Facile Synthesis of Near-Infrared Bodipy by Donor Engineering for In Vivo Tumor Targeted Dual-Modal Imaging

Feifei An[a,b], Jingqi Xin[a], Caiting Deng[a], Xiaofang Tan[c,d], Omer Aras[e], Nandi Chen[*b,f], Xiaohong Zhang[*,d], Richard Ting[*,b,g]

[a] Institute of Medical Engineering, Department of Biophysics, School of Basic Medical Science, Health Science Center, Xi'an Jiaotong University, No.76 Yanta West Road, Xi'an 710061, Shaanxi, People's Republic of China.

[b] Molecular Imaging Innovations Institute (MI3), Department of Radiology, Weill Cornell Medical College, 413 East 69th Street, New York, NY 10065, United States. E-mail: rct2001@med.cornell.edu

[c] Institute of Functional Nano & Soft Materials (FUNSOM) and Jiangsu Key Laboratory for Carbon-Based Functional Materials & Devices, Soochow University, Suzhou, Jiangsu 215123, P. R. China. E-mail: xiaohong_zhang@suda.edu.cn

[d] Jiangsu Institute of Marine Resources Development, Jiangsu Ocean University, 59 Cangwu Road, Lianyungang 222005, Jiangsu, People's Republic of China.

[e] Department of Radiology, Memorial Sloan Kettering Cancer Center, New York, New York 10065, United States

[f] Department of Gastrointestinal Surgery, Shenzhen People's Hospital (The Second Clinical Medicine College, Jinan University, The First Affiliated Hospital, Southern University of Science and Technology), Shenzhen, Guangdong 518020, China. E-mail: chennandi@hotmail.com

[g] Antelope Surgical, Biolabs@NYULangone, 180 Varick St. Fl 6. New York, NY, USA, 10014

1. Synthesis of Chemicals **1**-**6** (Figure 1)

1.1 Synthesis of Chemical **1**

Bodipy (36.8 mg, 0.1 mmol) and benzaldehyde (31.8 mg, 0.3 mmol) were dissolved in the solution containing 18 ml anhydrous acetonitrile and 2 ml piperidine. After overnight reflux, the solution was dried with rotavapor and then redissolved in 4 ml DMF. The solution was purified by preparative chromatography (Agilent, 1260 Infinity) equipped with a C18 reversed-phase LC column (Luna 10 μm C18, 100 Å, LC column 250 × 21.2 mm), water/ACN: 90/10 to 10/90, linear gradient for 20 min, and then 90% ACN for further 20 min, with a flow rate of 12 mL/min. Ultrapure water and HPLC grade ACN [Sigma, St. Louis, MO, USA)] were used. Chemical **1** was collected in fractions 25-26 min and lyophilized. ^{1}H NMR (500 MHz, d6-DMSO, 25°C, TMS): δ 8.13 (d, *J* = 8.0 Hz, 2H), 7.65-7.53 (m, 10H), 7.48 (t, *J* = 7.5 Hz, 4H), 7.40 (t, *J* = 7.3 Hz, 2H), 7.03 (s, 2H), 1.42 (s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25°C, TMS): δ 167.38, 152.82, 142.40, 139.01, 138.62, 137.82, 136.51, 132.83, 132.06, 130.61, 129.99, 129.69, 129.40, 127.75, 119.22, 118.52, 44.25, 22.71, 22.10, 14.87. HRMS (ESI) calc'd for [M] = [$C_{34}H_{27}BF_2N_2O_2$]: 544.2134, calc'd for [M-H]$^-$ = [$C_{34}H_{26}BF_2N_2O_2$]$^-$: 543.2061, found [M-H]$^-$: 543.2049.

1.2 Synthesis of Chemical **2**

Bodipy (36.8 mg, 0.1 mmol) and 4-formylbenzoic acid (45 mg, 0.3 mmol) were dissolved in the solution containing 18 ml anhydrous acetonitrile and 2 ml piperidine. After overnight reflux, the solution was dried with rotavapor and then redissolved in 4 ml DMF. The solution was purified by preparative chromatography (Agilent, 1260 Infinity) equipped with a C18 reversed-phase LC column (Luna 10 μm C18, 100 Å, LC column 250 × 21.2 mm), water/ACN: 90/10 to 10/90, linear gradient for 20 min, and then 90% ACN for further 30 min, with a flow rate of 12 mL/min. Ultrapure water and HPLC grade ACN [Sigma, St. Louis, MO, USA)] were used. Chemical **2** was collected in fractions 20.5-22 min and lyophilized. ^{1}H NMR (500 MHz, d6-DMSO, 25°C, TMS): δ 13.10 (s, 3H), 8.14 (d, *J* = 8.0 Hz, 2H), 8.03 (d, *J* = 8.2 Hz, 4H), 7.74 (d, *J* = 8.2 Hz, 4H), 7.72-7.63 (m, 6H), 7.08 (s, 2H), 1.43 (s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25°C, TMS): δ 167.36, 167.33, 152.57, 142.76, 140.55, 139.32, 138.80, 136.77, 133.26, 132.12, 131.44, 130.61, 129.31, 127.77, 120.47, 119.69, 14.89. HRMS (ESI) calc'd for [M] = [$C_{36}H_{27}BF_2N_2O_6$]: 632.1930, calc'd for [M-H]$^-$ = [$C_{36}H_{26}BF_2N_2O_6$]$^-$: 631.1857, found [M-H]$^-$: 631.1840.

1.3 Synthesis of Chemical **3**

Bodipy (36.8 mg, 0.1 mmol) and *p*-anisaldehyde (40.8 mg, 0.3 mmol) were dissolved in the solution containing 18 ml anhydrous acetonitrile and 2 ml piperidine. After overnight reflux, the solution was dried with rotavapor and then redissolved in 4 ml DMF. The solution was purified by preparative chromatography (Agilent, 1260 Infinity) equipped with a C18 reversed-phase LC column (Luna 10 μm C18, 100 Å, LC column 250 × 21.2 mm), water/ACN: 90/10 to 10/90, linear gradient for 20 min, and then 90% ACN for further 30 min, with a flow rate of 12 mL/min. Ultrapure water and HPLC grade ACN [Sigma, St. Louis, MO, USA)] were used. Chemical **3** was collected in fractions 27-29 min and lyophilized. ^{1}H NMR (500 MHz, d6-DMSO, 25°C, TMS): δ 8.12 (d, *J* = 8.2 Hz, 2H), 7.61-

7.54 (m, 8H), 7.41 (d, J = 16.3 Hz, 2H), 7.05 (d, J = 8.8 Hz, 4H), 6.96 (s, 2H), 3.82 (s, 6H), 1.40 (s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25°C, TMS): δ 167.39, 162.81, 160.94, 158.35, 158.10, 152.92, 141.80, 139.23, 137.43, 137.39, 132.53, 131.94, 130.53, 129.52, 129.40, 129.29, 118.98, 118.80, 116.59, 116.33, 115.21, 55.85, 36.28, 31.26, 22.70, 14.84. HRMS (ESI) calc'd for [M] = [$C_{36}H_{31}BF_2N_2O_4$]: 604.2345, calc'd for [M-H]$^-$ = [$C_{36}H_{30}BF_2N_2O_4$]$^-$: 603.2272, found [M-H]$^-$: 603.2262.

1.4 Synthesis of Chemical **4**

Bodipy (36.8 mg, 0.1 mmol) and *p*-hydroxybenzaldehyde (36.6 mg, 0.3 mmol) were dissolved in the solution containing 18 ml anhydrous acetonitrile and 2 ml piperidine. After overnight reflux, the solution was dried with rotavapor and then redissolved in 4 ml DMF. The solution was purified by preparative chromatography (Agilent, 1260 Infinity) equipped with a C18 reversed-phase LC column (Luna 10 μm C18, 100 Å, LC column 250 × 21.2 mm), water/ACN: 90/10 to 10/90, linear gradient for 20 min, and then 90% ACN for further 30 min, with a flow rate of 12 mL/min. Ultrapure water and HPLC grade ACN [Sigma, St. Louis, MO, USA)] were used. Chemical **4** was collected in fractions 21-22 min and lyophilized. ^{1}H NMR (500 MHz, d6-DMSO, 25°C, TMS): δ 13.27 (s, 1H), 10.00 (s, 2H), 8.11 (d, J = 8.2 Hz, 2H), 7.59 (d, J = 8.2 Hz, 2H), 7.51-7.47 (m, 6H), 7.35 (d, J = 16.3 Hz, 2H), 6.93 (s, 2H), 6.87 (d, J = 8.5 Hz, 4H), 1.39 (s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25°C, TMS): δ 179.98, 167.38, 159.58, 158.48, 158.23, 153.85, 152.99, 141.51, 139.33, 137.79, 136.84, 132.39, 131.88, 130.48, 129.57, 127.76, 118.61, 116.60, 115.39, 106.63, 105.51, 102.48, 98.53, 50.52, 44.22, 30.85, 28.70, 26.06, 24.14, 22.69, 22.09, 14.81, 14.36. HRMS (ESI) calc'd for [M] = [$C_{34}H_{27}BF_2N_2O_4$]: 576.2032, calc'd for [M-H]$^-$ = [$C_{34}H_{26}BF_2N_2O_4$]$^-$: 575.1959, found [M-H]$^-$: 575.1946.

1.5 Synthesis of Chemical **5**

Bodipy (36.8 mg, 0.1 mmol) and 4-(N,N-diphenylamino)benzaldehyde (82 mg, 0.3 mmol) were dissolved in the solution containing 18 ml anhydrous acetonitrile and 2 ml piperidine. After overnight reflux, the solution was dried with rotavapor and then redissolved in 4 ml DMF. The solution was purified by preparative chromatography (Agilent, 1260 Infinity) equipped with a C18 reversed-phase LC column (Luna 10 μm C18, 100 Å, LC column 250 × 21.2 mm), water/ACN: 80/20 to 0/100, linear gradient for 20 min, and then 100% ACN for further 30 min, with a flow rate of 12 mL/min. Ultrapure water and HPLC grade ACN [Sigma, St. Louis, MO, USA)] were used. Chemical **5** was collected in fractions 39-42 min and lyophilized. ^{1}H NMR (500 MHz, d6-DMSO, 25°C, TMS): δ 8.11 (d, J = 8.3 Hz, 2H), 7.95 (s, 1H), 7.60 (s, 2H), 7.49 (d, J = 7.9 Hz, 4H), 7.40-7.34 (m, 10H), 7.15-7.09 (m, 12H), 6.96 (d, J = 5.6 Hz, 6H), 6.38 (s, 1H), 2.36, 2.33 (s, s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25°C, TMS): Not available due to the poor solubility in DMSO. HRMS (ESI) calc'd for [M] = [$C_{58}H_{45}BF_2N_4O_2$]: 878.3604, calc'd for [M-H]$^-$ = [$C_{58}H_{44}BF_2N_4O_2$]$^-$: 877.3531, found [M-H]$^-$: 877.3513.

1.6 Synthesis of Chemical **6**

Bodipy (36.8 mg, 0.1 mmol) and 4-dimethylaminobenzaldehyde (44.8 mg, 0.3 mmol) were dissolved in the solution containing 18 ml anhydrous acetonitrile and 2 ml piperidine. After

overnight reflux, the solution was dried with rotavapor and then redissolved in 4 ml DMF. The solution was purified by preparative chromatography (Agilent, 1260 Infinity) equipped with a C18 reversed-phase LC column (Luna 10 µm C18, 100 Å, LC column 250 × 21.2 mm), water/ACN: 90/10 to 10/90, linear gradient for 20 min, and then 90% ACN for further 30 min, with a flow rate of 12 mL/min. Ultrapure water and HPLC grade ACN [Sigma, St. Louis, MO, USA)] were used. Chemical **6** was collected in fractions 23-25 min and lyophilized. ^{1}H NMR (500 MHz, d6-DMSO, 25°C, TMS): δ 8.10 (d, J = 7.8 Hz, 2H), 7.58-7.55 (m, 2H), 7.48-7.43 (m, 6H), 7.33-7.27 (m, 2H), 6.89 (s, 2H), 6.81 (d, J = 8.0 Hz, 4H), 3.01 (s, 12H), 1.38 (s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25°C, TMS): δ 167.41, 158.81, 158.52, 152.84, 151.43, 140.75, 137.84, 131.75, 130.50, 130.40, 129.73, 129.55, 129.34, 129.28, 118.34, 112.81, 112.73, 44.24, 22.70, 14.79. HRMS (ESI) calc'd for [M] = $[C_{38}H_{37}BF_2N_4O_2]$: 630.2978, calc'd for $[M+H]^+$ = $[C_{38}H_{38}BF_2N_4O_2]^+$: 631.3056, found $[M+H]^+$: 631.3052.

2. The normalized absorption and emission spectra of Chemicals **1-6** in DMSO.

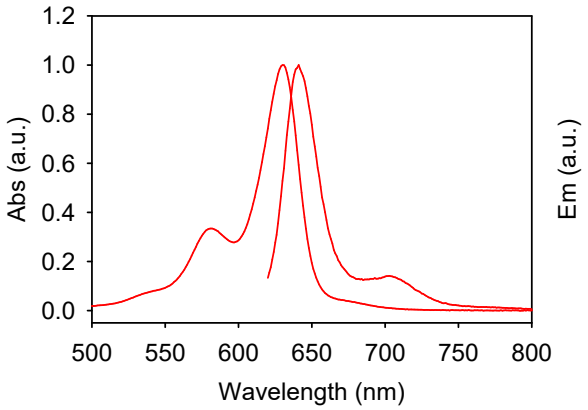


Figure S1. The normalized absorption and emission spectra of Chemical **1** in DMSO.

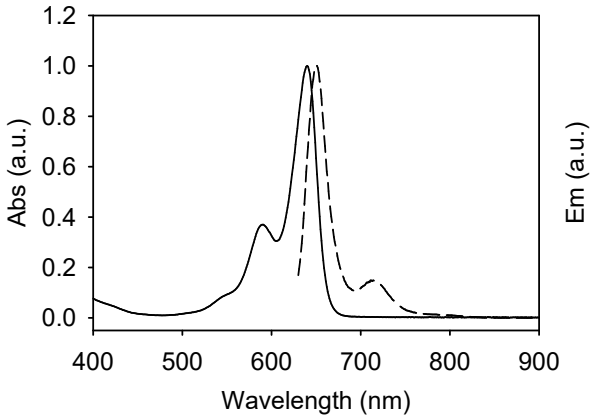


Figure S2. The normalized absorption and emission spectra of Chemical **2** in DMSO.

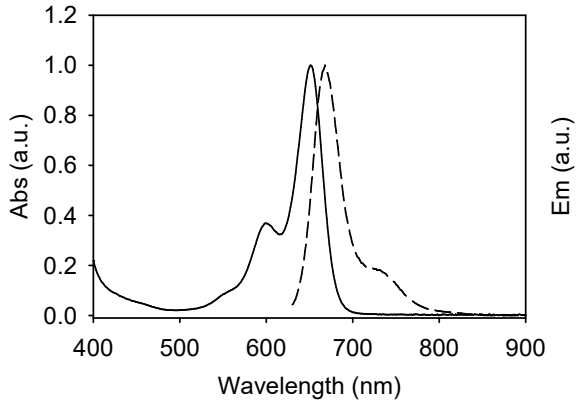


Figure S3. The normalized absorption and emission spectra of Chemical **3** in DMSO.

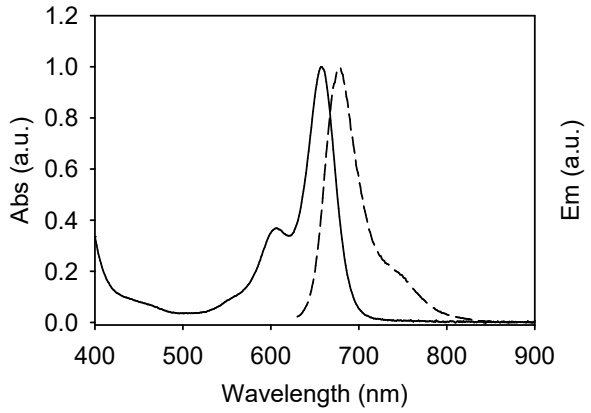


Figure S4. The normalized absorption and emission spectra of Chemical **4** in DMSO.

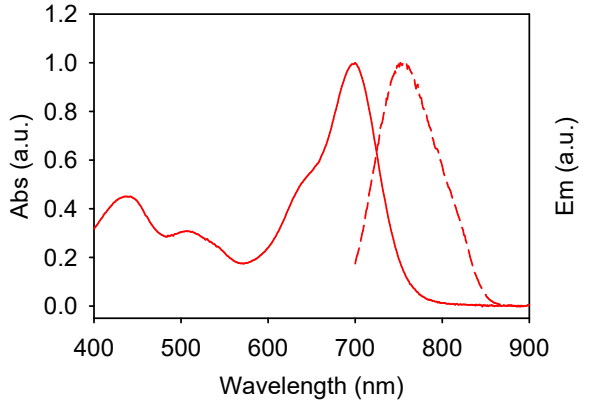


Figure S5. The normalized absorption and emission spectra of Chemical **5** in DMSO.

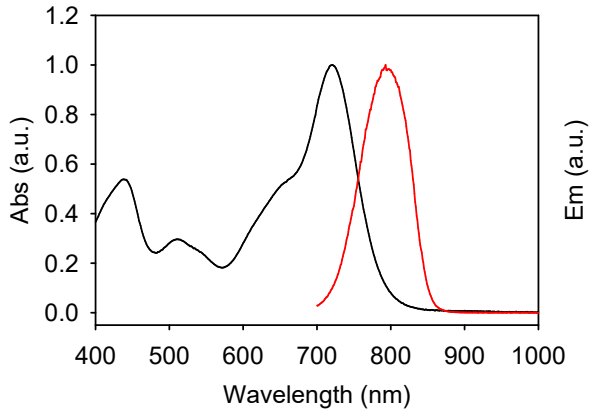


Figure S6. The normalized absorption and emission spectra of Chemical **6** in DMSO.

3. The MALDI-TOF characterization of PEGylated **5**.

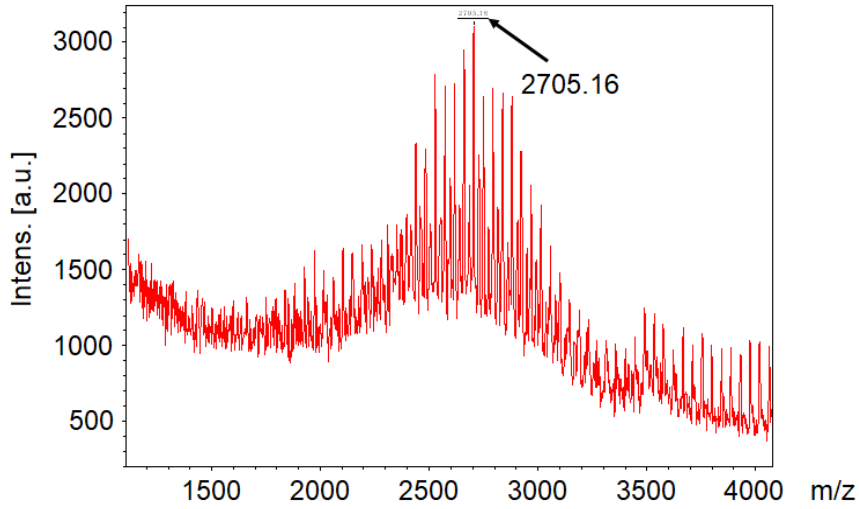


Figure S7. The MALDI-TOF characterization of PEGylated **5**. The arrow indicates the MW corresponding to the condensation reaction between the chemical **5** and the mean-MW-PEG_{2000} species.

4. The ^{1}H NMR characterization of PEGylated **5**.

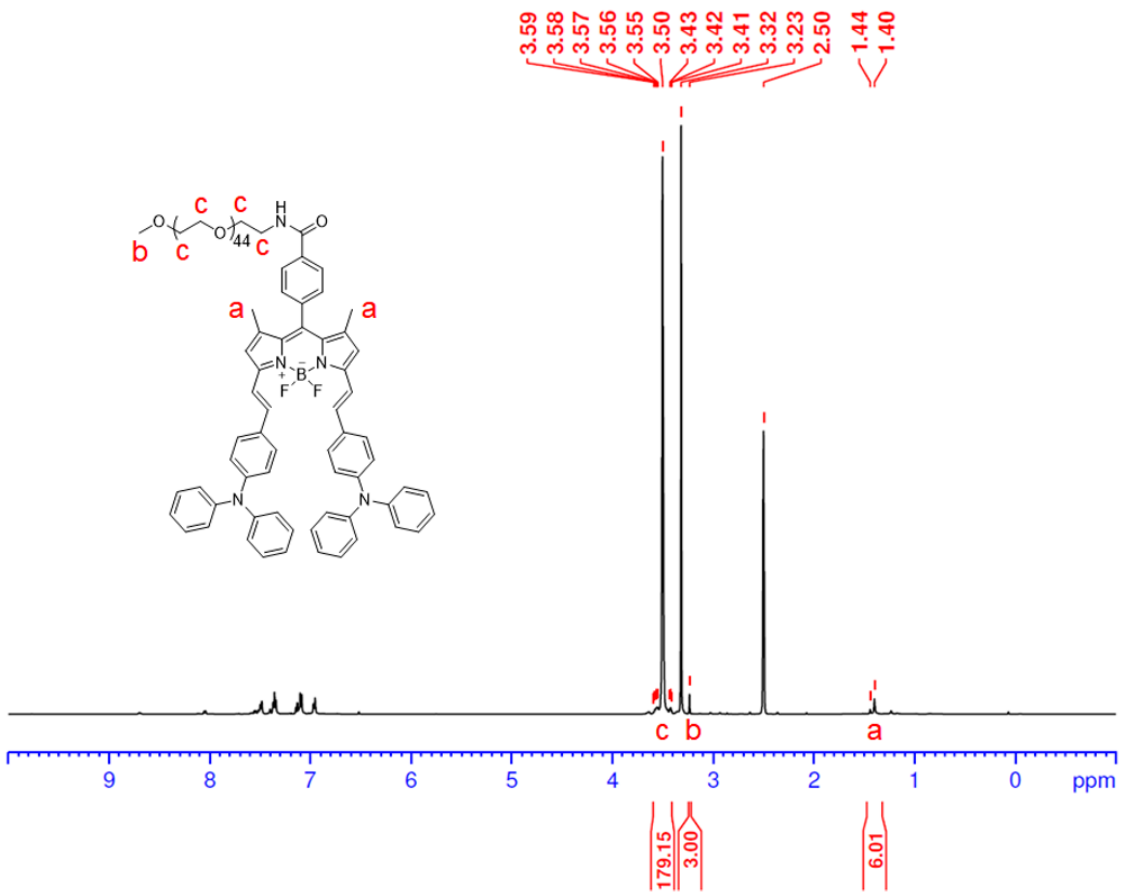


Figure S8. The ^{1}H NMR spectra of PEGylated **5** with signal assignation.

5. The critical micelle concentration (CMC) value of PEGylated **5.**

The CMC value of PEGylated **5** was estimated by the curves of the maximal emission wavelength of Pyrene in the presence of PEGylated **5** NPs at various concentrations (0.125 μM, 0.25 μM, 0.5 μM, 0.8 μM, 2 μM, 4 μM, 8 μM). The PEGylated **5** NPs solutions were prepared by diluting from 200 μM PEGylated **5** NPs solution. 20 μL Pyrene solution in acetone was added to 2 mL PEGylated **5** NPs solutions, then the mixtures were aged for 4 h. After 4 hours, the fluorescence spectra of Pyrene were measured (with the excitation wavelength of 330 nm, excitation slit width of 20 nm and emission slit width 2.5 nm) and analyzed to plot the curve for the estimation of the CMC value. The first spectral band at 373 nm (I_1) and the third spectral band at 383 nm (I_3) of Pyrene were recorded for plotting the CMC curve with concentration as abscissa and I_1/I_3 ratio as ordinate. To obtain the

CMC value, two trend lines were drawn and their intersection was defined as CMC.

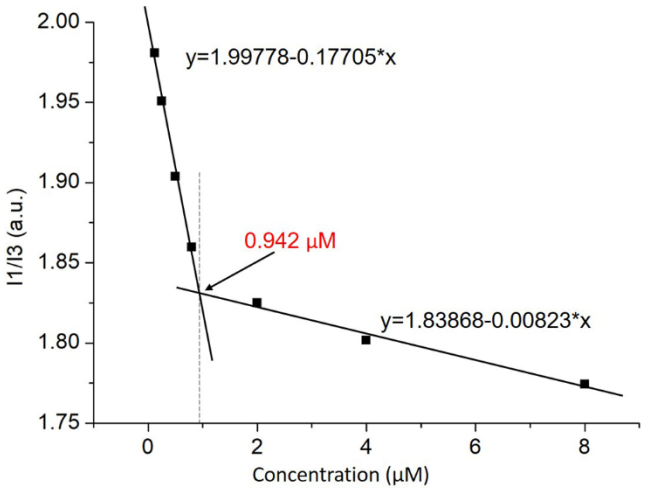


Figure S9. PEGylated **5** exhibited a critical micelle concentration of 0.942 μM.

6. The biocompatibility test (MTS assay) of NIR NPs with A549 lung cancer cells.

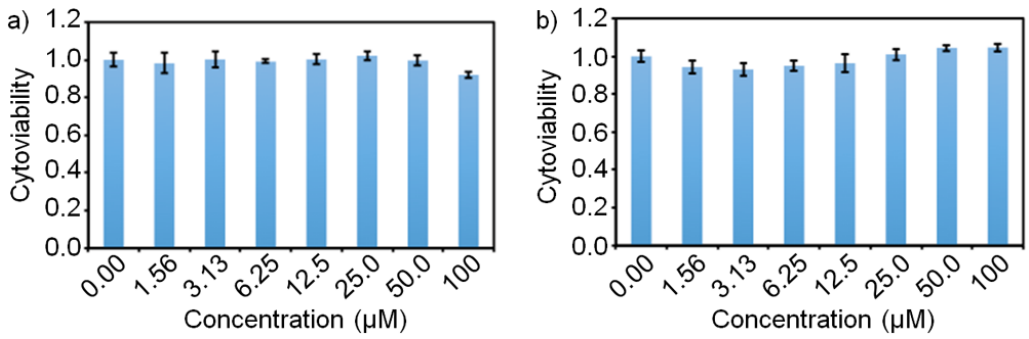


Figure S10. The cytoviability of A549 cancer cells after incubation with the NIR NPs at different concentrations for 24 h and 48 h, respectively.

7. The biocompatibility test (MTS assay) of NIR NPs with Human umbilical vein endothelial cells (HUVEC) cells.

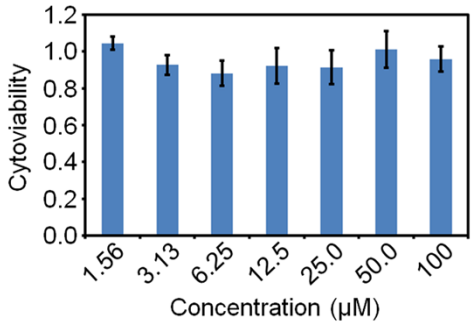
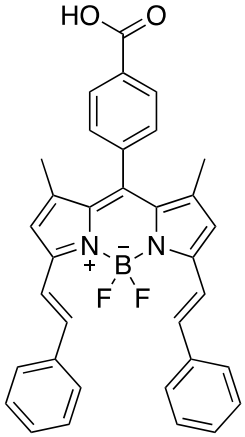


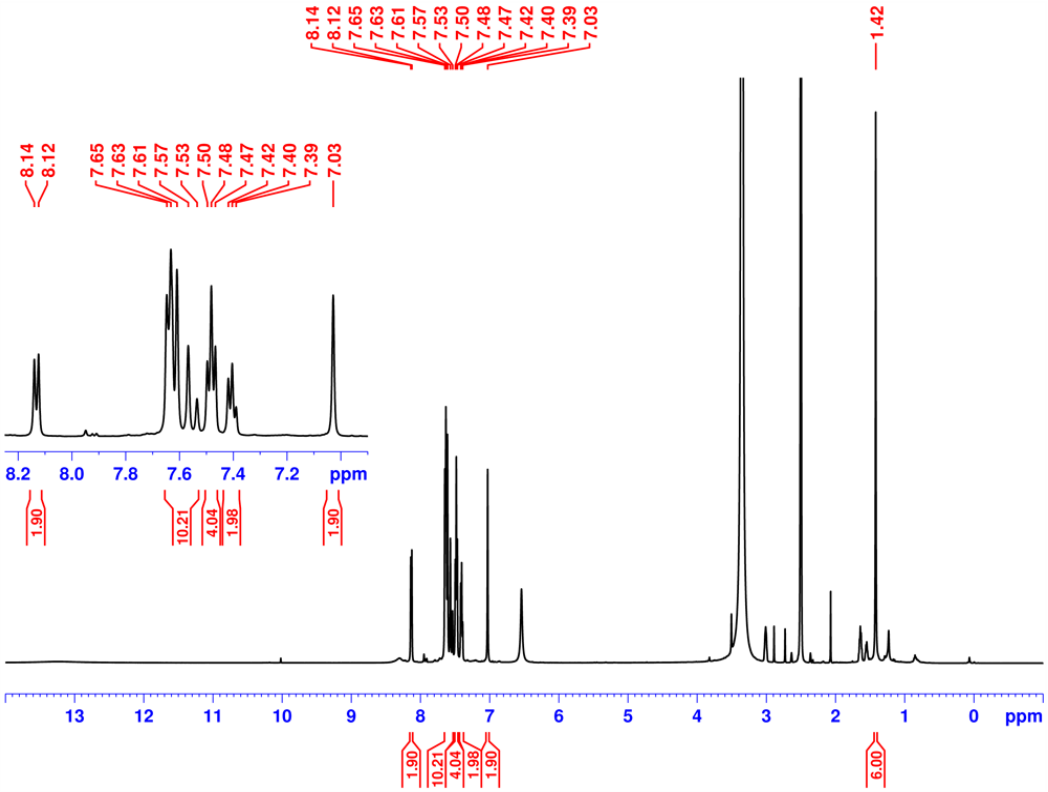
Figure S11. The cytoviability of HUVEC cells after incubation with the NIR NPs at different concentrations for 24 h.

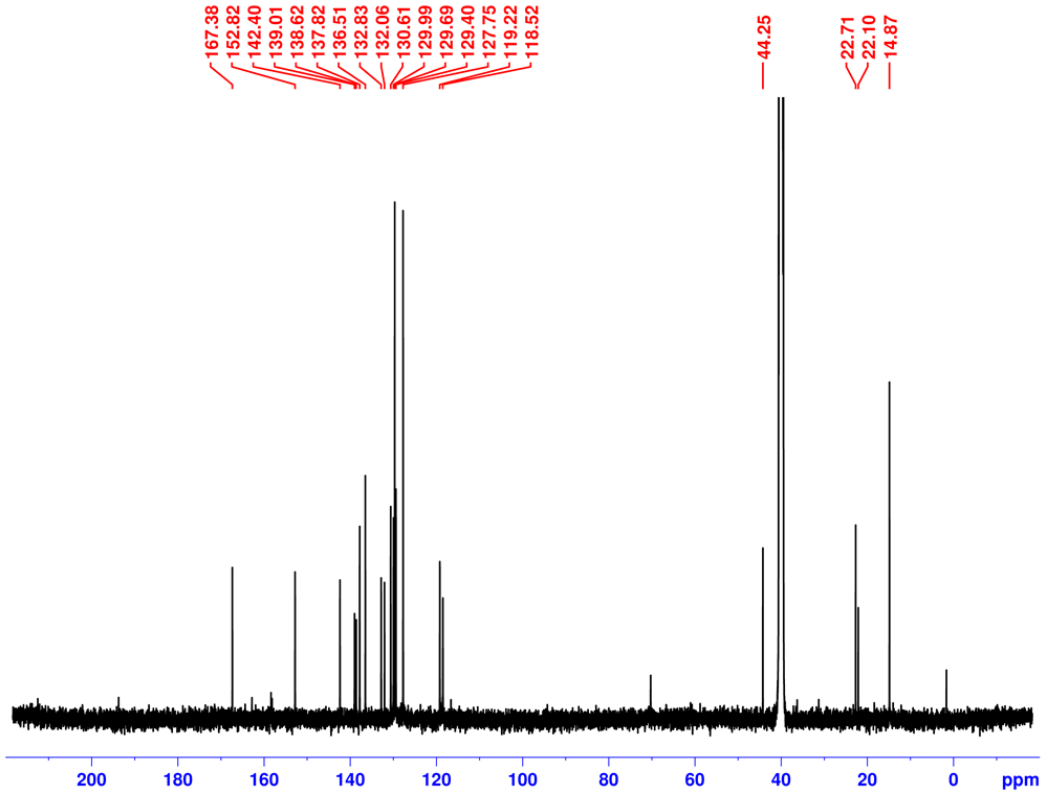
8. The ^{1}H NMR, ^{13}C NMR and HRMS (ESI) characterizations of Chemicals **1-6**.

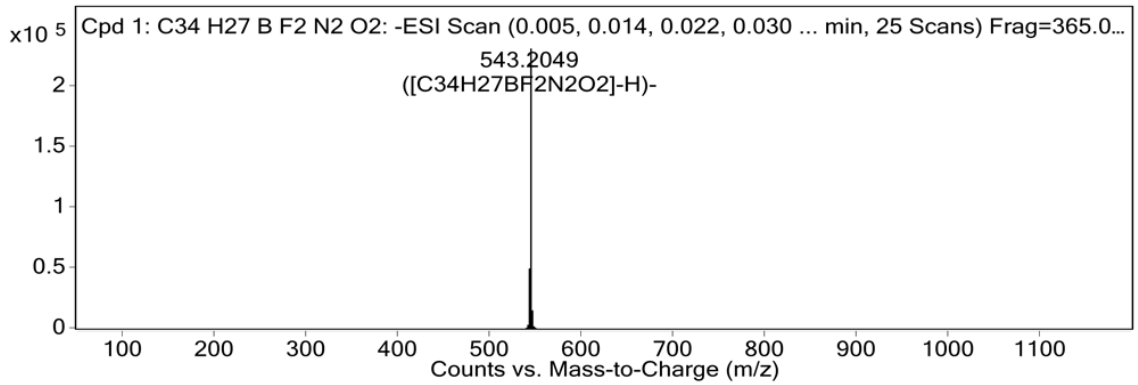
Chemical **1**:



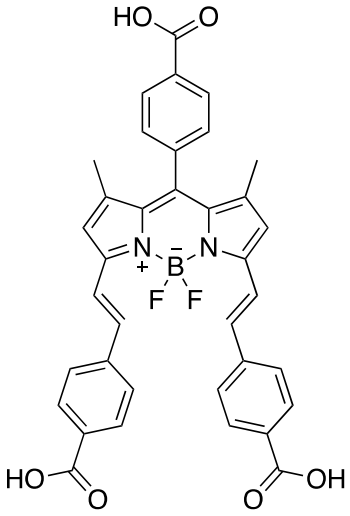
^{1}H NMR (500 MHz, d6-DMSO, 25℃, TMS): δ 8.13 (d, *J* = 8.0 Hz, 2H), 7.65-7.53 (m, 10H), 7.48 (t, *J* = 7.5 Hz, 4H), 7.40 (t, *J* = 7.3 Hz, 2H), 7.03 (s, 2H), 1.42 (s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25℃, TMS): δ 167.38, 152.82, 142.40, 139.01, 138.62, 137.82, 136.51, 132.83, 132.06, 130.61, 129.99, 129.69, 129.40, 127.75, 119.22, 118.52, 44.25, 22.71, 22.10, 14.87. HRMS (ESI) calc'd for [M]=[$C_{34}H_{27}BF_2N_2O_2$]: 544.2134, calc'd for [M-H]$^{-}$ =[$C_{34}H_{26}BF_2N_2O_2$]$^{-}$: 543.2061, found [M-H]$^{-}$: 543.2049.


8.14
8.12
7.65
7.63
7.61
7.57
7.53
7.50
7.48
7.47
7.42
7.40
7.39
7.03
1.42
8.2
8.0
7.8
7.6
7.4
7.2
ppm
1.90
10.21
4.04
1.98
1.90
13
12
11
10
9
8
7
6
5
4
3
2
1
0
ppm
1.90
10.21
4.04
1.98
1.90
6.00

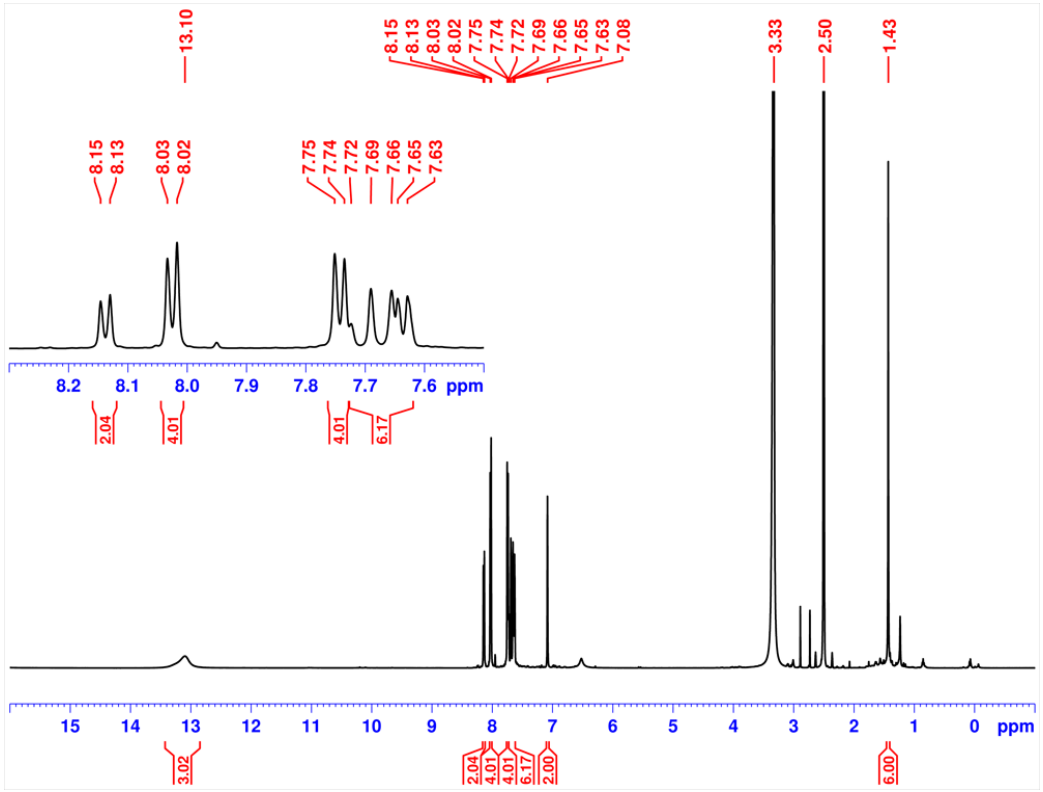

167.38
152.82
142.40
139.01
138.62
137.82
136.51
132.83
132.06
130.61
129.99
129.69
129.40
127.75
119.22
118.52
44.25
22.71
22.10
14.87
200
180
160
140
120
100
80
60
40
20
0
ppm

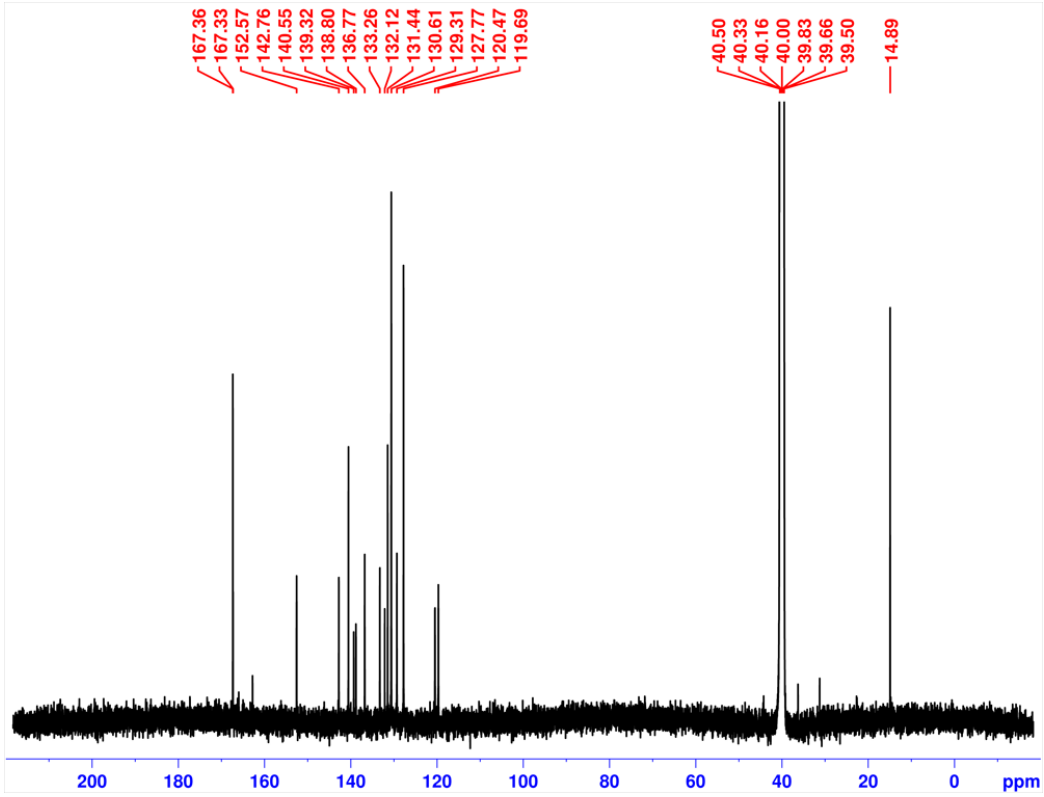


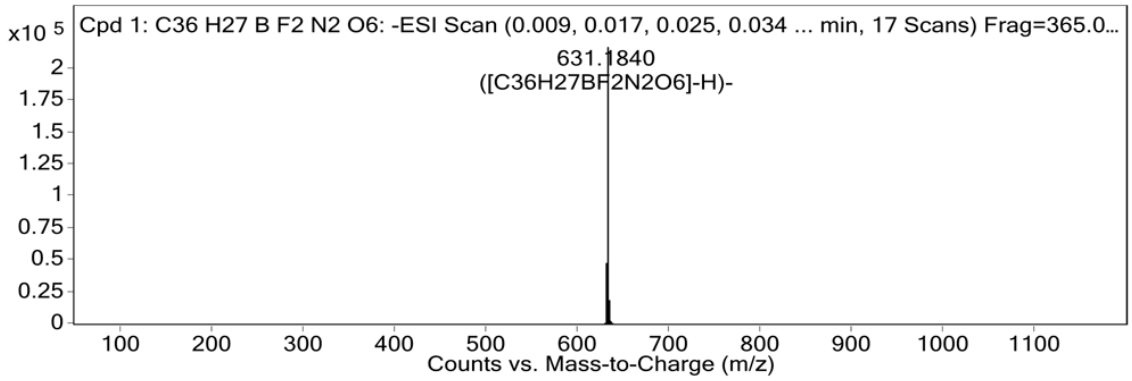
Chemical **2**:



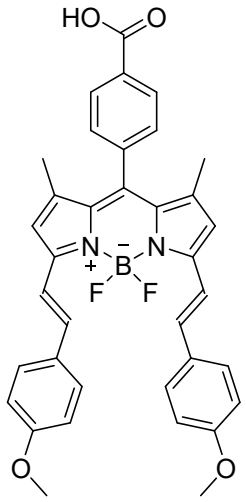
^{1}H NMR (500 MHz, d6-DMSO, 25°C, TMS): δ 13.10 (s, 3H), 8.14 (d, *J* = 8.0 Hz, 2H), 8.03 (d, *J* = 8.2 Hz, 4H), 7.74 (d, *J* = 8.2 Hz, 4H), 7.72-7.63 (m, 6H), 7.08 (s, 2H), 1.43 (s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25°C, TMS): δ 167.36, 167.33, 152.57, 142.76, 140.55, 139.32, 138.80, 136.77, 133.26, 132.12, 131.44, 130.61, 129.31, 127.77, 120.47, 119.69, 14.89. HRMS (ESI) calc'd for [M]=[$C_{36}H_{27}BF_2N_2O_6$]: 632.1930, calc'd for [M-H]$^-$ =[$C_{36}H_{26}BF_2N_2O_6$]$^-$: 631.1857, found [M-H]$^-$: 631.1840.


13.10
8.15
8.13
8.03
8.02
7.75
7.74
7.72
7.69
7.66
7.65
7.63
7.08
3.33
2.50
1.43
8.2
8.1
8.0
7.9
7.8
7.7
7.6 ppm
2.04
4.01
4.01
6.17
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0 ppm
3.02
2.04
4.01
4.01
6.17
2.00
6.00

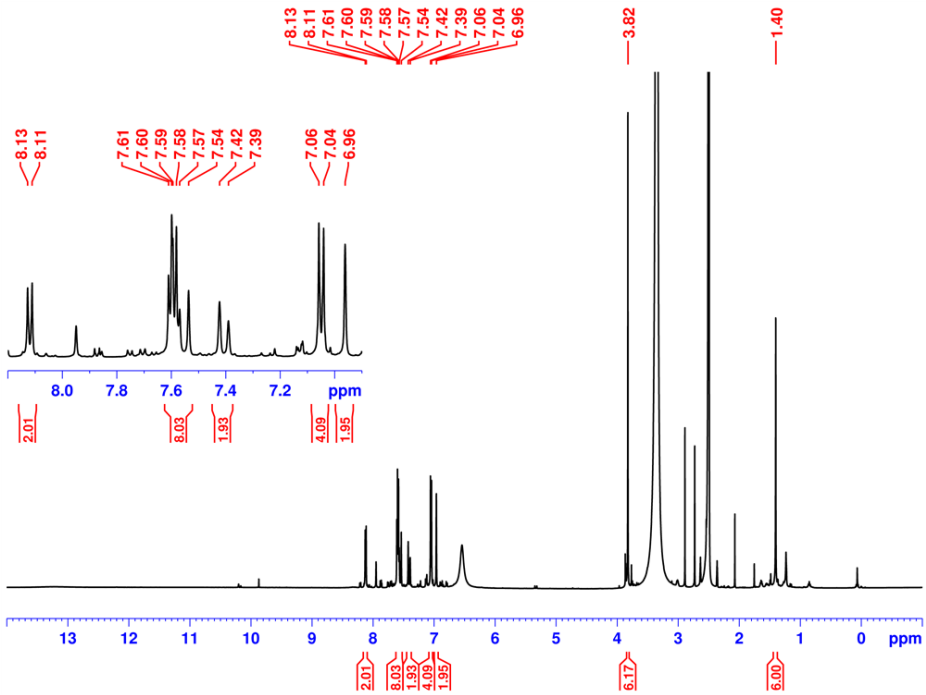

167.36
167.33
152.57
142.76
140.55
139.32
138.80
136.77
133.26
132.12
131.44
130.61
129.31
127.77
120.47
119.69
40.50
40.33
40.16
40.00
39.83
39.66
39.50
14.89
200
180
160
140
120
100
80
60
40
20
0
ppm

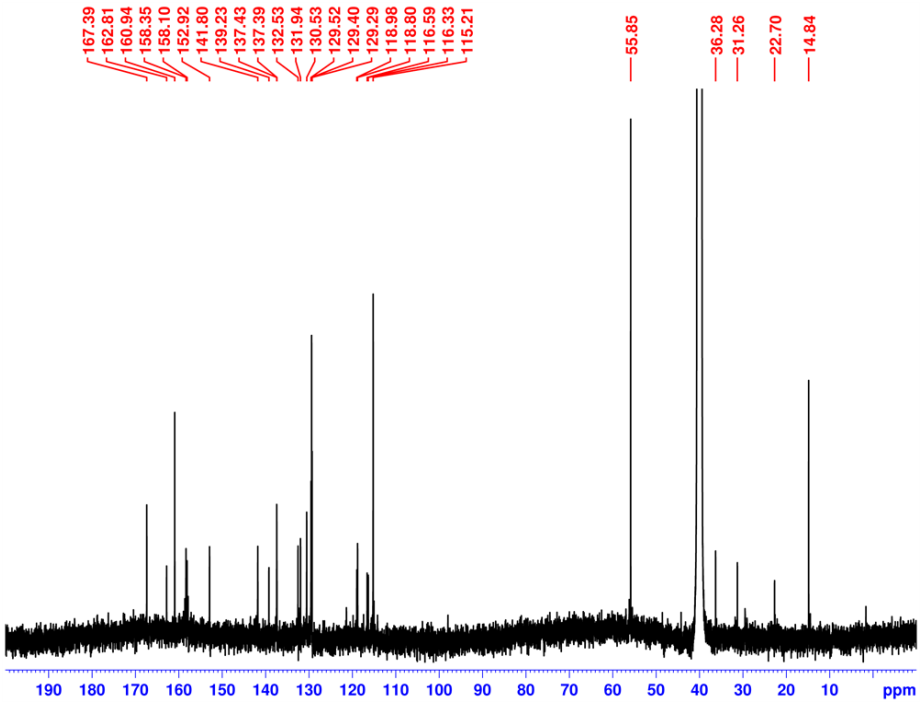


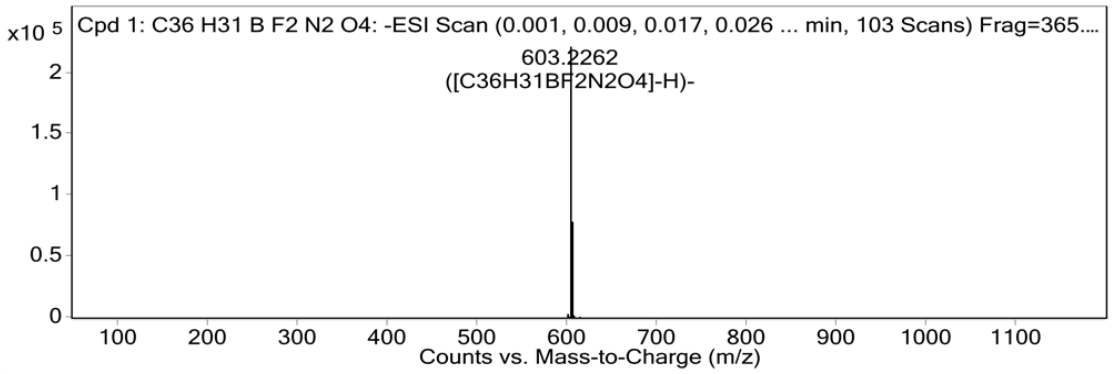
Chemical **3**:



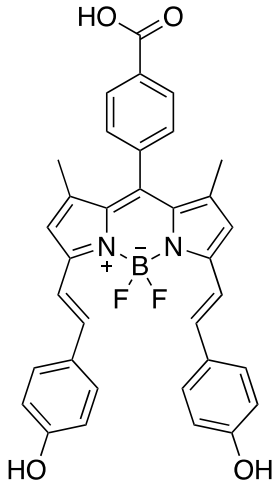
^{1}H NMR (500 MHz, d6-DMSO, 25°C, TMS): δ 8.12 (d, *J* = 8.2 Hz, 2H), 7.61-7.54 (m, 8H), 7.41 (d, *J* = 16.3 Hz, 2H), 7.05 (d, *J* = 8.8 Hz, 4H), 6.96 (s, 2H), 3.82 (s, 6H), 1.40 (s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25°C, TMS): δ 167.39, 162.81, 160.94, 158.35, 158.10, 152.92, 141.80, 139.23, 137.43, 137.39, 132.53, 131.94, 130.53, 129.52, 129.40, 129.29, 118.98, 118.80, 116.59, 116.33, 115.21, 55.85, 36.28, 31.26, 22.70, 14.84. HRMS (ESI) calc'd for [M]=[$C_{36}H_{31}BF_2N_2O_4$]: 604.2345, calc'd for [M-H]$^-$ =[$C_{36}H_{30}BF_2N_2O_4$]$^-$: 603.2272, found [M-H]$^-$: 603.2262.


8.13
8.11
7.61
7.60
7.59
7.58
7.57
7.54
7.42
7.39
7.06
7.04
6.96
3.82
1.40
8.0
7.8
7.6
7.4
7.2
ppm
2.01
8.03
1.93
4.09
1.95
13
12
11
10
9
8
7
6
5
4
3
2
1
0
ppm
2.01
8.03
1.93
4.09
1.95
6.17
6.00

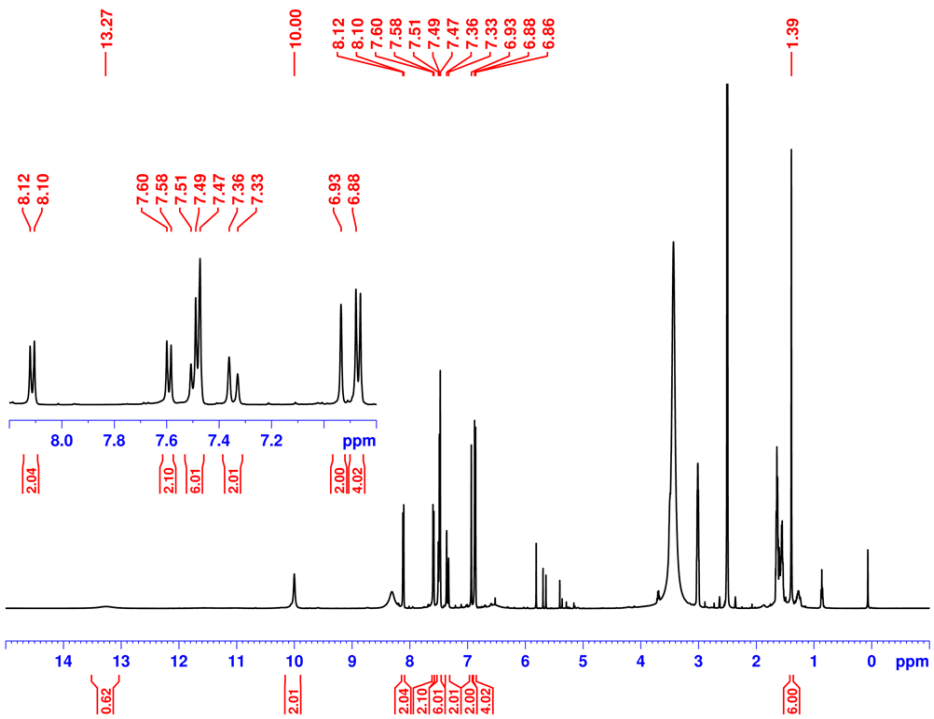

167.39
162.81
160.94
158.35
158.10
152.92
141.80
139.23
137.43
137.39
132.53
131.94
130.53
129.52
129.40
129.29
118.98
118.80
116.59
116.33
115.21
55.85
36.28
31.26
22.70
14.84
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

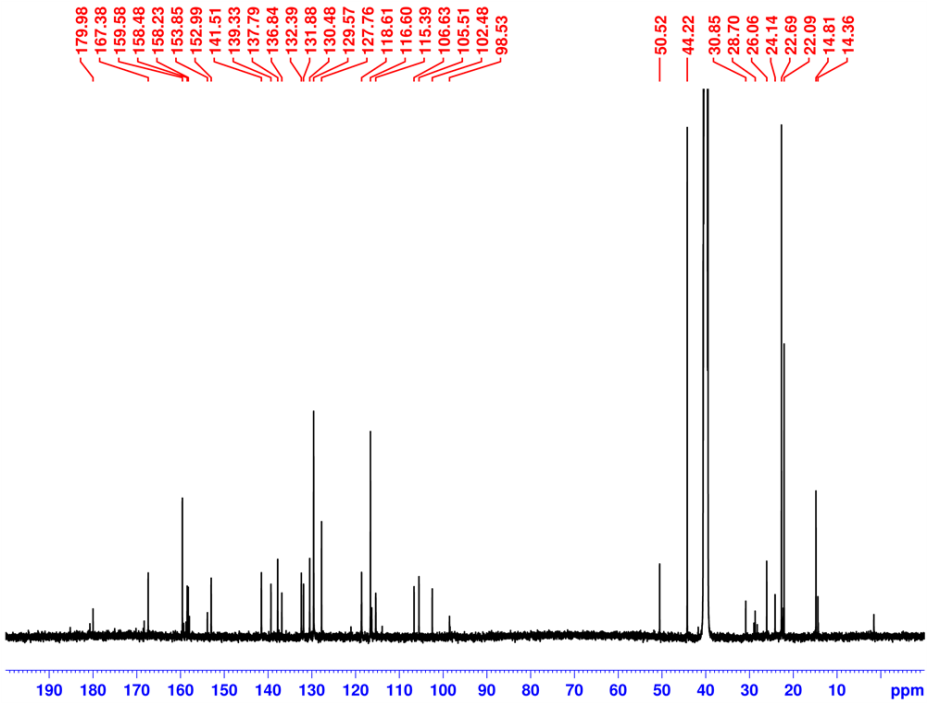


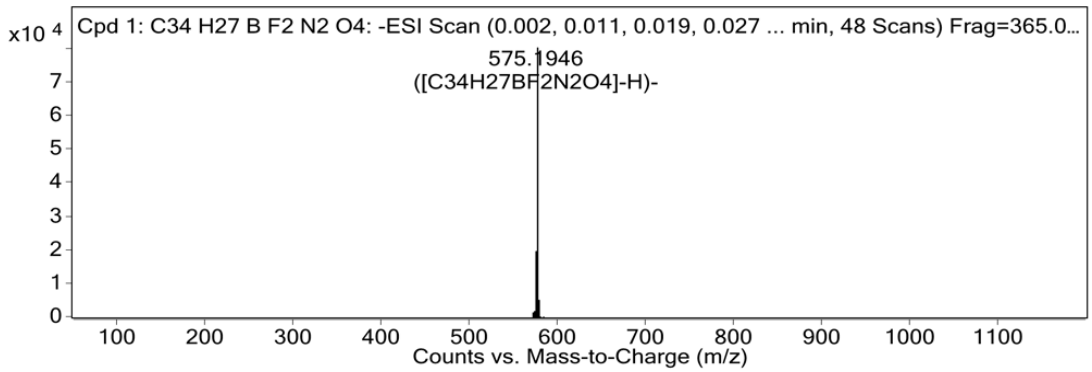
Chemical **4**:



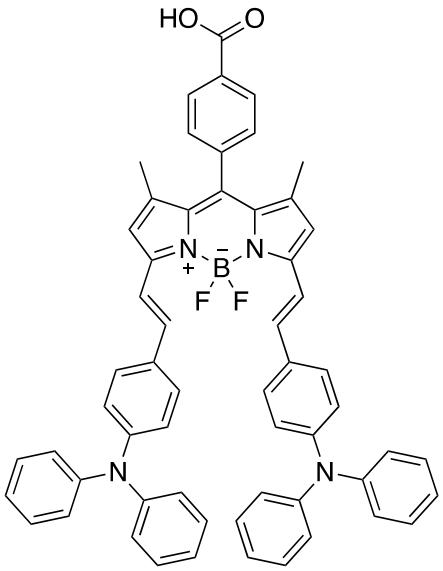
^{1}H NMR (500 MHz, d6-DMSO, 25°C, TMS): δ 13.27 (s, 1H), 10.00 (s, 2H), 8.11 (d, *J* = 8.2 Hz, 2H), 7.59 (d, *J* = 8.2 Hz, 2H), 7.51-7.47 (m, 6H), 7.35 (d, *J* = 16.3 Hz, 2H), 6.93 (s, 2H), 6.87 (d, *J* = 8.5 Hz, 4H), 1.39 (s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25°C, TMS): δ 179.98, 167.38, 159.58, 158.48, 158.23, 153.85, 152.99, 141.51, 139.33, 137.79, 136.84, 132.39, 131.88, 130.48, 129.57, 127.76, 118.61, 116.60, 115.39, 106.63, 105.51, 102.48, 98.53, 50.52, 44.22, 30.85, 28.70, 26.06, 24.14, 22.69, 22.09, 14.81, 14.36. HRMS (ESI) calc'd for [M]=[$C_{34}H_{27}BF_2N_2O_4$]: 576.2032, calc'd for [M-H]$^-$ =[$C_{34}H_{26}BF_2N_2O_4$]$^-$: 575.1959, found [M-H]$^-$: 575.1946.


13.27
10.00
8.12
8.10
7.60
7.58
7.51
7.49
7.47
7.36
7.33
6.93
6.88
6.86
1.39
8.0
7.8
7.6
7.4
7.2
ppm
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
ppm

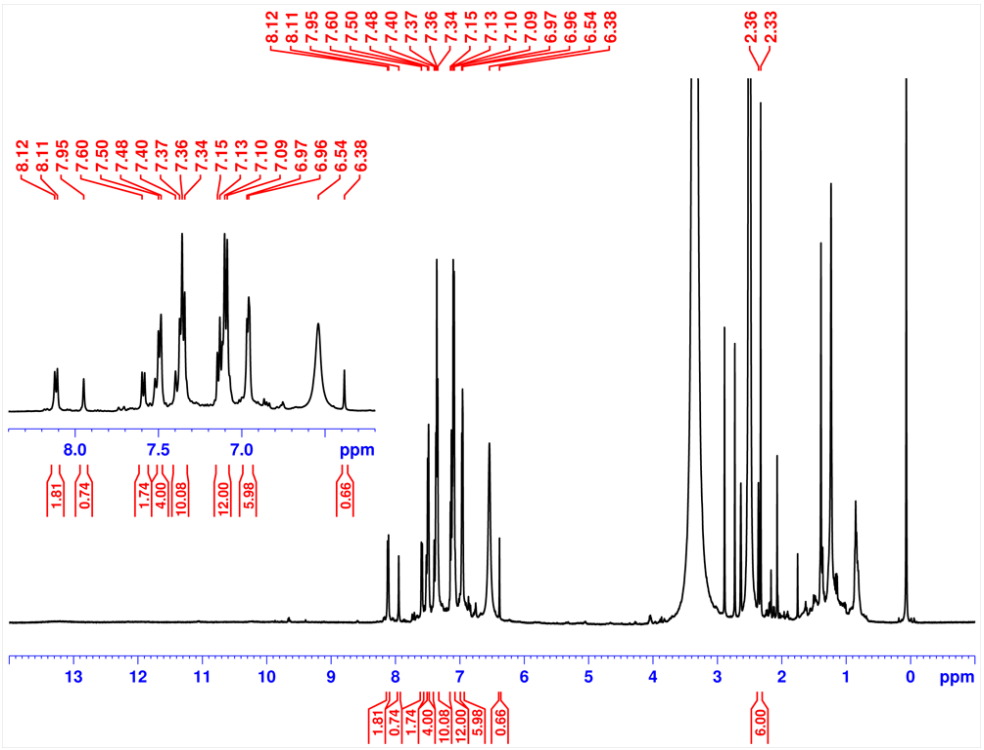

179.98
167.38
159.58
158.48
158.23
153.85
152.99
141.51
139.33
137.79
136.84
132.39
131.88
130.48
129.57
127.76
118.61
116.60
115.39
106.63
105.51
102.48
98.53
50.52
44.22
30.85
28.70
26.06
24.14
22.69
22.09
14.81
14.36
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

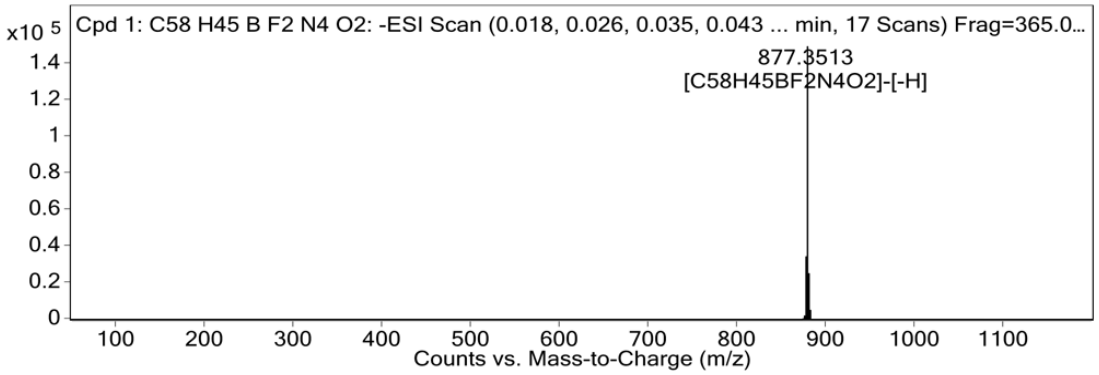


Chemical **5**:

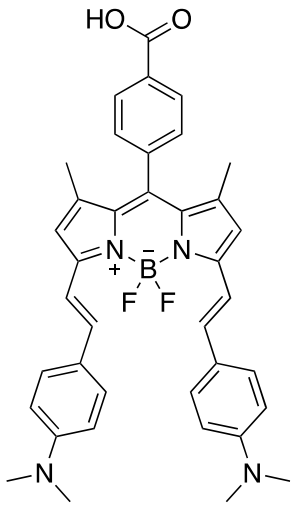


^{1}H NMR (500 MHz, d6-DMSO, 25°C, TMS): δ 8.11 (d, *J* = 8.3 Hz, 2H), 7.95 (s, 1H), 7.60 (s, 2H), 7.49 (d, *J* = 7.9 Hz, 4H), 7.40-7.34 (m, 10H), 7.15-7.09 (m, 12H), 6.96 (d, *J* = 5.6 Hz, 6H), 6.38 (s, 1H), 2.36, 2.33 (s, s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25°C, TMS): Not available due to the poor solubility in DMSO. HRMS (ESI) calc'd for [M]=[$C_{58}H_{45}BF_2N_4O_2$]: 878.3604, calc'd for [M-H]$^-$ =[$C_{58}H_{44}BF_2N_4O_2$]$^-$: 877.3531, found [M-H]$^-$: 877.3513.

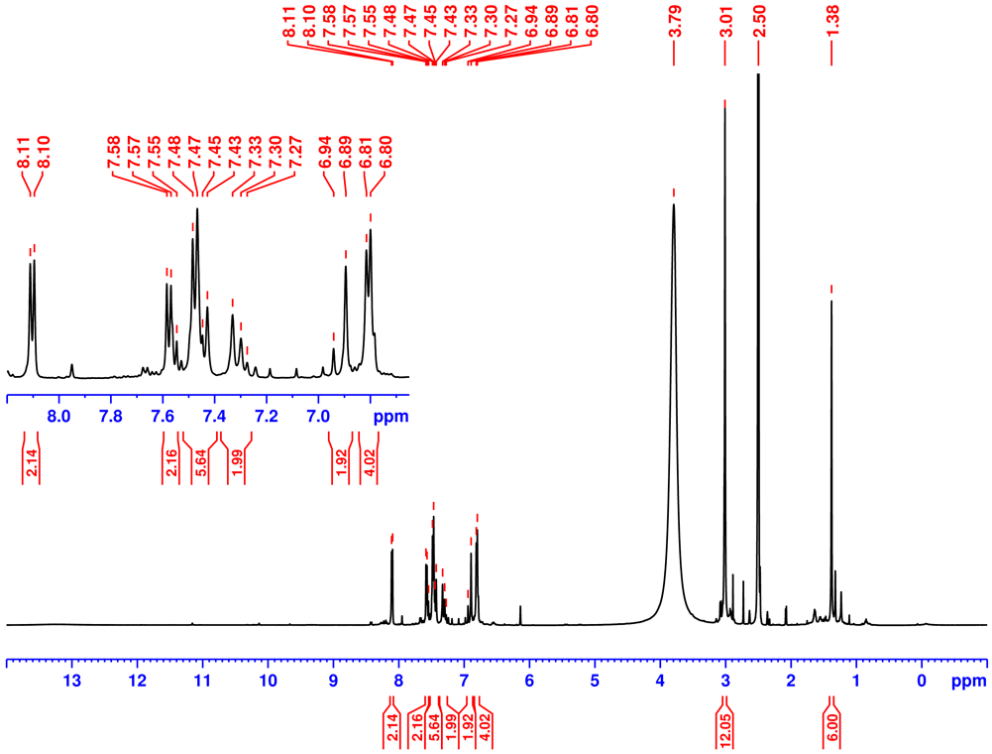

8.12
8.11
7.95
7.60
7.50
7.48
7.40
7.37
7.36
7.34
7.15
7.13
7.10
7.09
6.97
6.96
6.54
6.38
2.36
2.33
8.0
7.5
7.0
ppm
1.81
0.74
1.74
4.00
10.08
12.00
5.98
0.66
13
12
11
10
9
8
7
6
5
4
3
2
1
0
ppm
6.00

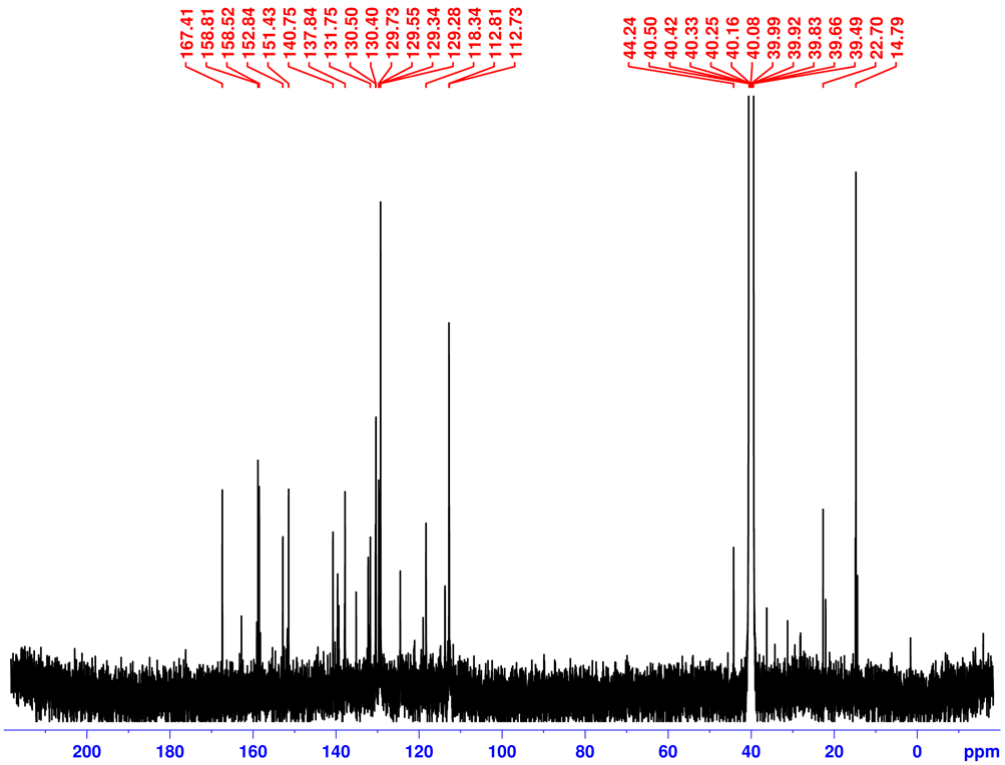

x10 5
Cpd 1: C58 H45 B F2 N4 O2: -ESI Scan (0.018, 0.026, 0.035, 0.043 ... min, 17 Scans) Frag=365.0...
877.3513
[C58H45BF2N4O2]-[-H]
1.4
1.2
1
0.8
0.6
0.4
0.2
0
100
200
300
400
500
600
700
800
900
1000
1100
Counts vs. Mass-to-Charge (m/z)

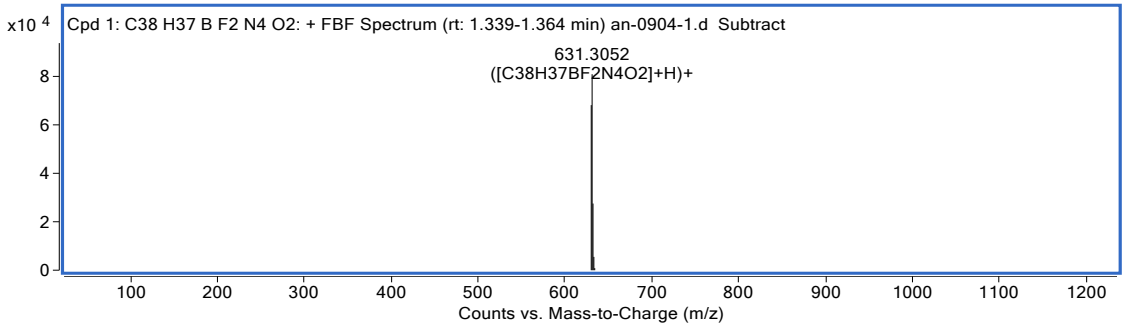
Chemical **6**:



^{1}H NMR (500 MHz, d6-DMSO, 25°C, TMS): δ 8.10 (d, *J* = 7.8 Hz, 2H), 7.58-7.55 (m, 2H), 7.48-7.43 (m, 6H), 7.33-7.27 (m, 2H), 6.89 (s, 2H), 6.81 (d, *J* = 8.0 Hz, 4H), 3.01 (s, 12H), 1.38 (s, 6H); ^{13}C NMR (125 MHz, d6-DMSO, 25°C, TMS): δ 167.41, 158.81, 158.52, 152.84, 151.43, 140.75, 137.84, 131.75, 130.50, 130.40, 129.73, 129.55, 129.34, 129.28, 118.34, 112.81, 112.73, 44.24, 22.70, 14.79. HRMS (ESI) calc'd for [M]=[$C_{38}H_{37}BF_2N_4O_2$]: 630.2978, calc'd for [M+H]$^+$ =[$C_{38}H_{38}BF_2N_4O_2$]$^+$: 631.3056, found [M+H]$^+$: 631.3052.




167.41
158.81
158.52
152.84
151.43
140.75
137.84
131.75
130.50
130.40
129.73
129.55
129.34
129.28
118.34
112.81
112.73
44.24
40.50
40.42
40.33
40.25
40.16
40.08
39.99
39.92
39.83
39.66
39.49
22.70
14.79
200
180
160
140
120
100
80
60
40
20
0
ppm


x10 4
Cpd 1: C38 H37 B F2 N4 O2: + FBF Spectrum (rt: 1.339-1.364 min) an-0904-1.d Subtract
631.3052
([C38H37BF2N4O2]+H)+
8
6
4
2
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Counts vs. Mass-to-Charge (m/z)