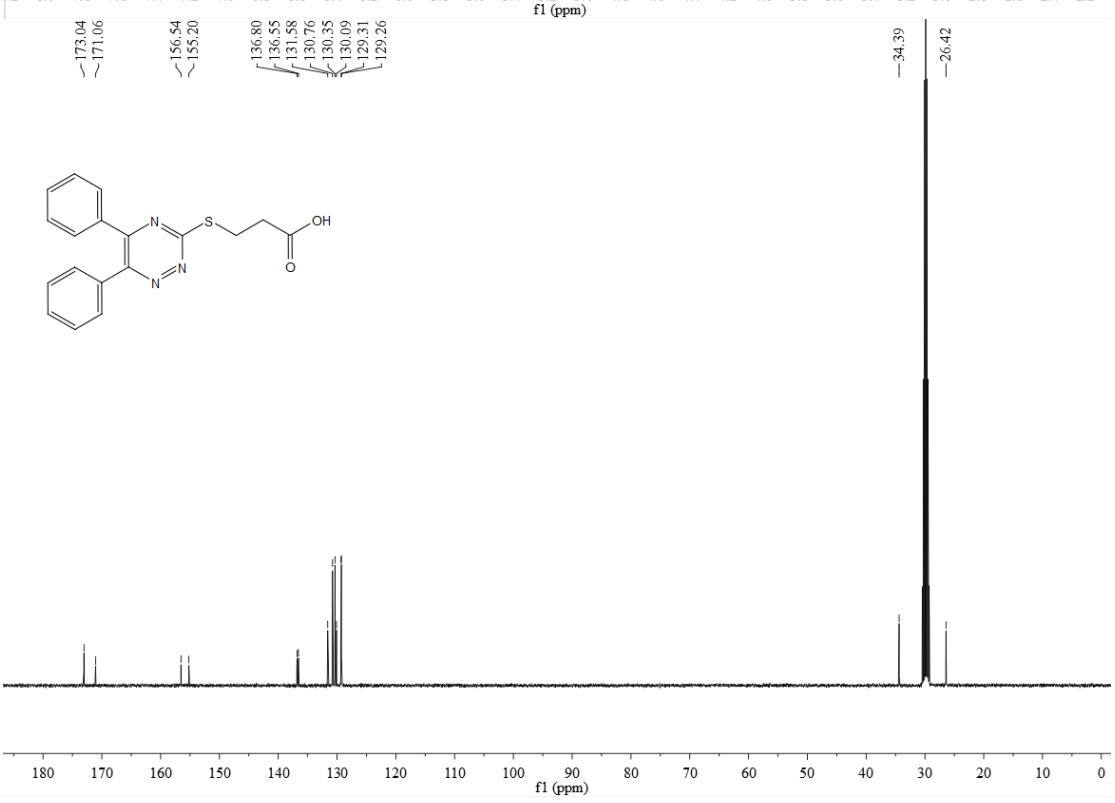


4-((5,6-diphenyl-1,2,4-triazin-3-yl)thio)butanoic acid (**10C**)



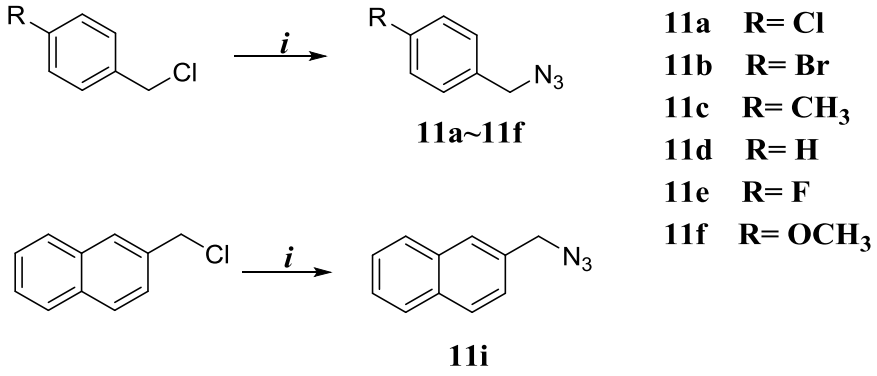
Light yellow solid; Mp:172~174 ^{0}C; Yield: 34%. ^{1}H NMR (400 MHz, Acetone-d^{6}) δ 7.56 – 7.13 (m, 10H), 3.44 (dd, *J* = 9.4, 4.5 Hz, 2H), 2.80 (t, *J* = 6.9 Hz, 2H). ^{13}C NMR (100 MHz, Acetone-d^{6}) δ 173.04, 171.06, 156.54, 155.20, 136.80, 136.55, 131.58, 130.76, 130.35, 130.09, 129.31, 129.26, 34.39, 26.42. HR-MS (ESI): Calcd. $C_{18}H_{16}N_3O_2S$, $[M+H]^+$m/z: 338.0965, found: 338.0963.





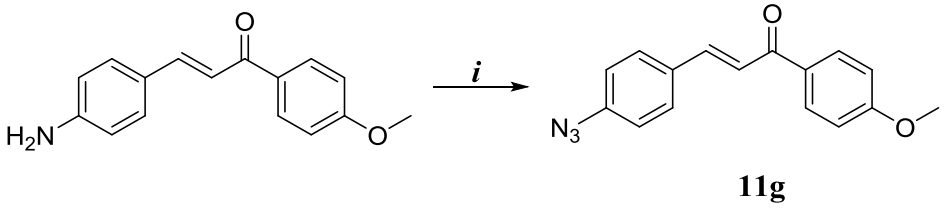
•Synthetic method and structure confirmation of azides 11a-11l

General method to synthesize azides 11a-11f and 11i



Scheme 1. Reagents and conditions: (***i***) NaN_3, acetone, reflux.
Azides **11a-11f** and **11i** were synthesized according to our previous method and these structures were reported in the previous work [1, 2].

General method to synthesize azide 11g

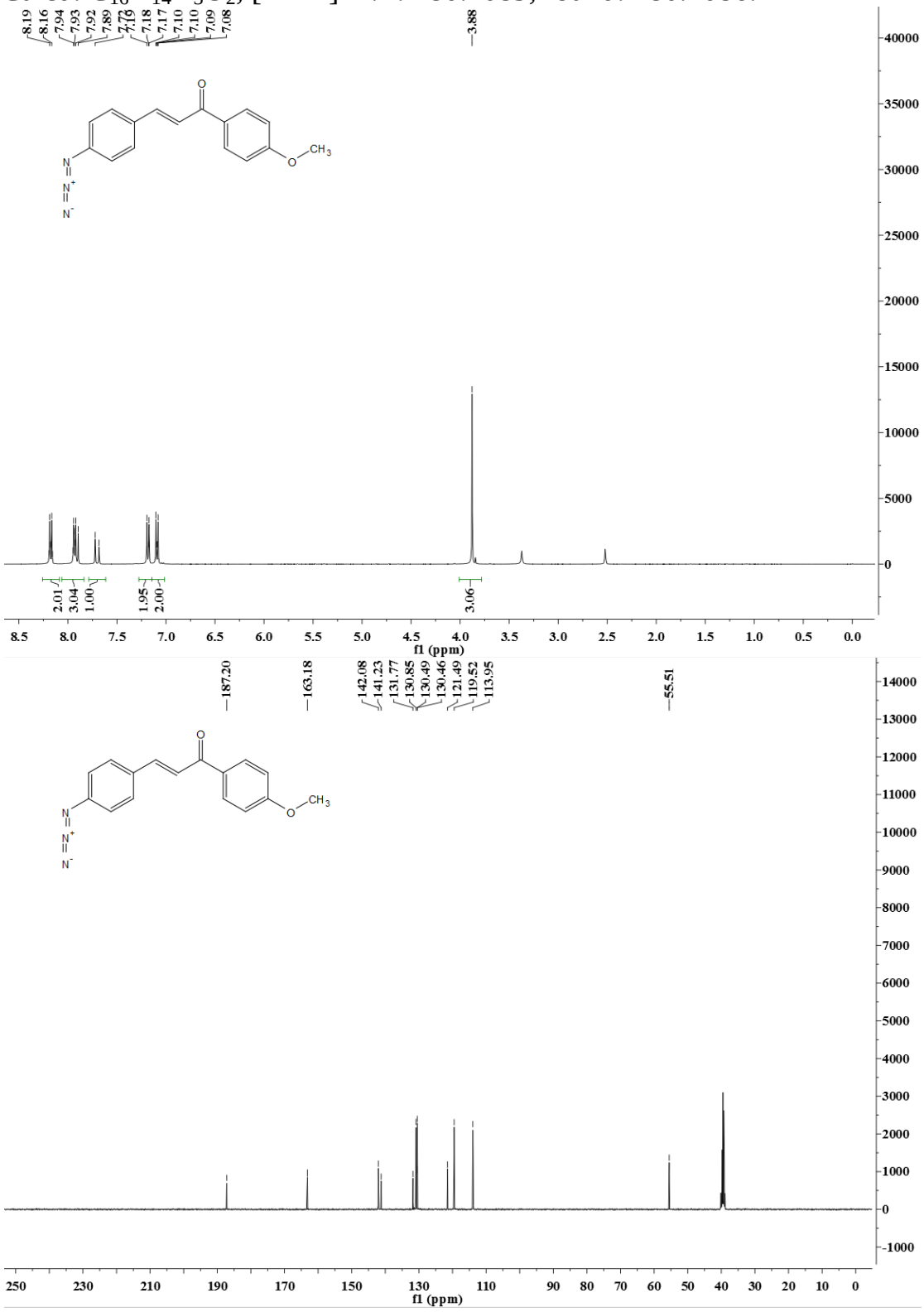


Scheme 2. Reagents and conditions: (***i***) H_2SO_4 (4M), $NaNO_2$, NaN_3, 0^oC.

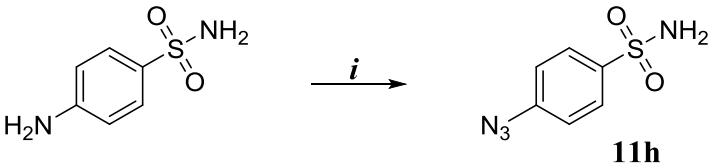
To a 0 °C solution of (*E*)-3-(4-aminophenyl)-1-(4-methoxyphenyl)prop-2-en-1-one (10 mmol) was added H_2SO_4 solution (4M, 15 mL), followed by a solution of $NaNO_2$ (12 mmol) in 10 mL of H_2O by dropwise addition over a period of 10 min with stirring. After the mixture was stirred for a further 1 h, a solution of NaN_3 (12 mmol) in H_2O (10 mL) was added to the above reaction mixture with stirring. Then the solution was extracted with EtOAc, dried over Na_2SO_4, filtered, and concentrated in vacuo. The crude product was purified with column chromatography (hexane: EtOAc = 7:1) to obtain analogue **11g**.

(*E*)-3-(4-azidophenyl)-1-(4-methoxyphenyl)prop-2-en-1-one (11g)
Yellow solid; Mp:108~110 ^{0}C; Yield: 46%. ^{1}H NMR (400 MHz, DMSO) δ 8.26 – 8.09 (m, 2H), 7.93 (dt, *J* = 11.7, 6.2 Hz, 3H), 7.70 (d, *J* = 15.6 Hz, 1H), 7.28 – 7.14 (m, 2H), 7.14 – 7.01 (m, 2H), 3.88 (s, 3H). ^{13}C

NMR (100 MHz, DMSO) δ 187.20, 163.18, 142.08, 141.23, 131.77, 130.85, 130.49, 130.46, 121.49, 119.52, 113.95, 55.51. HR-MS (ESI): Calcd. $C_{16}H_{14}N_3O_2$, $[M+H]^+$m/z: 280.1089, found: 280.1086.



General method to synthesize azide 11h

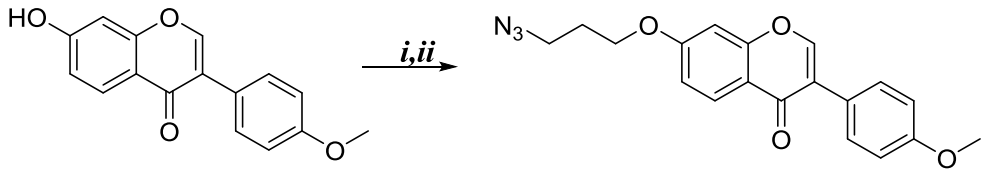


11h

Scheme 3. Reagents and conditions: (***i***) HCl (2M), $NaNO_2$, NaN_3, 0^oC.

Azides **11h** was synthesized according to the previous method [3].

General method to synthesize azide 11j

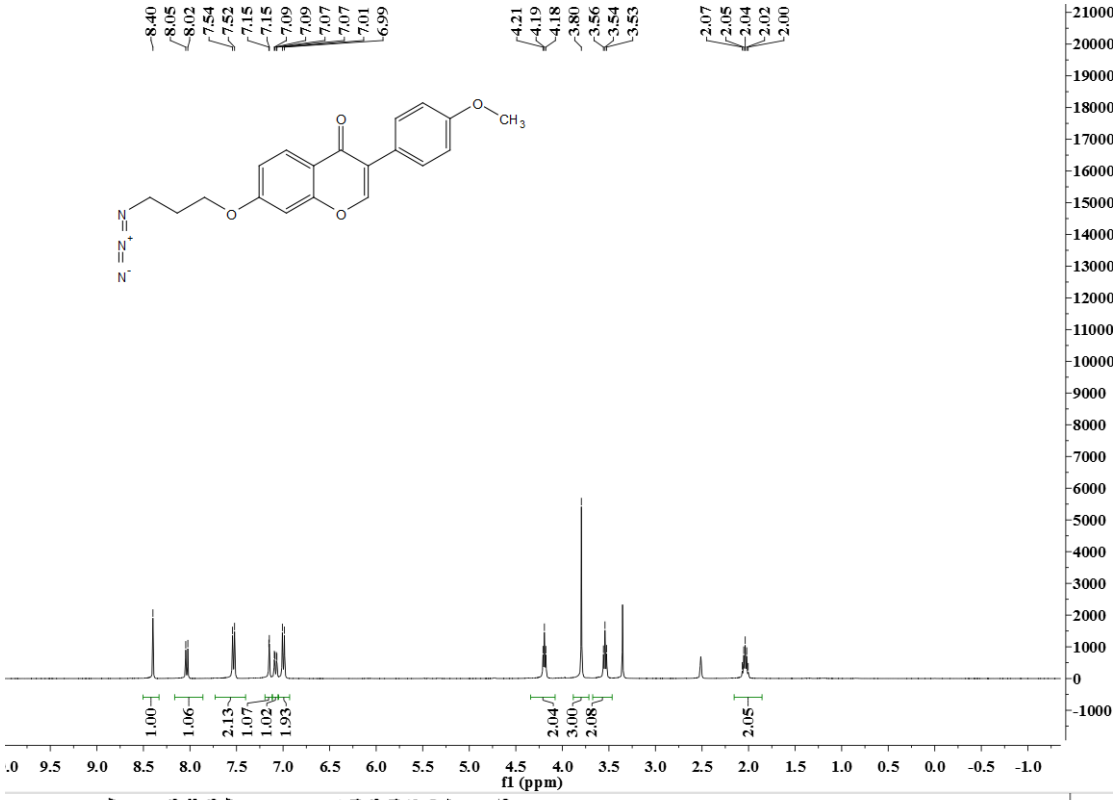


11j

Scheme 4. Reagents and conditions: (***i***) 1,3-Dibromopropane, K_2CO_3, acetonitrile, reflux; (***ii***) NaN_3, reflux.

7-Hydroxy-3-(4-methoxyphenyl)-4H-chromen-4-one (5 mmol) and K_2CO_3 (5 mmol) were added in the acetonitrile (15 ml) in the reflux condition. After the mixture was stirred for a further 6 h, NaN_3 (5 mmol) was added to the above reaction mixture with stirring. Then the solution was poured into H_2O, extracted with EtOAc, dried over Na_2SO_4, filtered, and concentrated in vacuo. The crude product was purified with column chromatography (hexane: EtOAc = 6:1) to obtain analogue **11j**.

7-(3-azidopropoxy)-3-(4-methoxyphenyl)-4H-chromen-4-one (11j)
White solid; Mp:119~120 ^{0}C; Yield: 48%. ^{1}H NMR (400 MHz, DMSO) δ 8.40 (s, 1H), 8.03 (d, *J* = 8.9 Hz, 1H), 7.53 (d, *J* = 8.6 Hz, 2H), 7.15 (d, *J* = 2.1 Hz, 1H), 7.08 (dd, *J* = 8.9, 2.1 Hz, 1H), 7.00 (d, *J* = 8.7 Hz, 2H), 4.19 (t, *J* = 6.1 Hz, 2H), 3.80 (s, 3H), 3.54 (t, *J* = 6.7 Hz, 2H), 2.04 (p, *J* = 6.3 Hz, 2H). ^{13}C NMR (100 MHz, DMSO) δ 174.57, 162.73, 158.98, 157.33, 153.37, 130.01, 126.94, 124.03, 123.34, 117.65, 114.90, 113.57, 101.06, 65.64, 55.09, 47.58, 27.87. HR-MS (ESI): Calcd. $C_{19}H_{18}N_3O_4$, $[M+H]^+$m/z: 352.1299, found: 352.1297.


8.40
8.05
8.02
7.54
7.52
7.15
7.15
7.09
7.09
7.07
7.07
7.07
7.01
6.99
4.21
4.19
4.18
3.80
3.56
3.54
3.53
2.07
2.05
2.04
2.02
2.00
O
O
O
CH3
N
N+
N-
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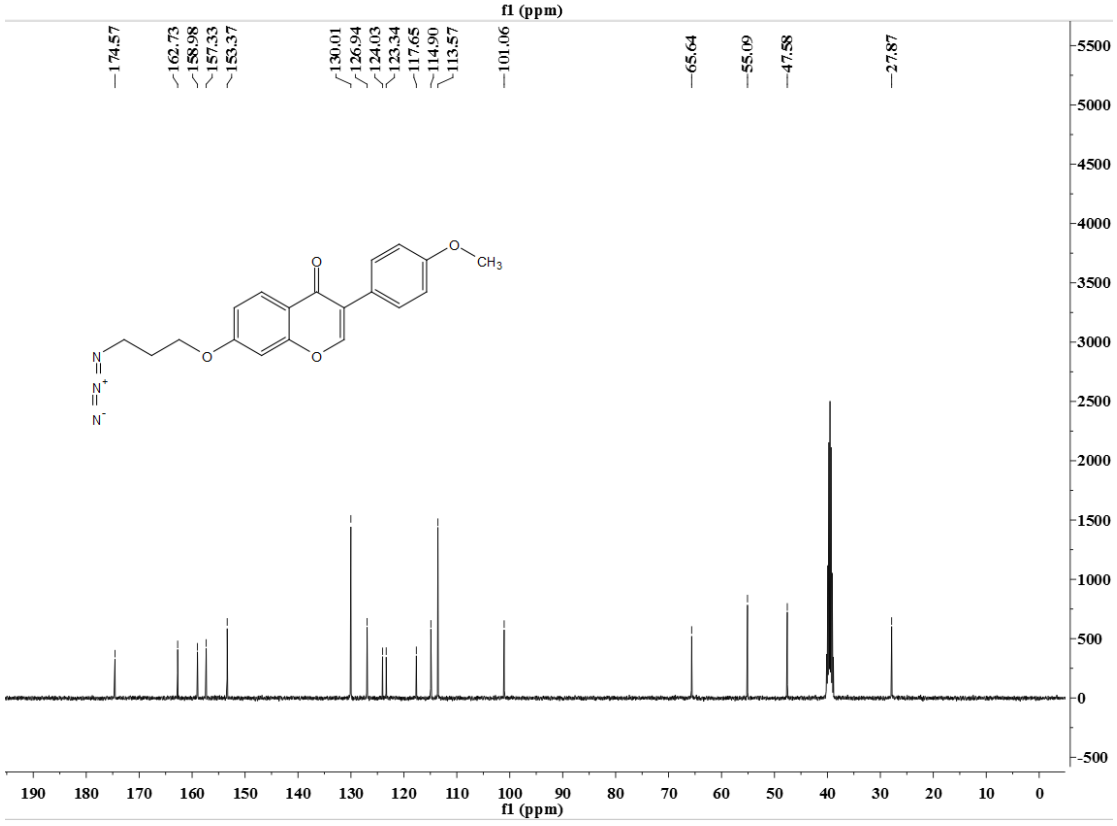
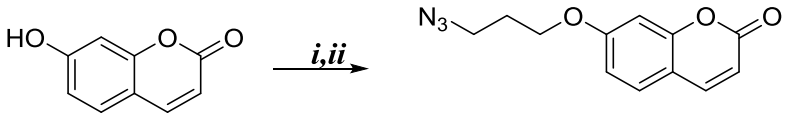
1.07
1.02
1.93
2.04
3.00
2.08
2.05
f1 (ppm)


174.57
162.73
158.98
157.33
153.37
130.01
126.94
124.03
123.34
117.65
114.90
113.57
101.06
65.64
55.09
47.58
27.87
O
O
O
CH3
N
N+
N-
f1 (ppm)

General method to synthesize azide 11k

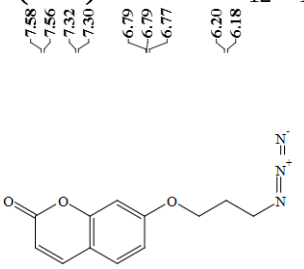


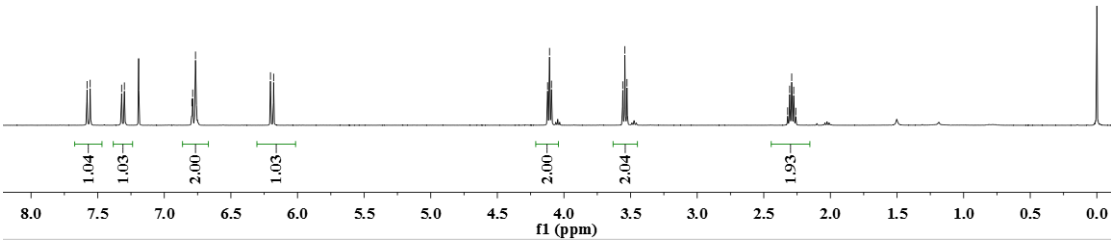
11k

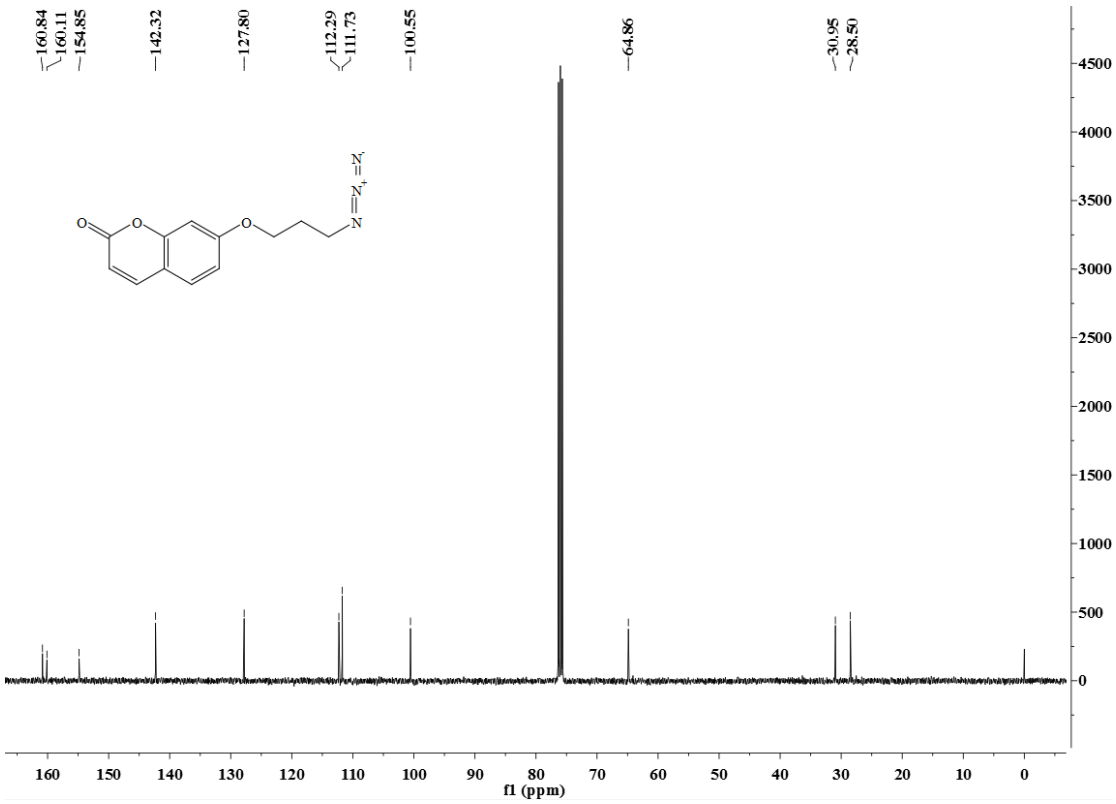
Scheme 5. Reagents and conditions: (***i***) 1,3-Dibromopropane, K_2CO_3, acetonitrile, reflux; (***ii***) NaN_3, reflux.

Azides **11k** was synthesized according to general method to synthesize azides **11j**.

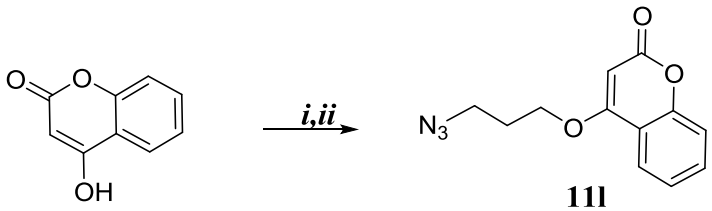
7-(3-azidopropoxy)-2*H*-chromen-2-one (11k)
White solid; Mp:101~102 ^{0}C; Yield: 54%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (d, *J* = 9.5 Hz, 1H), 7.31 (d, *J* = 8.3 Hz, 1H), 6.86 – 6.67 (m, 2H), 6.19 (d, *J* = 9.5 Hz, 1H), 4.11 (t, *J* = 5.8 Hz, 2H), 3.54 (t, *J* = 6.4 Hz, 2H), 2.29 (p, *J* = 6.1 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.84, 160.11, 154.85, 142.32, 127.80, 112.29, 111.73, 100.55, 64.86, 30.95, 28.50. HR-MS (ESI): Calcd. $C_{12}H_{12}N_3O_3$, $[M+H]^+$m/z: 246.0880, found: 246.0879.







General method to synthesize azide 11l

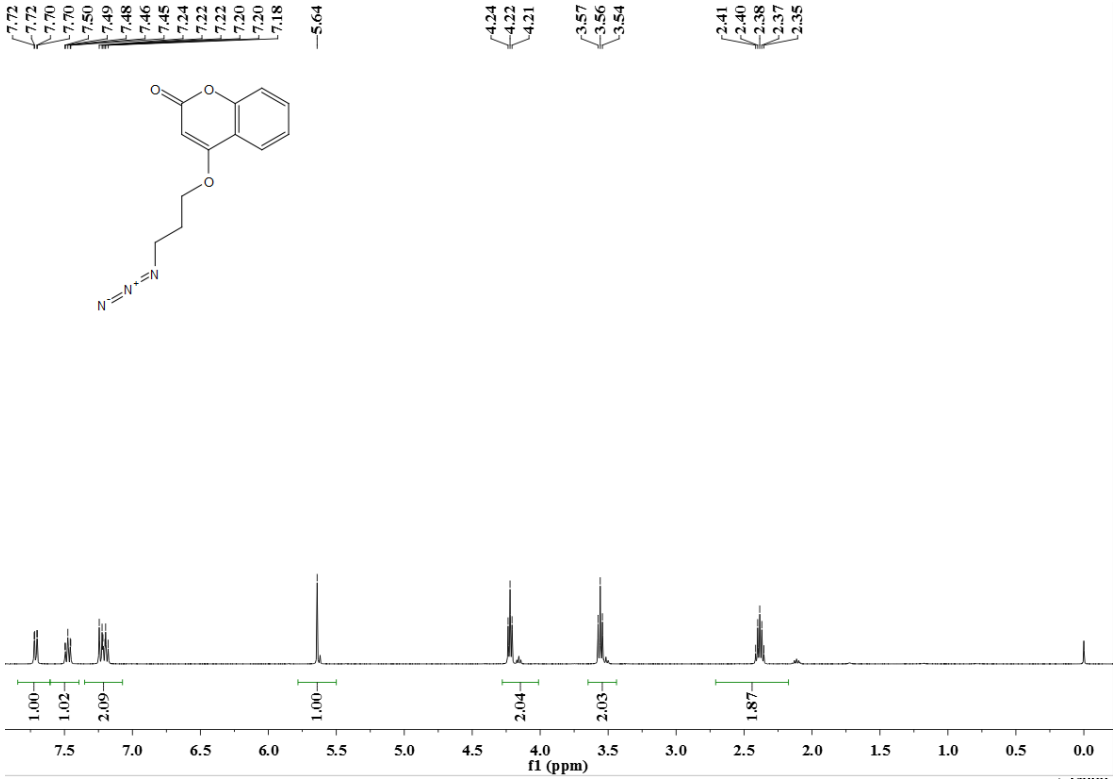


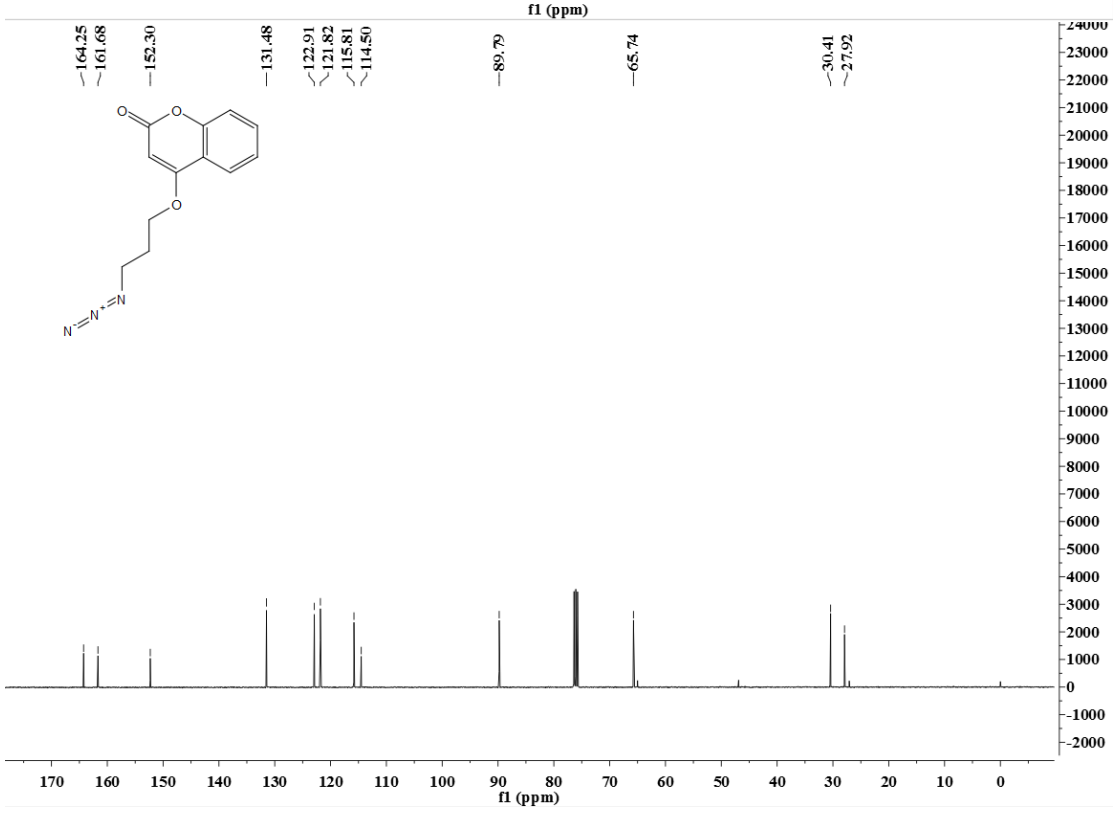
11l

Scheme 6. Reagents and conditions: (***i***) 1,3-Dibromopropane, K_2CO_3, acetonitrile, reflux; (***ii***) NaN_3, reflux.

Azides **11l** was synthesized according to general method to synthesize azides **11j**.

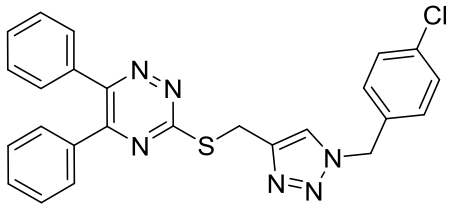
4-(3-azidopropoxy)-2H-chromen-2-one (11l)
White solid; Mp:112~113 ^{0}C; Yield: 58%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (dd, *J* = 7.9, 1.4 Hz, 1H), 7.61 – 7.39 (m, 1H), 7.35 – 7.07 (m, 2H), 5.64 (s, 1H), 4.22 (t, *J* = 5.8 Hz, 2H), 3.56 (t, *J* = 6.3 Hz, 2H), 2.38 (p, *J* = 6.1 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.25, 161.68, 152.30, 131.48, 122.91, 121.82, 115.81, 114.50, 89.79, 65.74, 30.41, 27.92. HR-MS (ESI): Calcd. $C_{12}H_{12}N_3O_3$, $[M+H]^+$m/z: 246.0881, found: 246.0879.


7.72
7.72
7.70
7.70
7.50
7.49
7.48
7.46
7.45
7.24
7.22
7.22
7.20
7.20
7.18
5.64
4.24
4.22
4.21
3.57
3.56
3.54
2.41
2.40
2.38
2.37
2.35
1.00
1.02
2.09
1.00
2.04
2.03
1.87
f1 (ppm)

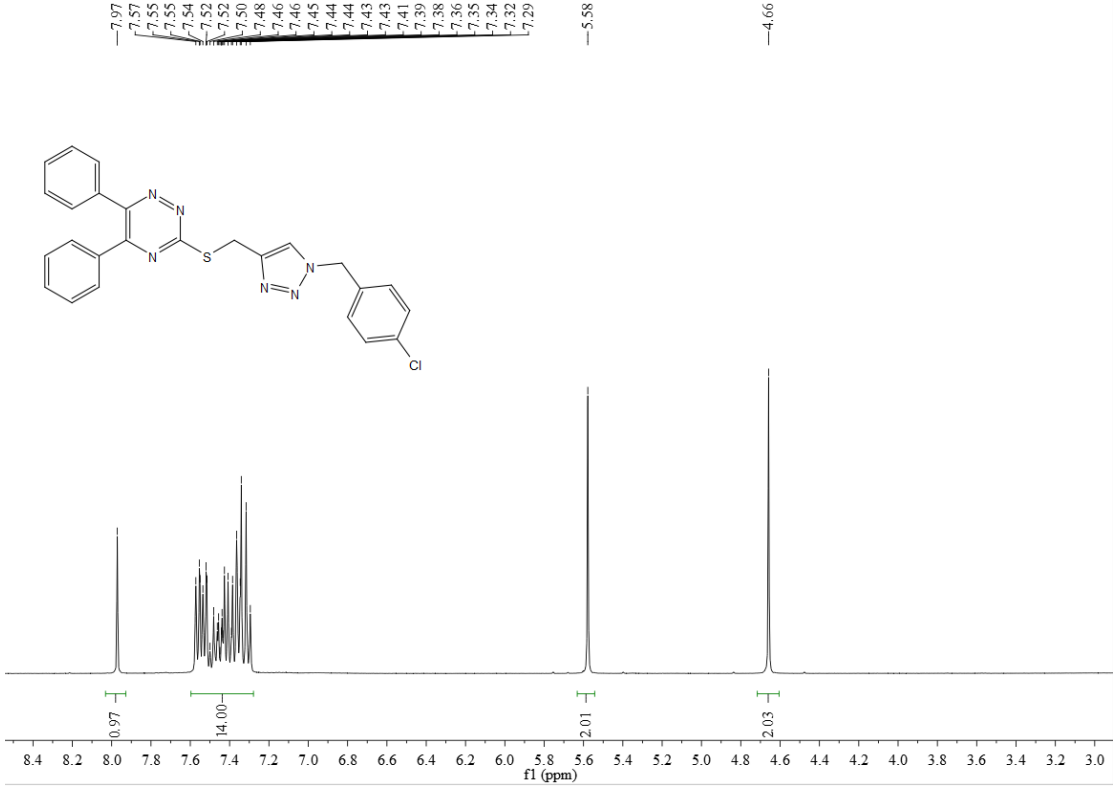

164.25
161.68
152.30
131.48
122.91
121.82
115.81
114.50
89.79
65.74
30.41
27.92
f1 (ppm)

Structure confirmation of 5,6-diaryl-1,2,4-triazine-triazole derivatives 11A-11L

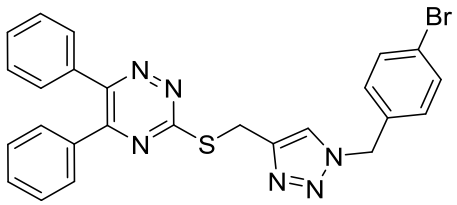
3-(((1-(4-chlorobenzyl)-1H-1,2,3-triazol-4-yl)methyl)thio)-5,6-diphenyl-1,2,4-triazine (**11A**)



Light yellow solid; Mp:120~122 ^{0}C; Yield: 52%. ^{1}H NMR (400 MHz, Acetone-d^{6}) δ 7.97 (s, 1H), 7.60 – 7.28 (m, 14H), 5.58 (s, 2H), 4.66 (s, 2H). ^{13}C NMR (100 MHz, Acetone-d^{6}) δ 170.68, 156.46, 155.21, 144.89, 136.72, 136.40, 135.91, 134.53, 131.64, 130.77, 130.65, 130.34, 130.15, 129.73, 129.34, 129.27, 124.06, 53.41, 26.05. HR-MS (ESI): Calcd. $C_{25}H_{20}ClN_6S$, $[M+H]^+$m/z: 471.1160, found: 471.1159.

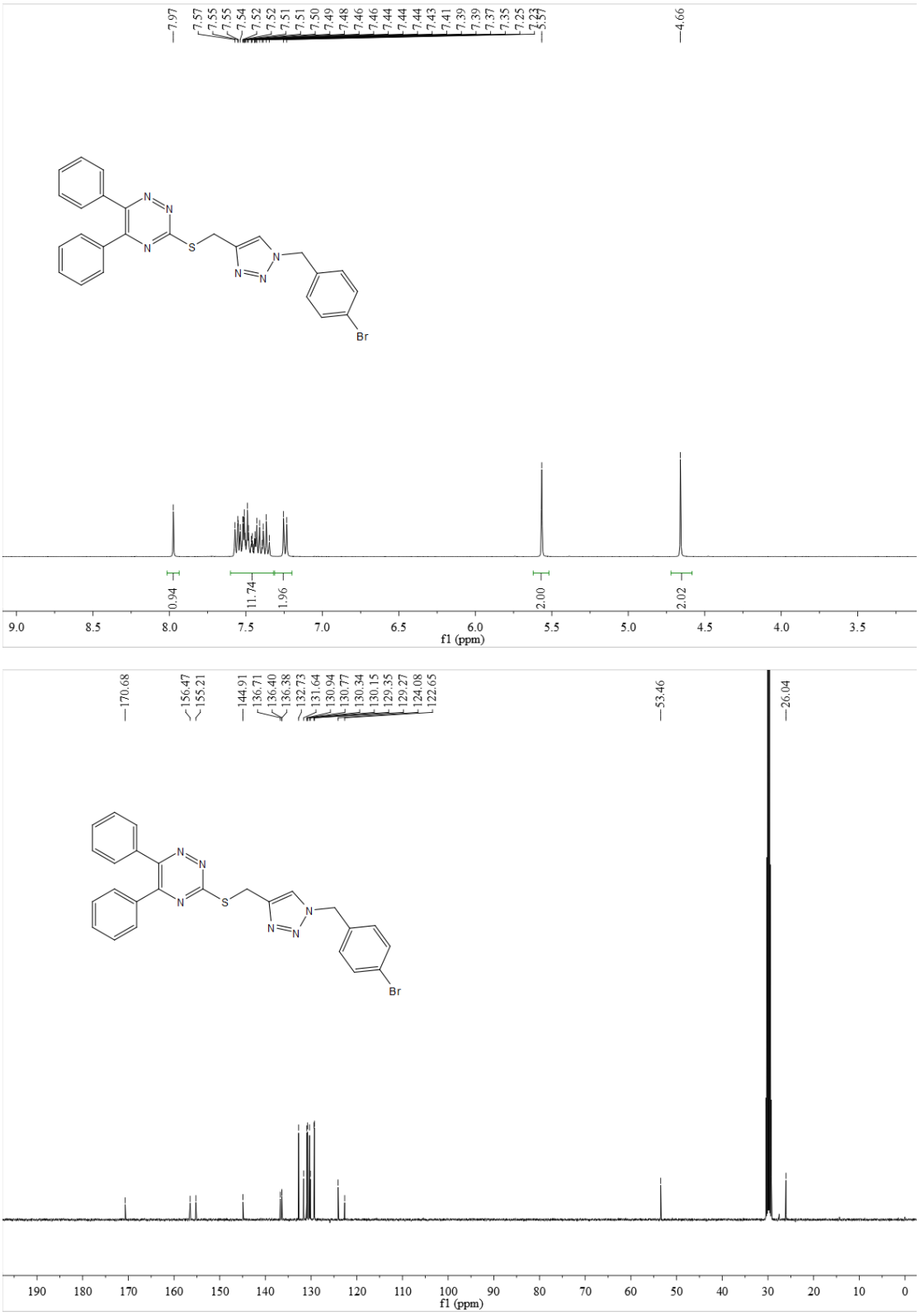


3-(((1-(4-bromobenzyl)-1H-1,2,3-triazol-4-yl)methyl)thio)-5,6-diphenyl-1,2,4-triazine (**11B**)

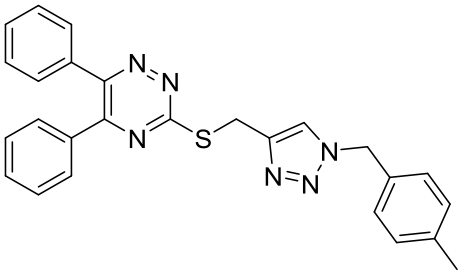


Light yellow solid; Mp:132~134 ^{0}C; Yield: 41%. ^{1}H NMR (400 MHz, Acetone-d^{6}) δ 7.97 (s, 1H), 7.60 – 7.32 (m, 12H), 7.24 (d, *J* = 8.4 Hz, 2H), 5.57 (s, 2H), 4.66 (s, 2H). ^{13}C NMR (100 MHz, Acetone-d^{6}) δ 170.68, 156.47, 155.21, 144.91, 136.71, 136.40,

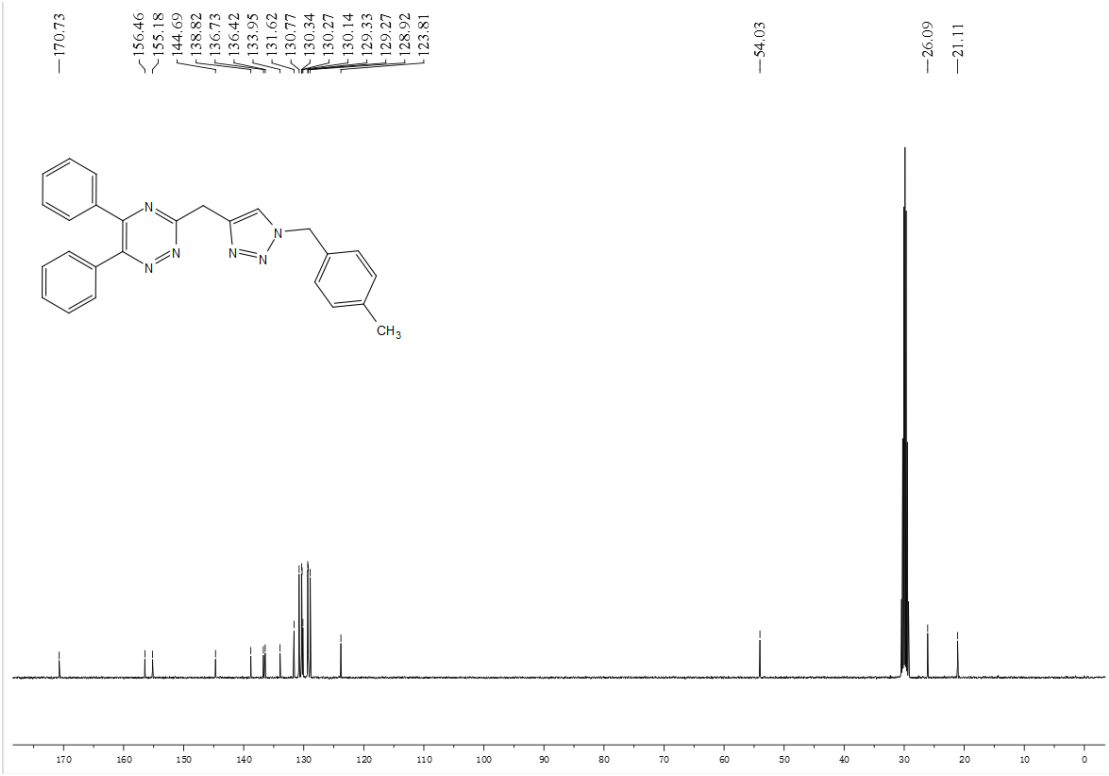
136.38, 132.73, 131.64, 130.94, 130.77, 130.34, 130.15, 129.35, 129.27, 124.08, 122.65, 53.46, 26.04. HR-MS (ESI): Calcd. $C_{25}H_{20}BrN_6S$, $[M+H]^+$m/z: 515.0657, found: 515.0654.



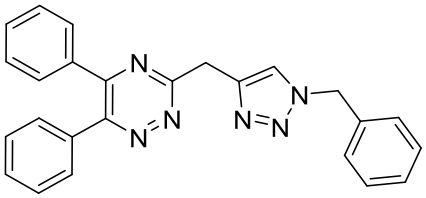
3-(((1-(4-methylbenzyl)-1H-1,2,3-triazol-4-yl)methyl)thio)-5,6-diphenyl-1,2,4-triazine (**11C**)



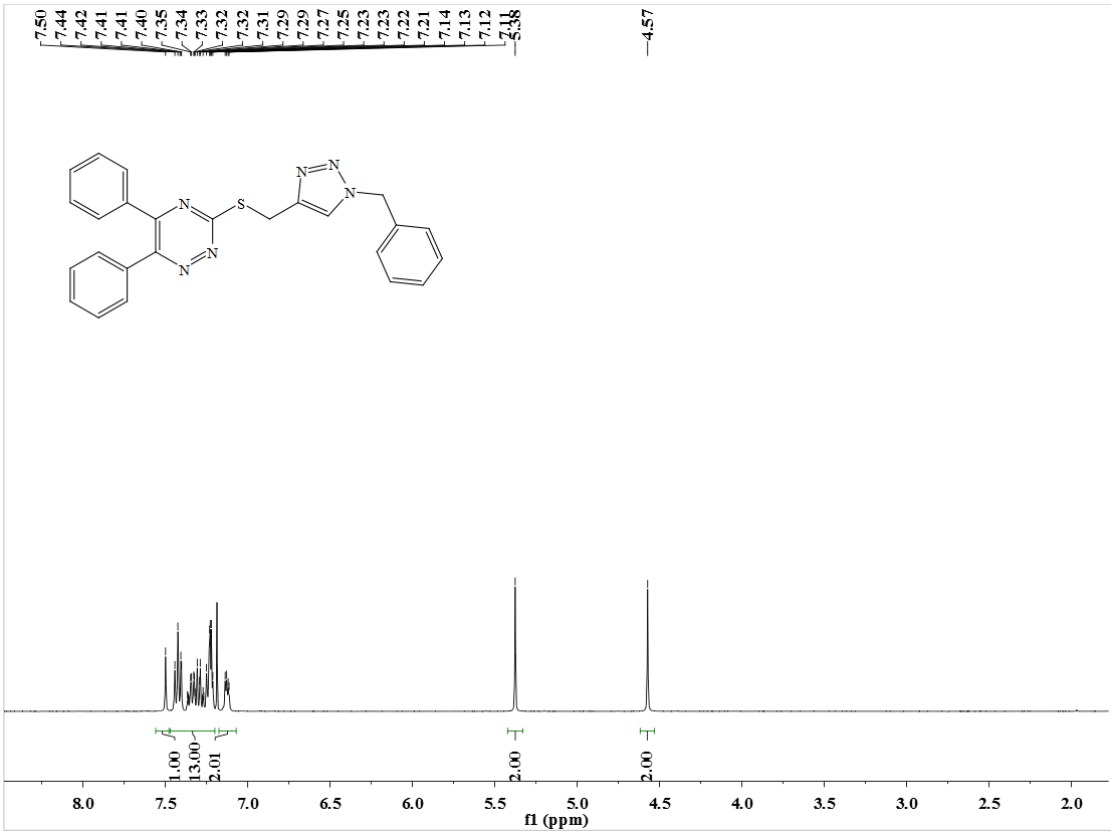
Light yellow solid; Mp:119~121 ^{0}C; Yield: 64%. ^{1}H NMR (400 MHz, Acetone-d^{6}) δ 7.90 (s, 1H), 7.60 – 7.32 (m, 10H), 7.15 (dd, *J* = 22.4, 8.0 Hz, 4H), 5.50 (s, 2H), 4.65 (s, 2H), 2.27 (s, 3H). ^{13}C NMR (100 MHz, Acetone-d^{6}) δ 170.73, 156.46, 155.18, 144.69, 138.82, 136.73, 136.42, 133.95, 131.62, 130.77, 130.34, 130.27, 130.14, 129.33, 129.27, 128.92, 123.81, 54.03, 26.09, 21.11. HR-MS (ESI): Calcd. $C_{26}H_{23}N_6S$, $[M+H]^+$m/z: 451.1708, found: 451.1705.

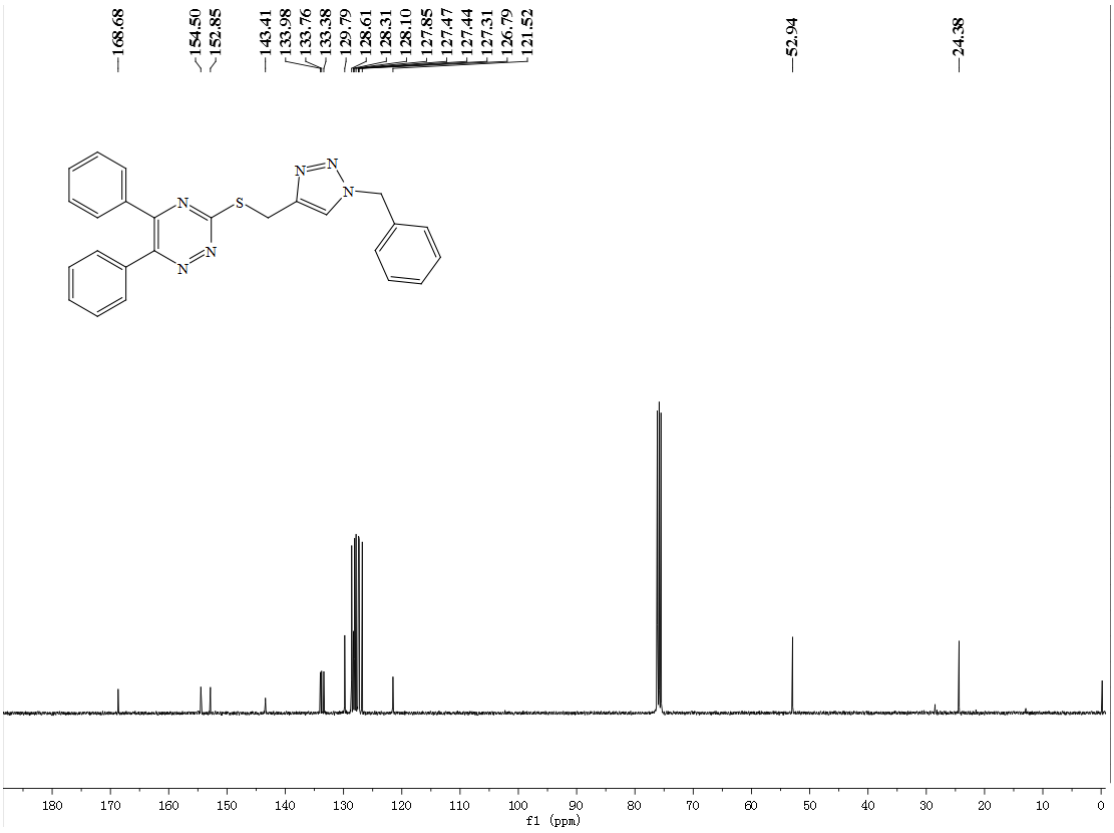


3-((1-benzyl-1H-1,2,3-triazol-4-yl)methyl)-5,6-diphenyl-1,2,4-triazine (**11D**)

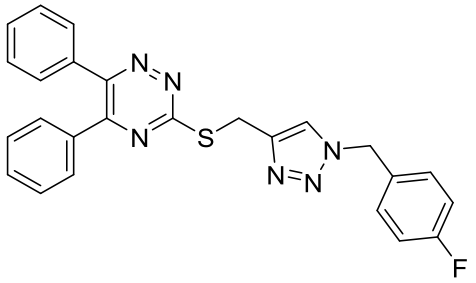


Light yellow solid; Mp:130~132 ^{0}C; Yield: 72%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (s, 1H), 7.47 – 7.20 (m, 13H), 7.12 (dd, *J* = 6.6, 2.9 Hz, 2H), 5.38 (s, 2H), 4.57 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.68, 154.50, 152.85, 143.41, 133.98, 133.76, 133.38, 129.79, 128.61, 128.31, 128.10, 127.85, 127.47, 127.44, 127.31, 126.79, 121.52, 52.94, 24.38. HR-MS (ESI): Calcd. $C_{25}H_{21}N_6S$, $[M+H]^+$m/z: 437.1549, found: 437.1548.

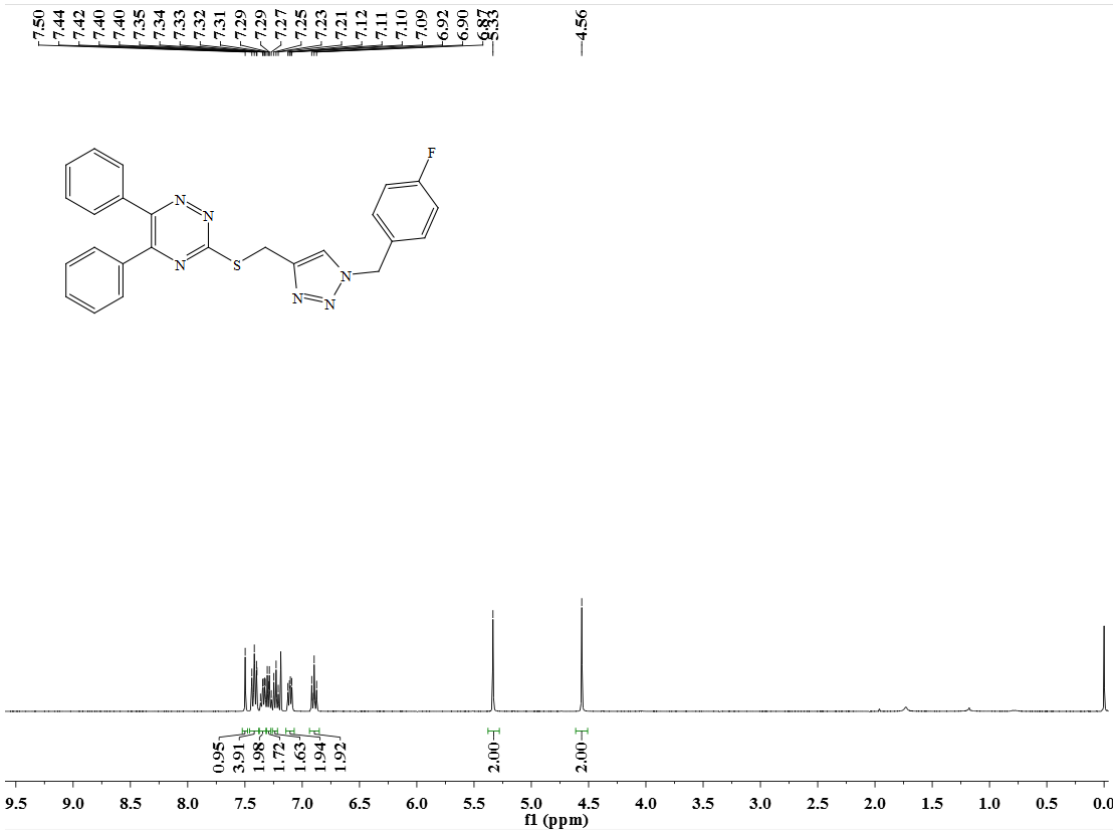


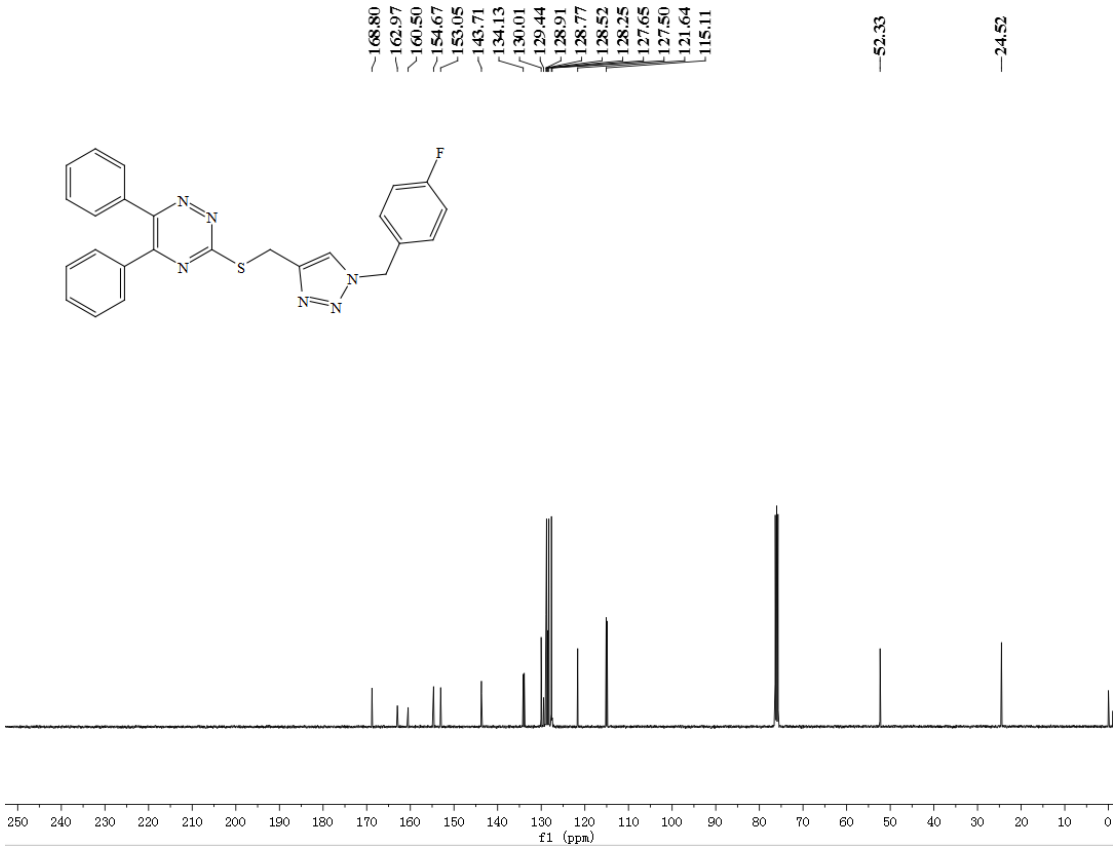


3-(((1-(4-fluorobenzyl)-1H-1,2,3-triazol-4-yl)methyl)thio)-5,6-diphenyl-1,2,4-triazine (**11E**)

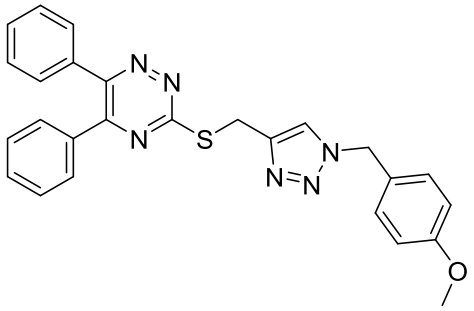


Light yellow solid; Mp:126~128 ^{0}C; Yield: 64%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (s, 1H), 7.41 (dd, *J* = 12.7, 5.1 Hz, 4H), 7.37 – 7.32 (m, 2H), 7.31 – 7.27 (m, 2H), 7.24 (d, *J* = 7.8 Hz, 2H), 7.11 (dd, *J* = 8.6, 5.2 Hz, 2H), 6.90 (dd, *J* = 11.9, 5.3 Hz, 2H), 5.33 (s, 2H), 4.56 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.80, 162.97, 160.50, 154.67, 153.05, 143.71, 134.13, 130.01, 129.44, 128.91, 128.77, 128.52, 128.25, 127.65, 127.50, 121.64, 115.11, 52.33, 24.52. HR-MS (ESI): Calcd. $C_{25}H_{20}FN_6S$, $[M+H]^+$m/z: 455.1456, found: 455.1454.

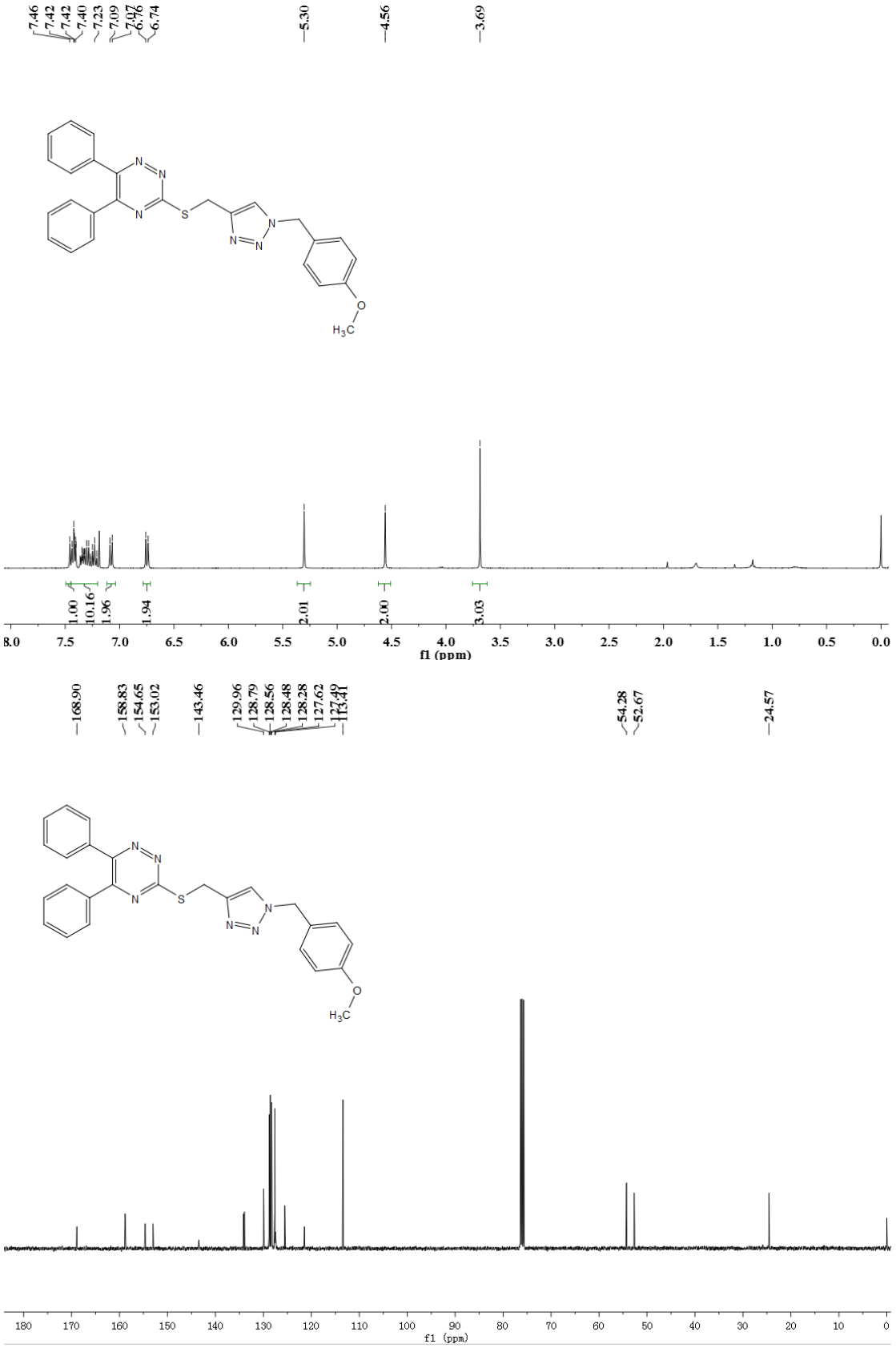




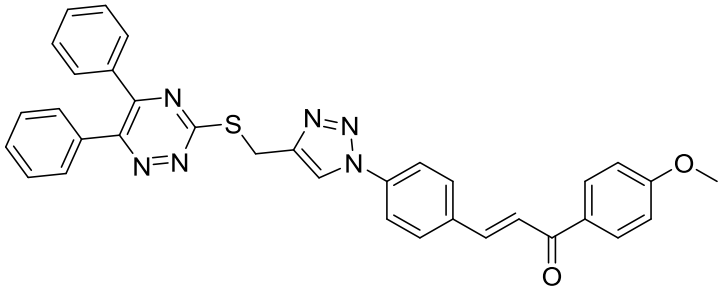
3-(((1-(4-methoxybenzyl)-1H-1,2,3-triazol-4-yl)methyl)thio)-5,6-diphenyl-1,2,4-triazine (**11F**)



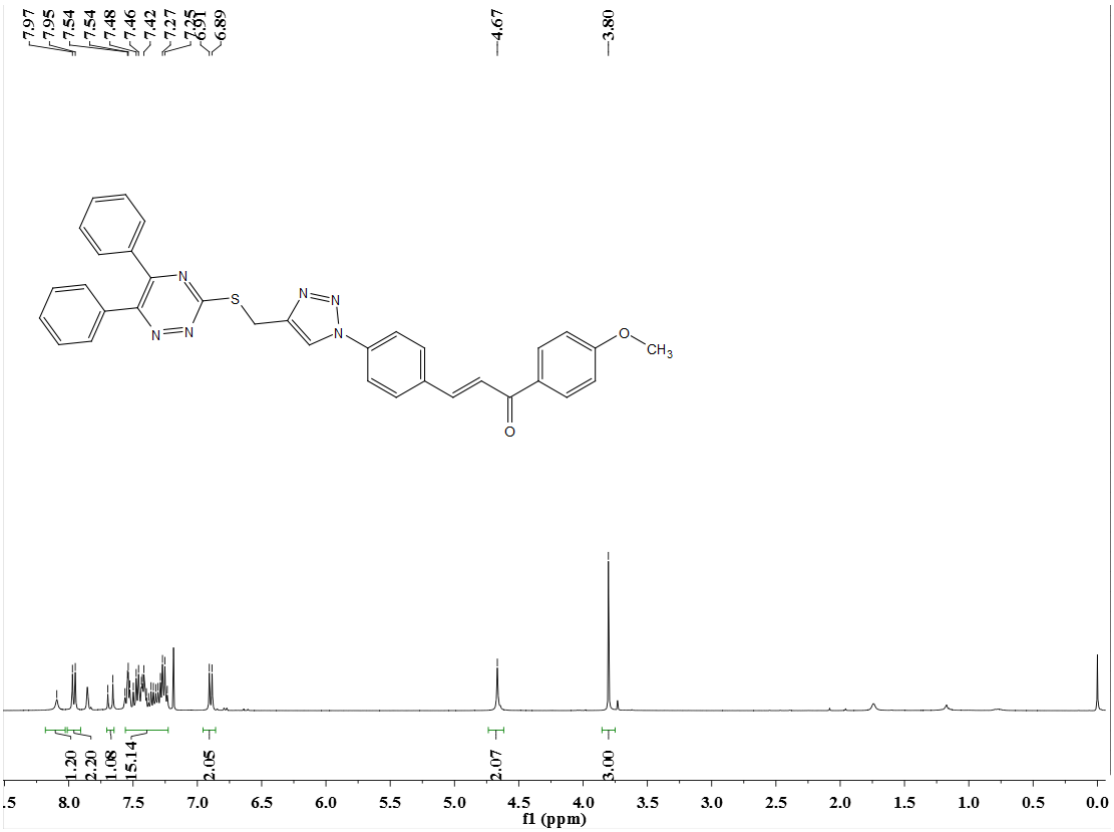
Light yellow solid; Mp:108~111 ^{0}C; Yield: 65%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (s, 1H), 7.45 – 7.20 (m, 10H), 7.08 (d, *J* = 8.6 Hz, 2H), 6.75 (d, *J* = 8.7 Hz, 2H), 5.30 (s, 2H), 4.56 (s, 2H), 3.69 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.90, 158.83, 154.65, 153.02, 143.46, 134.18, 133.96, 129.96, 128.79, 128.56, 128.48, 128.28, 127.62, 127.49, 125.55, 121.45, 113.41, 54.28, 52.67, 24.57. HR-MS (ESI): Calcd. $C_{26}H_{23}N_6OS$, $[M+H]^+$m/z: 467.1657, found: 467.1654.

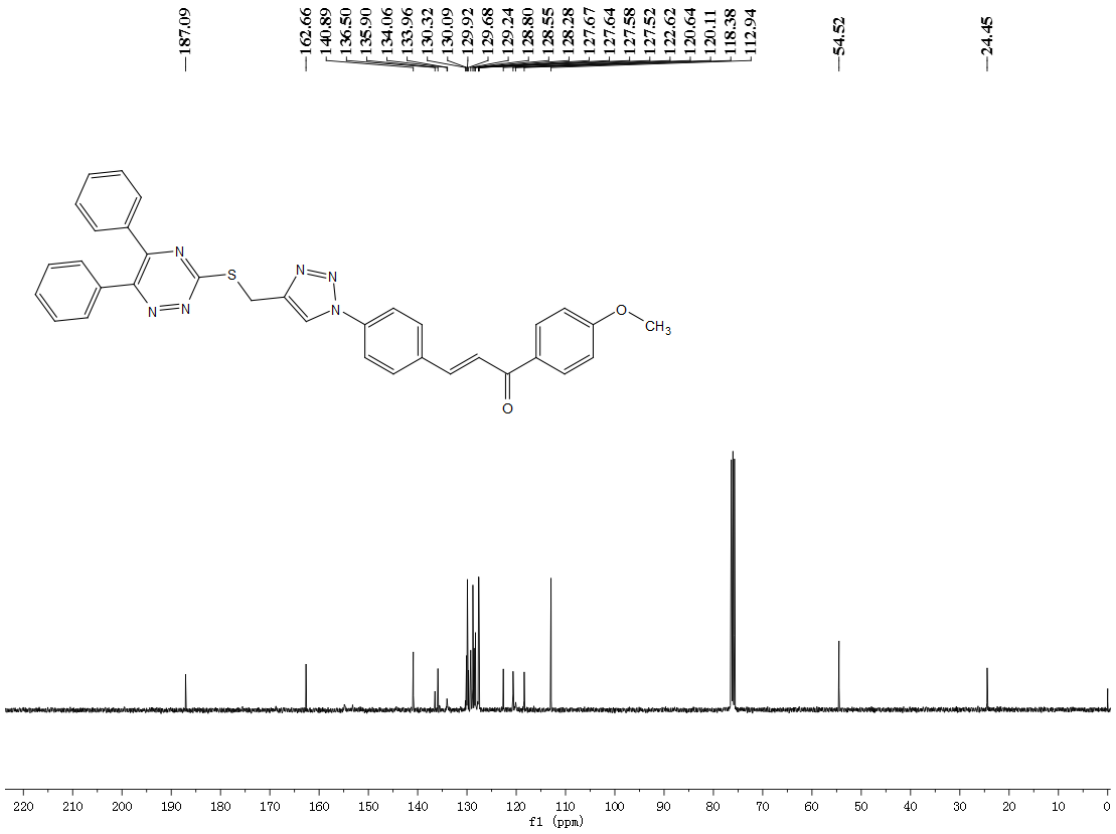


(*E*)-3-(4-(4-(((5,6-diphenyl-1,2,4-triazin-3-yl)thio)methyl)-1H-1,2,3-triazol-1-yl)phenyl)-1-(4-methoxyphenyl)prop-2-en-1-one (**11G**)

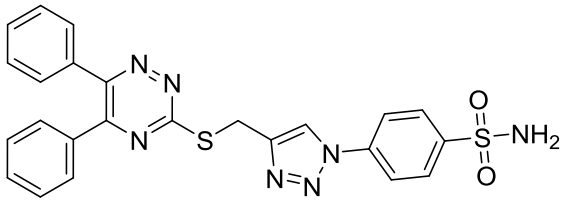


Light yellow solid; Mp:162~164 ^{0}C; Yield: 61%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09 (s, 1H), 7.96 (d, *J* = 8.8 Hz, 2H), 7.68 (d, *J* = 15.6 Hz, 1H), 7.56 – 7.23 (m, 15H), 6.90 (d, *J* = 8.8 Hz, 2H), 4.67 (s, 2H), 3.80 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 187.09, 162.66, 140.89, 136.50, 135.90, 134.06, 133.96, 130.32, 130.09, 129.92, 129.68, 129.24, 128.80, 128.55, 128.28, 127.67, 127.64, 127.58, 127.52, 122.62, 120.64, 120.11, 118.38, 112.94, 54.52, 24.45. HR-MS (ESI): Calcd. $C_{34}H_{27}N_6O_2S$, $[M+H]^+$m/z: 583.1919, found: 583.1916.

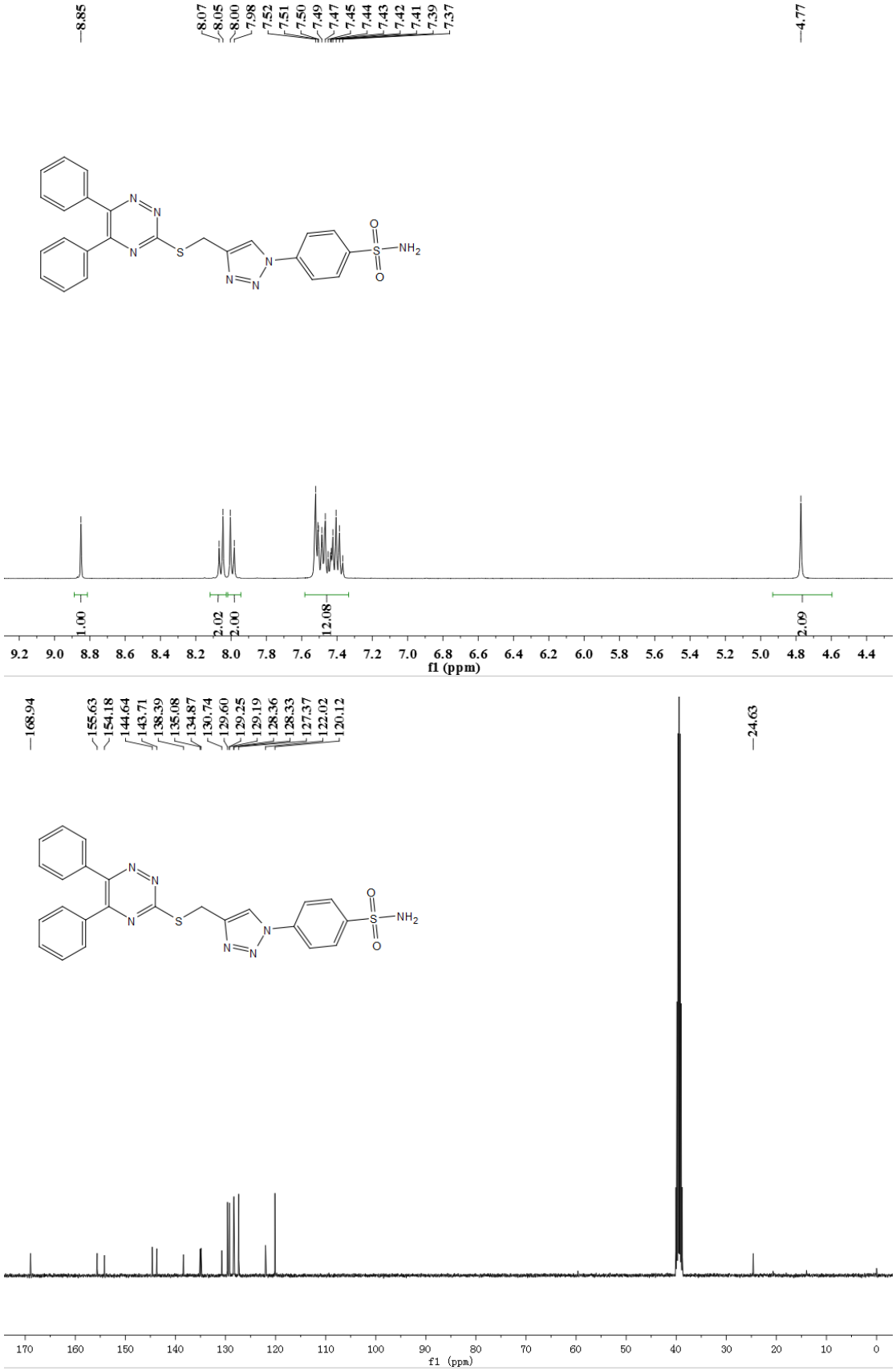




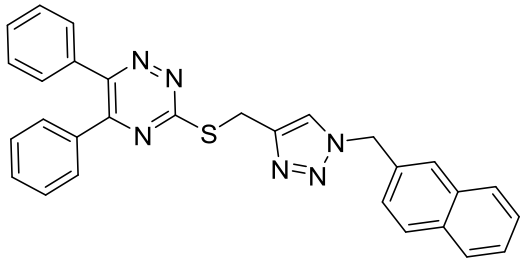
4-(4-(((5,6-diphenyl-1,2,4-triazin-3-yl)thio)methyl)-1H-1,2,3-triazol-1-yl)benzenesulfonamide (**11H**)



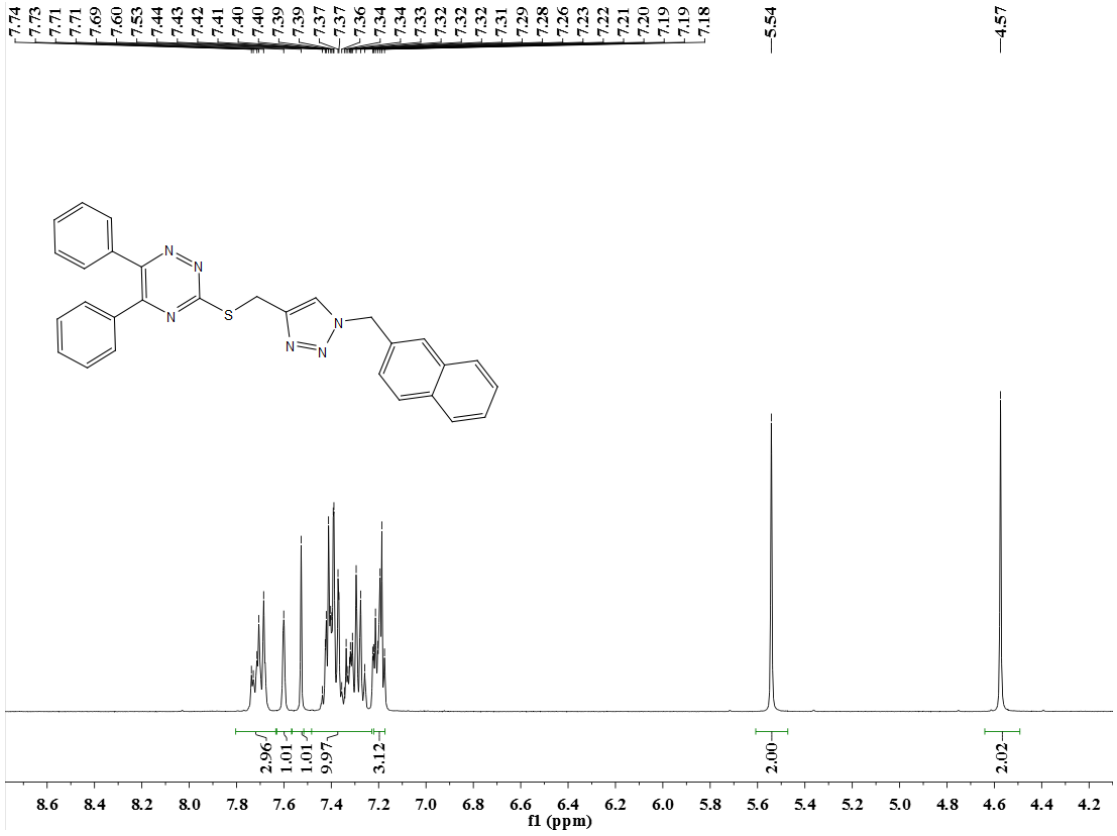
Light yellow solid; Mp:236~238 ^{0}C; Yield: 56%. ^{1}H NMR (400 MHz, DMSO-d^{6}) δ 8.85 (s, 1H), 8.06 (d, *J* = 8.8 Hz, 2H), 7.99 (d, *J* = 8.8 Hz, 2H), 7.58 – 7.33 (m, 12H), 4.77 (s, 2H). ^{13}C NMR (101 MHz, DMSO-d^{6}) δ 168.94, 155.63, 154.18, 144.64, 143.71, 138.39, 135.08, 134.87, 130.74, 129.60, 129.25, 129.19, 128.36, 128.33, 127.37, 122.02, 120.12, 24.63. HR-MS (ESI): Calcd. $C_{24}H_{20}N_7O_2S_2$, $[M+H]^+$m/z: 502.1127, found: 502.1120.

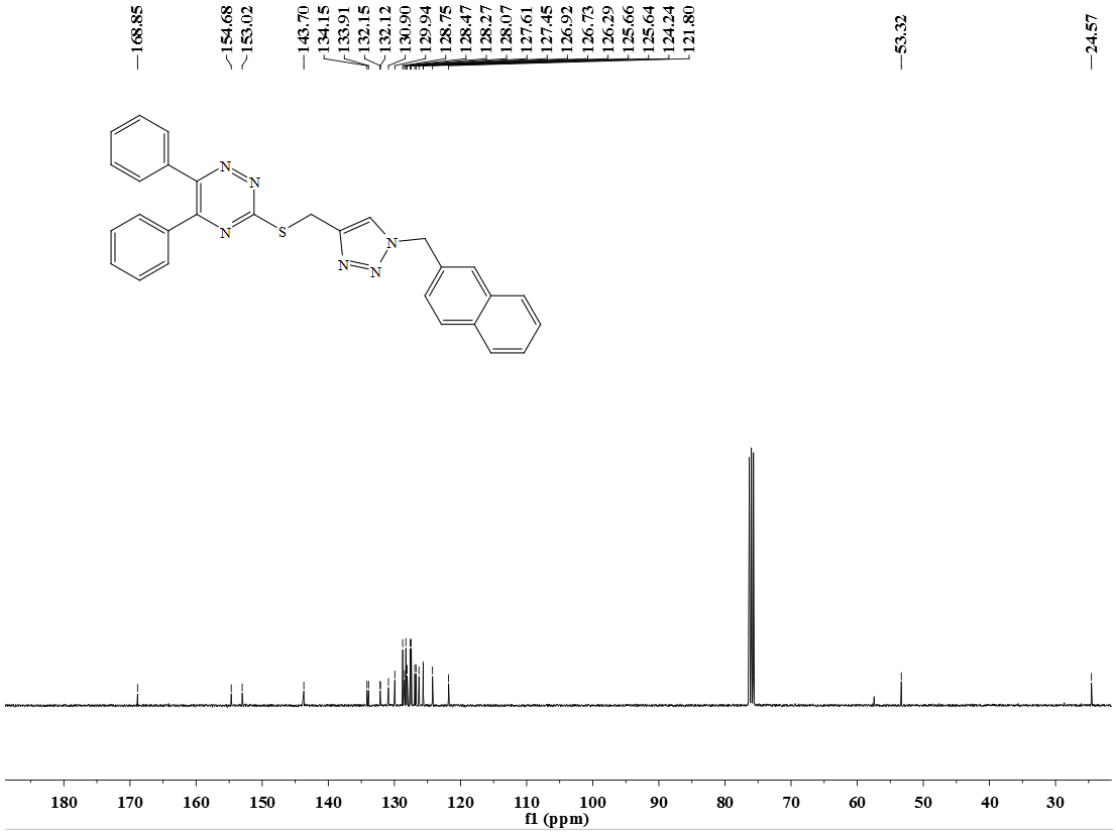


3-(((1-(naphthalen-2-ylmethyl)-1H-1,2,3-triazol-4-yl)methyl)thio)-5,6-diphenyl-1,2,4-triazine (**11I**)

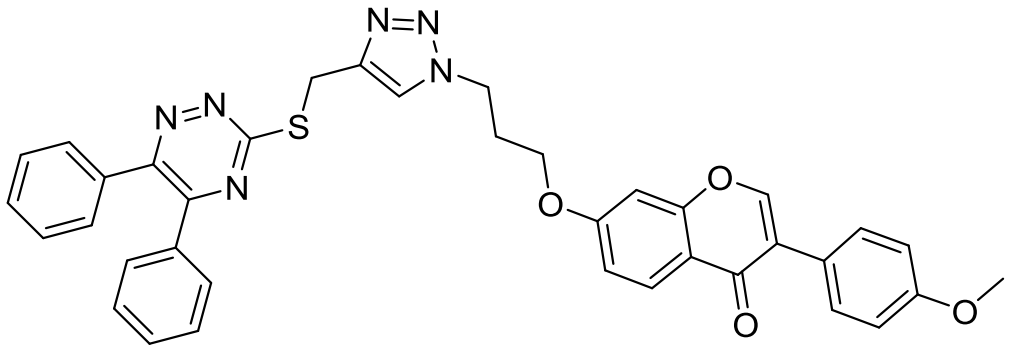


Light yellow solid; Mp:136~138 ^{0}C; Yield: 69%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.80 – 7.63 (m, 3H), 7.60 (s, 1H), 7.53 (s, 1H), 7.52 – 7.23 (m, 10H), 7.20 (dt, *J* = 11.5, 3.8 Hz, 3H), 5.54 (s, 2H), 4.57 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.85, 154.68, 153.02, 143.70, 134.15, 133.91, 132.15, 132.12, 130.90, 129.94, 128.75, 128.47, 128.27, 128.07, 127.61, 127.45, 126.92, 126.73, 126.29, 125.66, 125.64, 124.24, 121.80, 53.32, 24.57. HR-MS (ESI): Calcd. $C_{29}H_{23}N_6S$, $[M+H]^+$m/z: 487.1709, found: 487.1705.

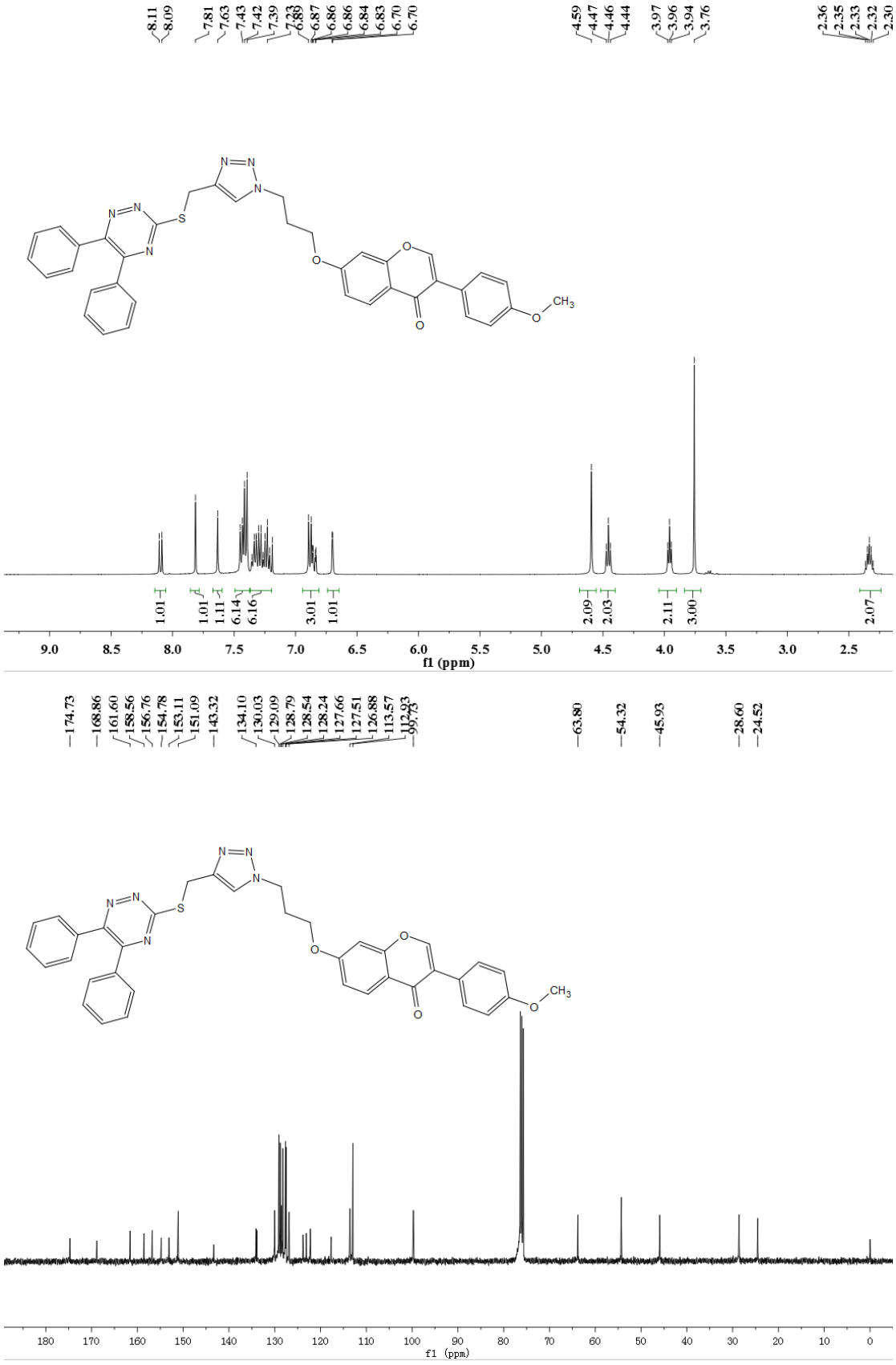




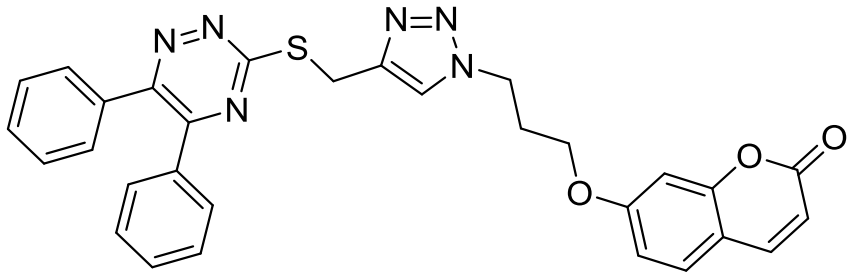
7-(3-(4-(((5,6-diphenyl-1,2,4-triazin-3-yl)thio)methyl)-1H-1,2,3-triazol-1-yl)propoxy)-3-(4-methoxyphenyl)-4H-chromen-4-one (**11J**)



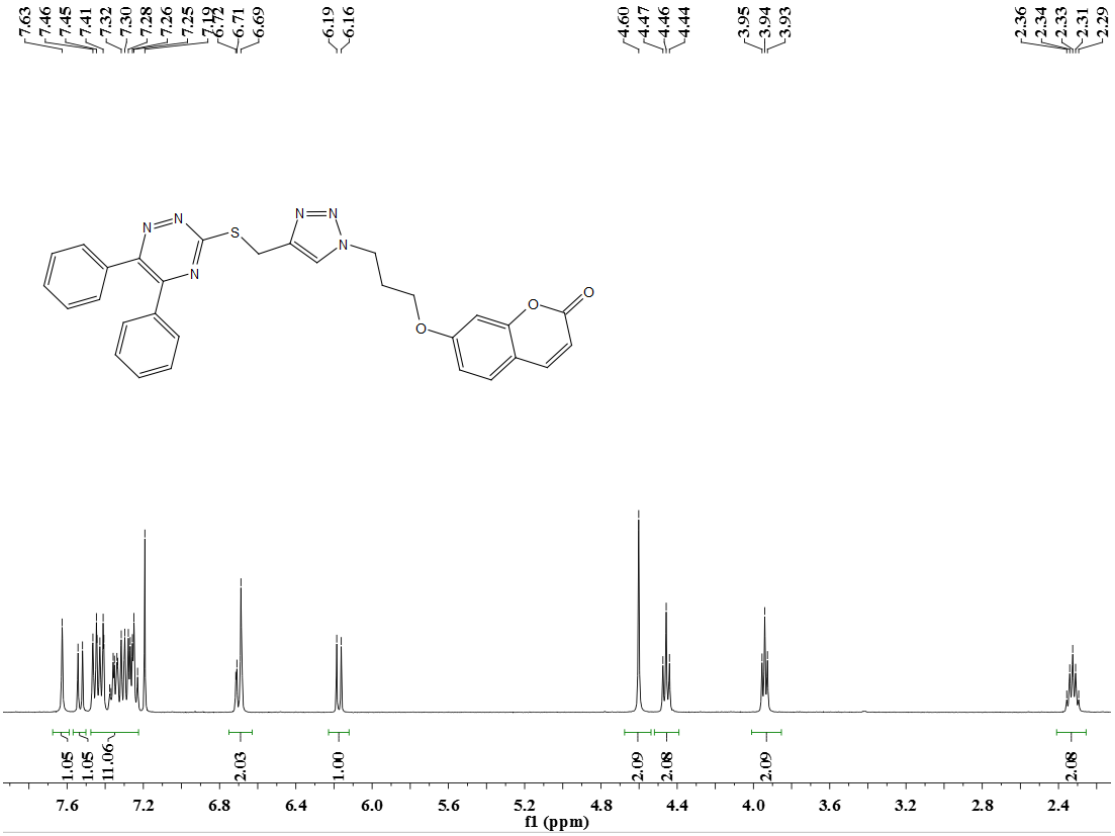
Light yellow solid; Mp:162~164 ^{0}C; Yield: 70%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10 (d, *J* = 8.9 Hz, 1H), 7.81 (s, 1H), 7.63 (s, 1H), 7.42 (dd, *J* = 14.5, 7.9 Hz, 6H), 7.29 (ddt, *J* = 21.4, 15.3, 7.7 Hz, 6H), 6.94 – 6.81 (m, 3H), 6.70 (d, *J* = 2.2 Hz, 1H), 4.59 (s, 2H), 4.46 (t, *J* = 6.8 Hz, 2H), 3.96 (t, *J* = 5.7 Hz, 2H), 3.76 (s, 3H), 2.41 – 2.24 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 174.73, 168.86, 161.60, 158.56, 156.76, 154.78, 153.11, 151.09, 143.32, 134.10, 133.88, 130.03, 129.09, 128.79, 128.54, 128.24, 127.66, 127.51, 126.88, 123.85, 123.13, 122.24, 117.66, 113.57, 112.93, 99.73, 63.80, 54.32, 45.93, 28.60, 24.52. HR-MS (ESI): Calcd. $C_{37}H_{31}N_6O_4S$, $[M+H]^+$m/z: 655.2128, found: 655.2127.

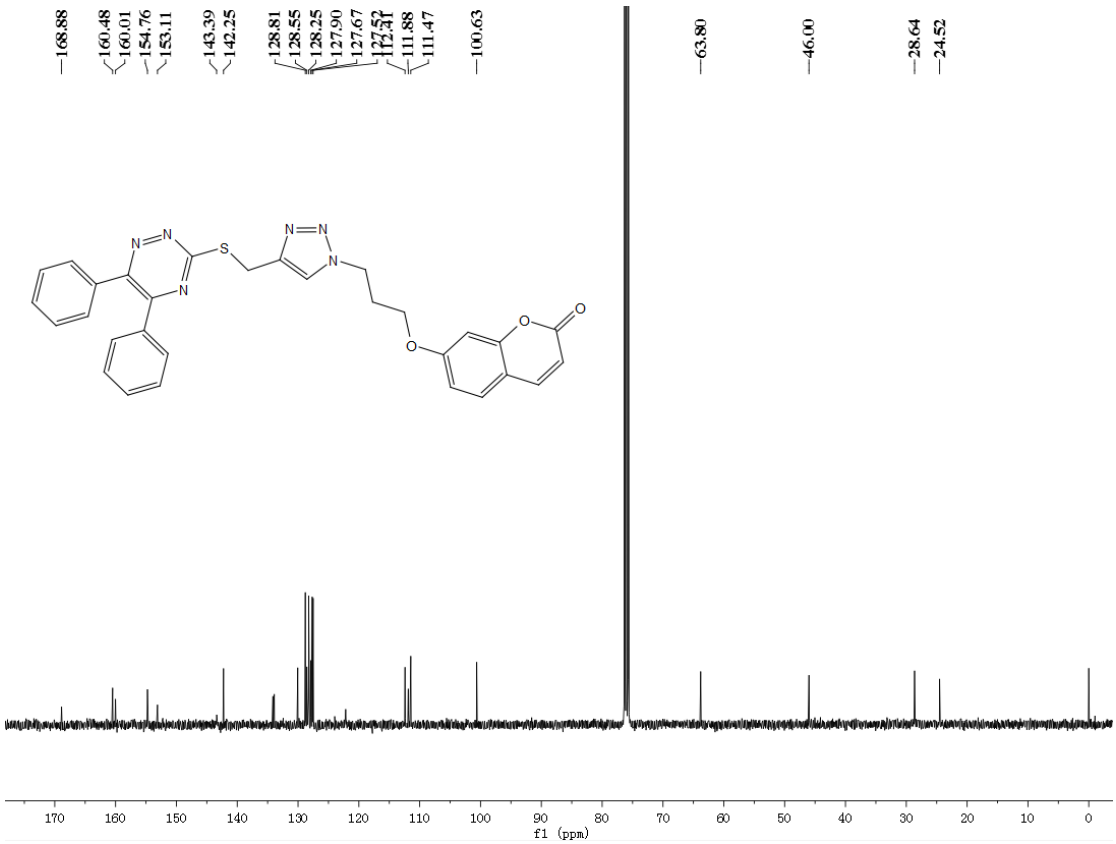


7-(3-(4-(((5,6-diphenyl-1,2,4-triazin-3-yl)thio)methyl)-1H-1,2,3-triazol-1-yl)propoxy)-2H-chromen-2-one (**11K**)

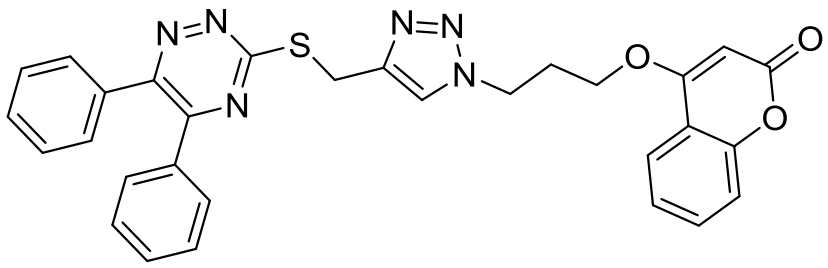


Light yellow solid; Mp:127~129 ^{0}C; Yield: 68%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 (s, 1H), 7.53 (d, *J* = 9.5 Hz, 1H), 7.48 – 7.23 (m, 11H), 6.75 – 6.63 (m, 2H), 6.17 (d, *J* = 9.5 Hz, 1H), 4.60 (s, 2H), 4.46 (t, *J* = 6.8 Hz, 2H), 3.94 (t, *J* = 5.7 Hz, 2H), 2.33 (p, *J* = 6.4 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.88, 160.48, 160.01, 154.76, 153.11, 143.39, 142.25, 134.13, 133.91, 130.05, 128.81, 128.55, 128.25, 127.90, 127.67, 127.52, 123.97, 122.17, 112.41, 111.88, 111.47, 100.63, 63.80, 46.00, 28.64, 24.52. HR-MS (ESI): Calcd. $C_{30}H_{25}N_6O_3S$, $[M+H]^+$m/z: 549.1712, found: 549.1709.

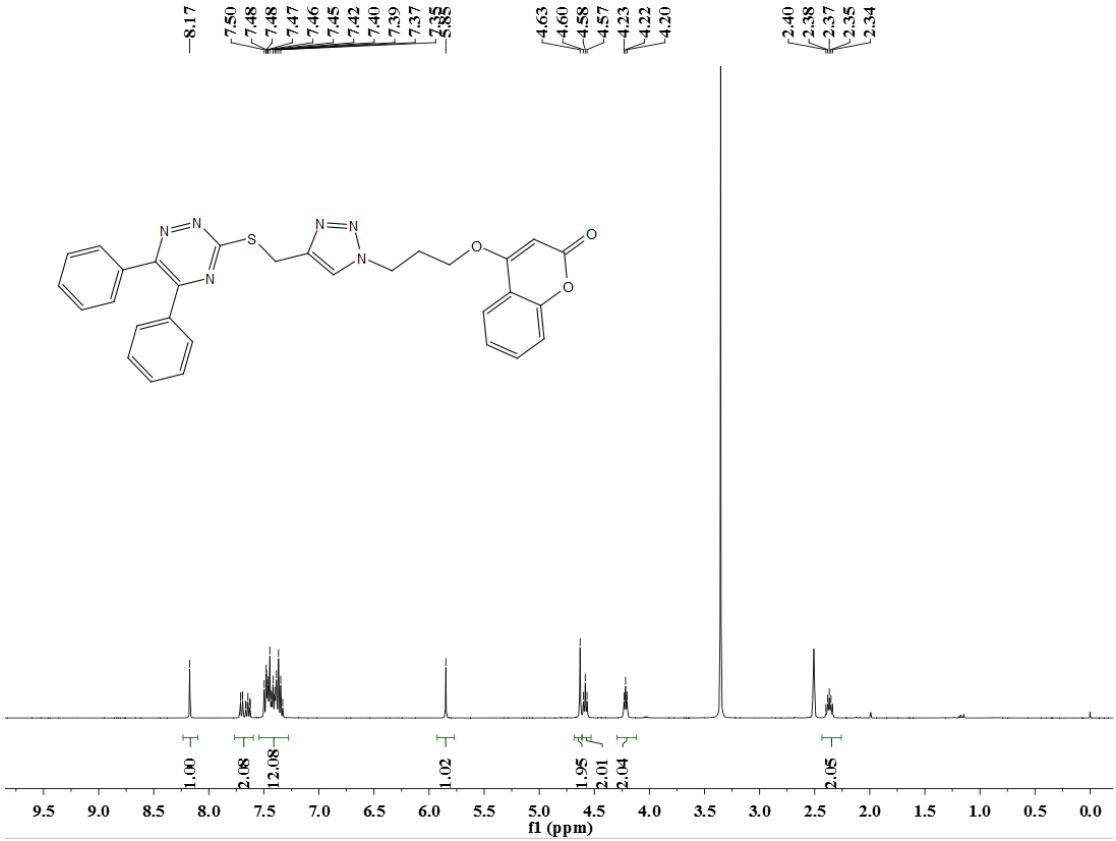




4-(3-(4-(((5,6-diphenyl-1,2,4-triazin-3-yl)thio)methyl)-1H-1,2,3-triazol-1-yl)propoxy)-2H-chromen-2-one (**11L**)



Light yellow solid; Mp:131~132 ^{0}C; Yield: 70%. ^{1}H NMR (400 MHz, DMSO) δ 8.17 (s, 1H), 7.67 (ddd, *J* = 15.6, 8.3, 4.1 Hz, 2H), 7.54 – 7.28 (m, 12H), 5.85 (s, 1H), 4.63 (s, 2H), 4.58 (t, *J* = 6.7 Hz, 2H), 4.22 (t, *J* = 5.7 Hz, 2H), 2.43 – 2.26 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ 169.24, 164.70, 161.53, 155.54, 154.09, 152.68, 142.89, 135.14, 134.89, 132.71, 130.80, 129.64, 129.31, 129.22, 128.43, 128.36, 124.05, 123.77, 122.98, 116.33, 115.05, 90.54, 66.78, 46.69, 28.67, 24.89. HR-MS (ESI): Calcd. $C_{30}H_{25}N_6O_3S$, $[M+H]^+$m/z: 549.1715, found: 549.1709.


8.17
7.50
7.48
7.48
7.47
7.46
7.45
7.42
7.40
7.39
7.37
7.35
7.35
4.63
4.60
4.58
4.57
4.23
4.22
4.20
2.40
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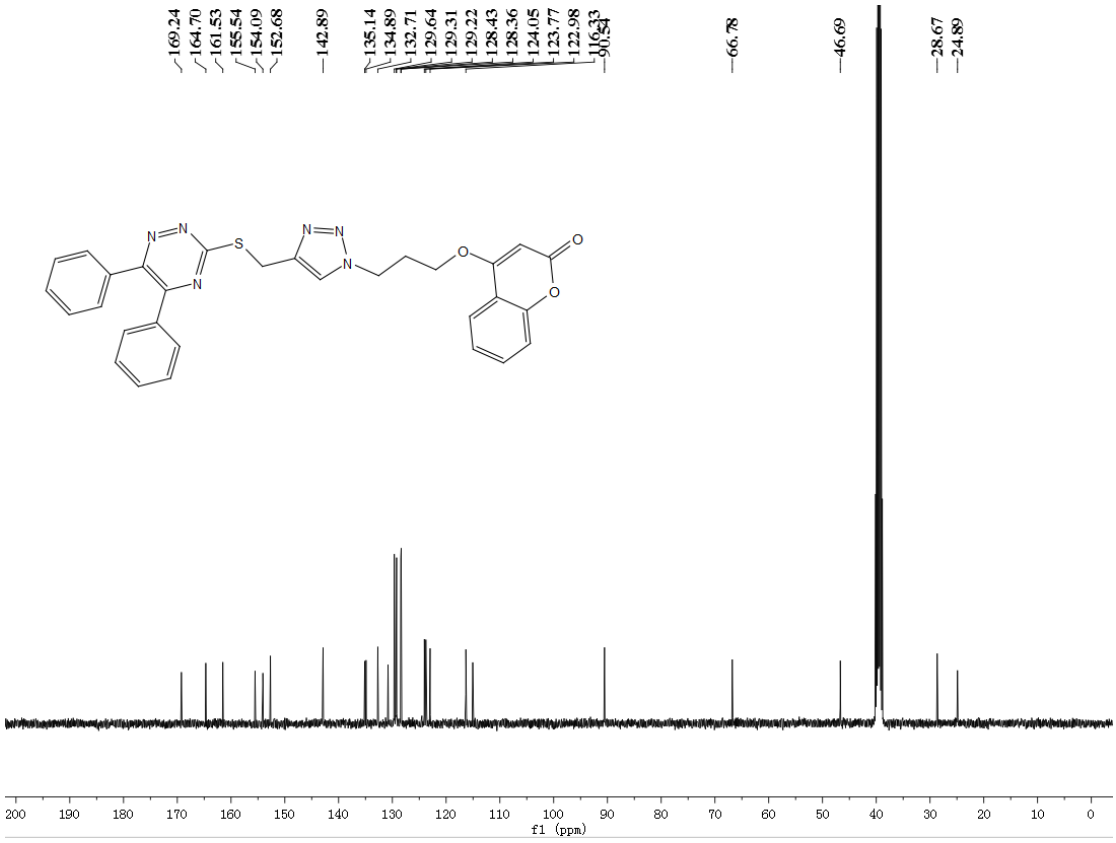
1.02
1.95
2.01
2.04
2.05
f1 (ppm)


169.24
164.70
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134.89
132.71
129.64
129.31
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128.43
128.36
124.05
123.77
122.98
116.33
90.54
66.78
46.69
28.67
24.89
f1 (ppm)

References

1. Y.C. Zheng, Y.C. Duan, J.L. Ma, R.M. Xu, X. Zi, W.L. Lv, M.M. Wang, X.W. Ye, S. Zhu, D. Mobley, Triazole-dithiocarbamate based selective lysine specific demethylase 1 (LSD1) inactivators inhibit gastric cancer cell growth, invasion, and migration, J. Med. Chem. 56 (2013) 8543-8560.
2. D.-J. Fu, S.-Y. Zhang, Y.-C. Liu, X.-X. Yue, J.-J. Liu, J. Song, R.-H. Zhao, F. Li, H.-H. Sun, Y.-B. Zhang, H.-M. Liu, Design, synthesis and antiproliferative activity studies of 1,2,3-triazole-chalcones, MedChemComm. 7 (2016) 1664-1671.
3. A. Nocentini, M. Ferraroni, F. Carta, M. Ceruso, P. Gratteri, C. Lanzi, E. Masini, C.T. Supuran, Benzenesulfonamides incorporating flexible triazole moieties are highly effective carbonic anhydrase inhibitors: synthesis, kinetic, crystallographic, computational and intraocular pressure lowering investigations, 59 (2016) 10692–10704.