Supporting Information

Hydrophobicity-driven folding and seeded polymerization of cystine-based dimeric diamides in aqueous media

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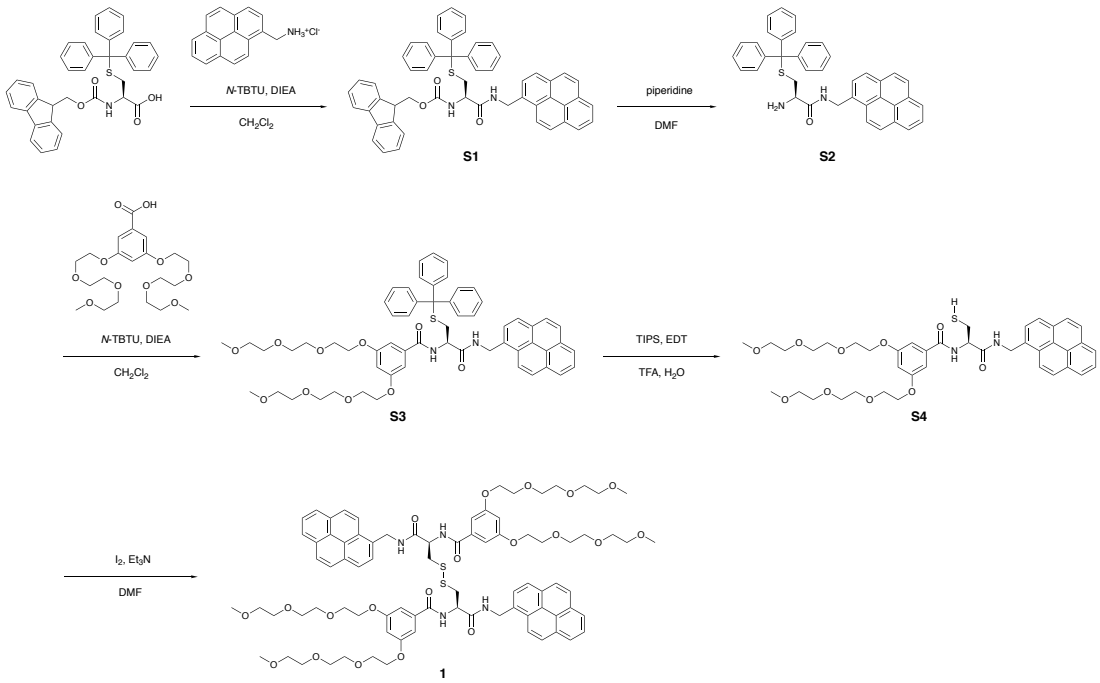
Experimental Procedures

General

^{1}H and ^{13}C NMR spectra were recorded with a JEOL AL-400 spectrometer (400 MHz for ^{1}H, 100 MHz for ^{13}C) or JEOL JNM-ECS400 (400 MHz for ^{1}H, 100 MHz for ^{13}C) in $CDCl_3$ or CD_2Cl_2. The chemical shifts in ^{1}H NMR spectra are reported in δ ppm using the residual protons of the solvents as an internal standard ($CHCl_3$ δ 7.26 and CD_2Cl_2 δ 5.32), and those in ^{13}C NMR spectra are reported using the solvent signal as an internal standard ($CHCl_3$ δ 77.16). Melting points (mp) were determined with a Yanaco MP-S3 instrument. Mass spectra were measured with a Thermo Fisher Scientific Exactive Plus Orbitrap MS System with the ionization methods of electrospray ionization (ESI). Thin layer chromatography (TLC) was performed on glass plates coated with 0.25 mm thickness of silica gel $60F_{254}$ (Merck). Column chromatography was performed using silica gel PSQ100B (Fuji Silysia Chemicals). Preparative Gel permeation Chromatography (GPC) was performed using LC-918 (Japan Analytical Industry) equipped with gel column (JAIGEL-2.5H and -3H) using $CHCl_3$ as eluent. The spectroscopic measurements were conducted under ambient conditions using solvents of spectroscopic grade. UV-vis absorption spectra were recorded using quartz cell of 1 cm path length with a JASCO V-750 spectrophotometer equipped with a JASCO ETCR-762 cell holder for temperature control. Fourier transform infrared (FT-IR) spectroscopic analysis was performed on a JASCO FT/IR-4200 spectrometer. The fluorescence spectra were recorded with a JASCO FP-8500 spectrometer. CD spectra were recorded were measured with a JASCO J-720WN spectrophotometer. Transmission electron microscopy (TEM) was performed with a JEM-1400EM (JEOL) using an acceleration voltage of 80 kV. Atomic force microscopy (AFM) was performed at ambient conditions with a JSPM-5200V (JEOL) in NC mode. Silicon cantilevers (HQ:NSC35/Al BS, MikroMasch) with a resonance frequency of ~300 kHz and force constant of ~16 Nm^{-1} were used. All chemicals were purchased from commercial suppliers and used without further purification. Anhydrous CH_2Cl_2 was purchased from Kanto Chemicals and further purified by Glass Contour Solvent Systems. Compounds **S1** and **S2**,[1] 3,5-bis{2-[2-(2-methoxyethoxy)ethoxy]ethoxy}benzoic acid,[2] and 3,5-Bis{2-[2-(2-methoxyethoxy)ethoxy]ethoxy}aniline[3] were synthesized according to the reported procedure. All reactions were performed with dry glassware and under a nitrogen atmosphere unless stated otherwise.

Synthesis of 1.

Compound **1** was synthesized in five steps from *N*-[(9*H*-fluoren-9-ylmethoxy)carbonyl]-*S*-(triphenylmethyl)-L-cysteine by introduction of 1-pyrenylamine to the COOH terminus followed by *N*-Boc deprotection and amidation of the NH_2 terminus with 3,5-bis{2-[2-(2-methoxyethoxy)ethoxy]ethoxy}benzoic acid.[4] The subsequent deprotection of the trityl group using an iodine oxidation method formed the disulfide bond of **1**.[5]



Scheme S1. Synthesis of **1**

Compound S3. A solution of **S2** (529 mg, 0.918 mmol) in anhydrous CH_2Cl_2 (15 mL) was slowly added to a solution of 3,5-bis{2-[2-(2-methoxyethoxy)ethoxy]ethoxy}benzoic acid (478 mg, 1.07 mmol), *O*-(benzotriazol-1-yl)-*N,N,N′,N′*-tetramethyluronium tetrafluoroborate (*N*-TBTU) (329 mg, 1.02 mmol), and *N,N*-diisopropylethylamine (DIEA) (487 mg, 3.77 mmol) in CH_2Cl_2 (15 mL). The

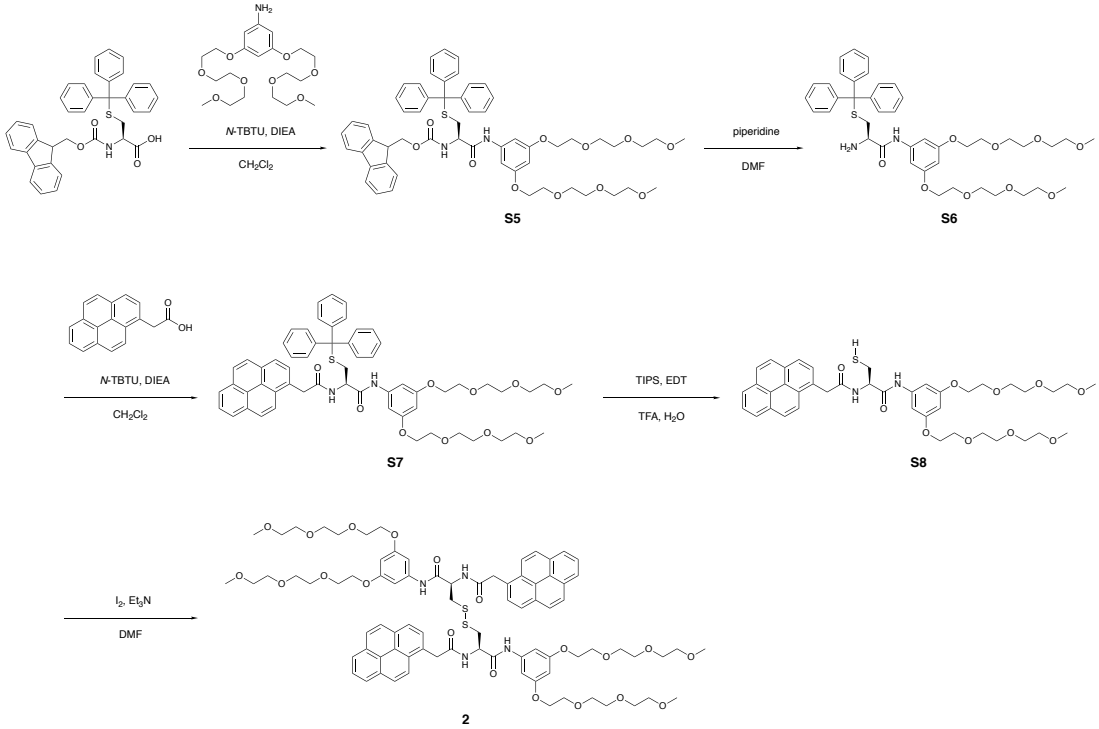
reaction mixture was stirred at room temperature for 22 h. The resulting mixture was quenched with an aqueous solution of $KHSO_4$ (1 M, 50 mL) and the aqueous layer was extracted with CH_2Cl_2 (3 × 20 mL). The combined organic layer was washed with an aqueous solution of HCl (1 M, 60 mL), an aqueous solution of $NaHCO_3$ (sat., 40 mL), and brine (60 mL), and dried over Na_2SO_4. After filtration, solvent was removed under reduced pressure. The resulting mixture was purified by preparative GPC ($CHCl_3$) to afford **S3** as a sticky oil (484 mg, 0.481 mmol, 84%). ^{1}H NMR (400 MHz, CD_2Cl_2) δ 7.94–8.23 (m, 9H), 7.30–7.34 (m, 6H), 7.10–7.17 (m, 9H), 6.78 (d, J = 2.2 Hz, 2H), 6.64 (d, J = 7.6 Hz, 1H), 6.60 (t, J = 2.3 Hz, 1H), 6.37 (t, J = 5.4 Hz, 1H), 5.07 (m, 2H), 4.20 (q, J = 6.8 Hz, 1H), 4.04 (m, 4H), 3.76 (t, J = 4.6 Hz, 4H), 3.55–3.65 (m, 12H), 3.46–3.48 (m, 4H), 3.30 (s, 6H), 2.64–2.82 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 169.7, 167.0, 159.9, 144.4, 135.5, 131.3, 130.8, 130.6, 129.6, 129.0, 128.2, 128.1, 127.6, 127.4, 127.3, 126.9, 126.0, 125.5, 125.4, 125.0, 124.8, 124.7, 123.0, 106.0, 105.2, 72.0, 70.9, 70.7, 70.6, 69.6, 67.7, 67.2, 59.1, 52.9, 42.2, 33.9; HRMS (ESI): *m/z* calcd. for $C_{60}H_{64}N_2NaO_{10}S$: 1027.4179 ([M+Na$^+$]); found: 1027.4174.

Compound S4. Compound **S3** (480 mg, 0.477 mmol) was dissolved in 5.1 mL of trifluoroacetic acid (TFA). To the solution, water (0.05 mL), triisopropylsilane (TIPS) (0.14 mL, 0.68 mmol), 1,2-ethaneditiol (EDT) (0.14 mL, 1.7 mmol) were added. The reaction mixture was stirred at room temperature for 3 h. The mixture was diluted with CH_2Cl_2 (10 mL), and washed with an aqueous solution of $NaHCO_3$ (5%, 10 mL), an aqueous solution of HCl (1 M, 10 mL), and an aqueous solution of $NaHCO_3$ (sat., 10 mL), and dried over Na_2SO_4. After filtration, solvent was removed under reduced pressure to afford **S4** as a colorless solid, which was used in next step without further purification. HRMS (ESI): *m/z* calcd. for $C_{41}H_{50}N_2NaO_{10}S$: 785.3084 ([M+Na$^+$]); found: 785.3077.

Compound 1. Compound **S4** (364 mg, 0.478 mmol) was dissolved in $CHCl_3$ (25 mL) and cooled to 0 °C. Et_3N (0.38 mL, 2.7 mmol) and iodine (33.4 mg, 0.132 mmol) were subsequently added to the solution and the mixture was stirred at 0 °C for 16 h. An aqueous solution of $NaHCO_3$ (sat., 20 mL) was added to the mixture and the aqueous layer was extracted with CH_2Cl_2 (3 × 20 mL). The combined organic layer was washed by an aqueous solution of $NaHSO_4$ (10%, 20 mL) and brine, and dried over Na_2SO_4. After filtration, solvent was removed under reduced pressure. The mixture was subjected to silica gel column chromatography using a 95/5 $CHCl_3$/MeOH mixed solvent as eluent (R_f = 0.28). The product was further purified by preparative GPC ($CHCl_3$) to afford **1** as a colorless solid (281 mg, 0.184 mmol, 77%). Mp: 169.0–170.7 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.97 (br, 2H), 7.95–8.27 (m, 18H), 7.18 (d, J = 8.7 Hz, 2H), 6.69 (d, J = 2.3 Hz, 4H), 6.52 (t, J = 2.1 Hz, 2H), 5.67 (br, 2H), 5.21 (m, 4H), 3.84 (t, J = 4.6 Hz, 8H), 3.59–3.63 (m, 32H), 3.50 (q, J = 3.0 Hz, 8H), 3.34 (s, 12H), 3.02–3.23 (m, 4H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 169.9, 167.7, 160.0, 135.6, 131.4, 131.1, 130.8, 128.7, 128.1, 127.6, 127.4, 126.4, 126.1, 125.4, 125.1, 125.0, 124.8, 122.9, 105.9, 105.0, 72.0, 70.8, 70.7, 69.6, 67.6, 59.2, 54.4, 46.8, 41.8; HRMS (ESI): *m/z* calcd. for $C_{82}H_{98}N_4NaO_{20}S_2$: 1545.6114 ([M+Na$^+$]); found: 1545.6136.

Synthesis of 2.

Compound **2** was synthesized according to the procedure described for **1**.



Scheme S2. Synthesis of **2**

Compound S5. DIEA (682 mg, 5.28 mmol) was slowly added to a solution of *N*-[(9*H*-fluoren-9-ylmethoxy)carbonyl]-*S*-(triphenylmethyl)-L-cysteine (770 mg, 1.31 mmol), and *N*-TBTU (466 mg, 1.45 mmol), and 3,5-bis{2-[2-(2-methoxyethoxy)ethoxy]ethoxy}aniline (609 mg, 1.46 mmol) in CH_2Cl_2 (100 mL). The reaction mixture was stirred at room temperature

for 20 h. An aqueous solution of $KHSO_4$ (1 M, 30 mL) was added to the resulting mixture and the aqueous layer was extracted with CH_2Cl_2 (3 × 20 mL). The combined organic layer was washed with an aqueous solution of $NaHCO_3$ (sat., 30 mL), and brine (60 mL), and dried over Na_2SO_4. After filtration, solvent was removed under reduced pressure. The mixture was subjected to silica gel column chromatography using a 9/1 $CHCl_3$/MeOH mixed solvent as eluent (R_f = 0.73) to afford **S5** as a colorless oil (999 mg, 1.01 mmol, 77%). ^{1}H NMR (400 MHz, CD_2Cl_2) δ 7.77 (t, J = 7.5 Hz, 2H), 7.70 (s, 1H), 7.59 (d, J = 7.3 Hz, 2H), 7.36–7.44 (m, 8H), 7.21–7.31 (m, 11H), 6.69 (d, J = 1.8 Hz, 2H), 6.27 (t, J = 2.2 Hz, 1H), 5.07 (d, J = 7.3 Hz, 1H), 4.38–4.47 (m, 2H), 4.22 (t, J = 6.2 Hz, 1H), 4.05 (t, J = 4.8 Hz, 4H), 3.83–3.86 (m, 1H), 3.78 (t, J = 4.8 Hz, 4H), 3.64–3.67 (m, 4H), 3.57–3.61 (m, 8H), 3.49–3.51 (m, 4H), 3.33 (s, 6H), 2.68 (d, J = 6.6 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.3, 160.1, 156.4, 144.4, 143.6, 141.4, 139.0, 129.7, 128.2, 127.9, 127.2, 127.1, 125.0, 120.1, 99.1, 98.3, 72.0, 70.9, 70.7, 70.6, 69.7, 67.6, 67.6, 67.2, 59.1, 54.8, 47.2, 33.5; HRMS (ESI): *m/z* calcd. for $C_{57}H_{64}N_2NaO_{11}S$: 1007.4129 ([M+Na$^+$]); found: 1007.4119.

Compound S6. Compound **S5** (523 mg, 0.531 mmol) was dissolved in a 20% piperidine/DMF solution (4.3 mL) and stirred at room temperature for 4 h. The solvents were removed under reduced pressure to afford **S6** as a colorless solid, which was used in next step without further purification. HRMS (ESI): *m/z* calcd. for $C_{42}H_{54}N_2NaO_9S$: 785.3448 ([M+Na$^+$]); found: 785.3446.

Compound S7. DIEA (286 mg, 2.21 mmol) was slowly added to a solution of **S6** (405 mg, 0.531 mmol), 1-pyrenemethyl carboxylic acid (141 mg, 0.540 mmol), and *N*-TBTU (188 mg, 0.586 mmol) in CH_2Cl_2 (40 mL). The reaction mixture was stirred at room temperature for 13 h. An aqueous solution of $KHSO_4$ (1 M, 30 mL) was added to the resulting mixture and the aqueous layer was extracted with CH_2Cl_2 (2 × 30 mL). The combined organic layer was washed with an aqueous solution of $NaHCO_3$ (sat. 30 mL), and brine, and dried over Na_2SO_4. After filtration, the solvent was removed under reduced pressure. The mixture was subjected to silica gel column chromatography using a 9/1 $CHCl_3$/MeOH mixed solvent as eluent (R_f = 0.43) to afford **S7** as a colorless oil (470 mg, 0.466 mmol, 88%). ^{1}H NMR (400 MHz, CD_2Cl_2) δ 7.91-8.24 (m, 10H), 7.15–7.21 (m, 15H), 6.57 (s, 2H), 6.23 (s, 1H), 5.79 (d, J = 7.9 Hz, 1H), 4.28 (s, 2H), 4.12 (s, 1H), 3.98 (t, J = 4.0 Hz, 4H), 3.74 (t, J = 4.0 Hz, 4H), 3.57–3.64 (m, 12H), 3.49 (t, J = 4.0 Hz, 4H), 3.33 (d, J = 1.8 Hz, 6H), 2.36–2.53 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.4, 168.0, 160.1, 144.3, 139.2, 131.4, 130.8, 129.6, 129.5, 128.8, 128.6, 128.1, 127.8, 127.5, 127.0, 126.3, 125.8, 125.3, 124.7, 122.9, 98.9, 98.4, 72.1, 70.9, 70.8, 70.7, 69.7, 67.6, 67.1, 59.2, 53.4, 41.8, 32.2; HRMS (ESI): *m/z* calcd. for $C_{60}H_{64}N_2NaO_{10}S$: 1027.4179 ([M+Na$^+$]); found: 1027.4170.

Compound S8. Compound **S7** (397 mg, 0.394 mmol) was dissolved in 4.3 mL of TFA. To the mixture, water (45 µL), TIPS (0.11 mL, 0.54 mmol), EDT (0.11 mL, 1.3 mmol) were added and the resulting mixture was stirred at room temperature for 4 h. An aqueous solution of $NaHCO_3$ (sat., 30 mL) was added to the mixture and the aqueous layer was extracted with CH_2Cl_2 (3 × 30 mL). The combined organic layer was dried over Na_2SO_4. After filtration, the solvent was removed under reduced pressure and the mixture was dissolved in $CHCl_3$. After precipitation by the addition of hexane, the solid was collected by filtration and dried under reduced pressure to afford **S8** as a colorless solid (296 mg, 0.387 mmol, 98%), which was used in next step without further purification. HRMS (ESI): *m/z* calcd. for $C_{41}H_{50}N_2NaO_{10}S$: 785.3084 ([M+Na$^+$]); found: 785.3076.

Compound 2. Compound **S8** (296 mg, 0.387 mmol) was dissolved in $CHCl_3$ (20 mL) and cooled to 0 °C. Et_3N (0.30 mL, 2.15 mmol) and iodine (28.5 mg, 0.112 mmol) were subsequently added to the solution and the mixture was stirred at 0 °C for 16 h. An aqueous solution of Na_2SO_3 (10%, 15 mL) was added to the mixture and the aqueous layer was extracted with CH_2Cl_2 (3 × 20 mL). The combined organic layer was washed by brine, and dried over Na_2SO_4. After filtration, the solvent was removed under reduced pressure. The mixture was subjected to silica gel column chromatography using a 9/1 $CHCl_3$/MeOH mixed solvent as eluent (R_f = 0.55). The product was further purified by preparative GPC ($CHCl_3$) to afford **2** as a colorless solid (142 mg, 0.0929 mmol, 48%). Mp: 144.2–145.8 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.92 (s, 2H), 7.98–8.21 (m, 18H), 6.64 (d, J = 2.2 Hz, 4H), 6.51 (d, J = 10.0 Hz, 2H), 6.16 (t, J = 2.1 Hz, 2H), 5.62–5.67 (m, 2H), 4.44 (m, 4H), 3.92–3.94 (m, 8H), 3.70–3.76 (m, 8H), 3.57–3.66 (m, 24H), 3.47–3.51 (m, 8H), 3.32 (s, 12H), 2.68–3.06 (m, 4H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 172.1, 167.8, 159.9, 139.4, 131.4, 130.8, 129.6, 128.6, 128.5, 127.7, 127.6, 127.3, 126.3, 125.7, 125.6, 125.5, 125.2, 124.7, 123.1, 99.0, 98.2, 72.0, 70.9, 70.7, 70.6, 69.7, 67.4, 59.1, 54.4, 46.8, 42.2; HRMS (ESI): *m/z* calcd. for $C_{82}H_{98}N_4NaO_{20}S_2$: 1545.6114 ([M+Na$^+$]); found: 1545.6126.

Results and Discussion

Solvent-dependent ^{1}H NMR spectra

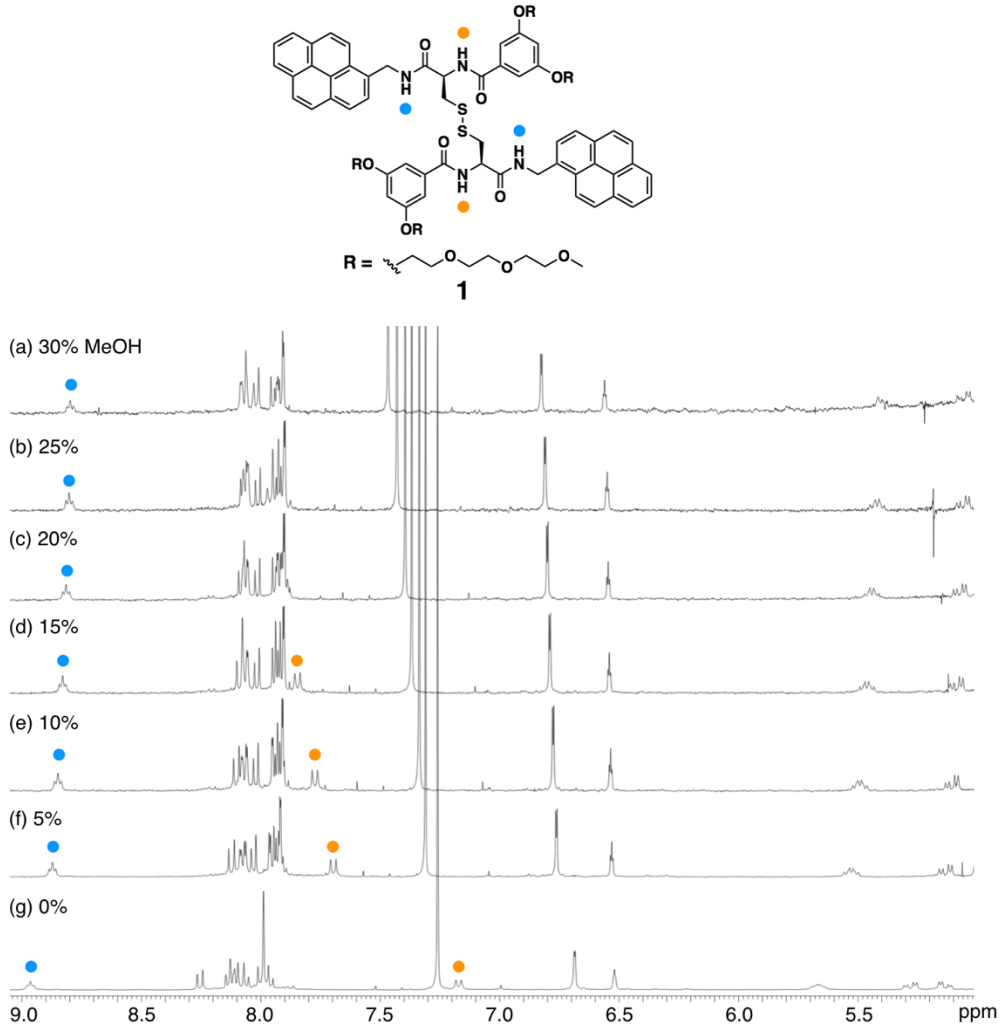


Fig. S1 ^{1}H NMR spectra of **1** in (a) 70/30, (b) 75/25, (c) 80/20, (d) 85/15, (e) 90/10 and (f) 95/5 chloroform-d_1/methanol mixture and in (g) chloroform-d_1 with a concentration of 5×10^{-4} M at room temperature. Tetramethylsilane was used as a chemical shift reference.

MD simulation of 1 in a water box

MD simulation was conducted using the AMBER molecular dynamics package.[6]

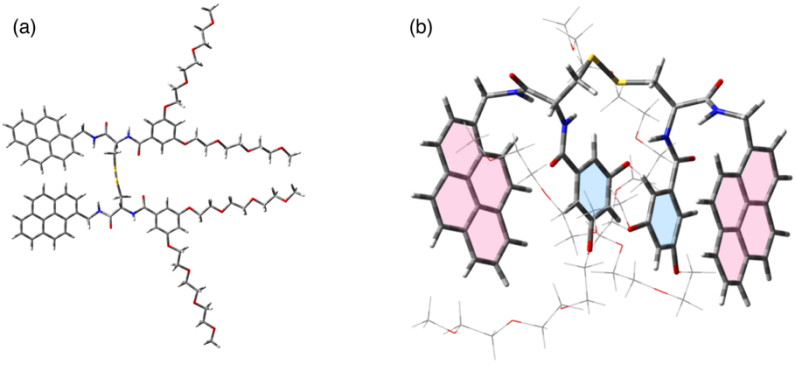


Fig. S2 (a) An open ring structure employed as the starting structure of **1** for the MD simulation in a water box, and (b) a final structure of **1** obtained after the simulation run at equilibrium and 300 K for 100 ns.

ONIOM calculation of 1

Geometry optimizations were performed using the Gaussian 16 program.[7]

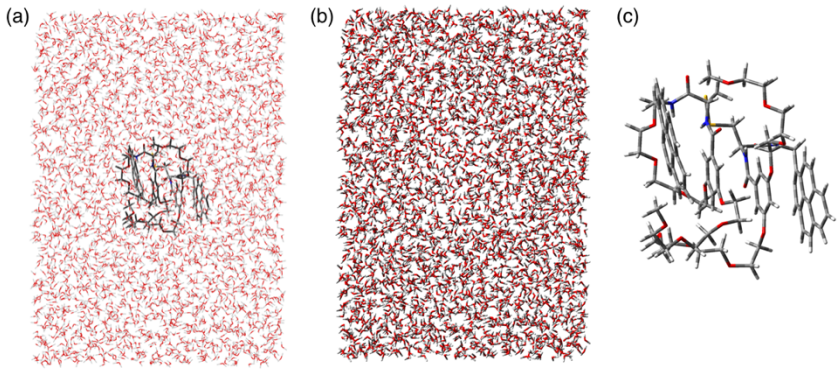


Fig. S3 (a) An input structure of **1** containing water molecules for the two-layer ONIOM calculation of (b) the low layer (AMBER) and (c) the high layer (B3LYP/6-31G*).

MD simulation of 1 in a methanol box

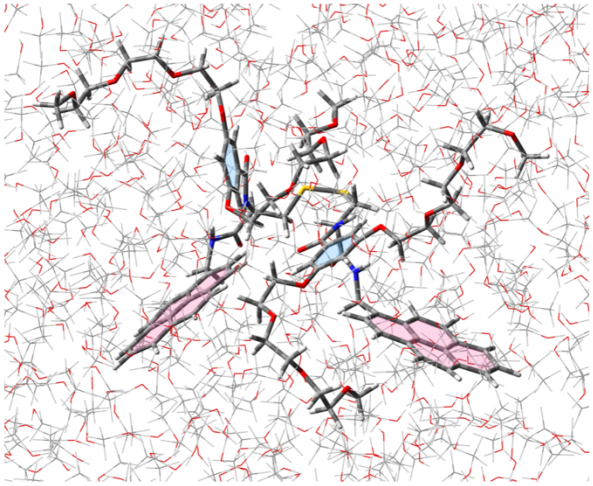


Fig. S4 A final structure of **1** obtained after the MD simulation run at equilibrium and 300 K for 100 ns in a methanol box.

Temperature-dependent self-assembly of 1 in methanol/water

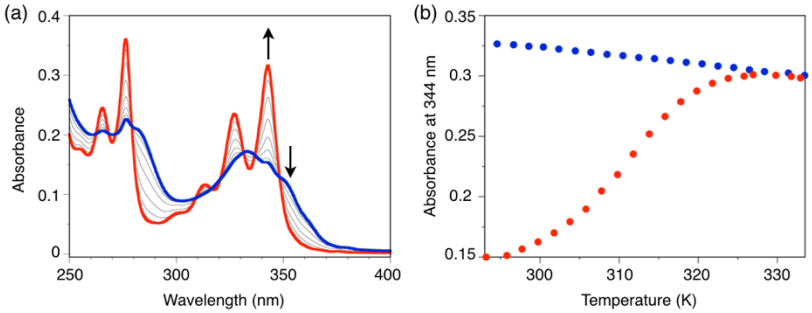


Fig. S5 (a) UV-vis absorption spectral changes of **1** in 65/35 methanol/water (5×10^{-6} M) upon increasing temperature from 293 K (blue line) to 333 K (red line) at a rate of 1 K min^{-1} and (b) thermal hysteresis observed during slow (1 K min^{-1}) heating (red circle) and cooling (blue circle) processes by monitoring the absorbance change at 344 nm.

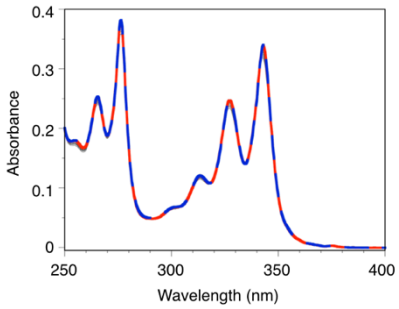


Fig. S6 Spectral changes in UV-vis absorption spectra of **1** in 65/35 methanol/water (5×10^{-6} M) upon cooling from 333 K (blue dashed line) to 293 K (red solid line) at a rate of 1 K min^{-1}.

Solvent-dependent self-assembly of 2 in methanol/water

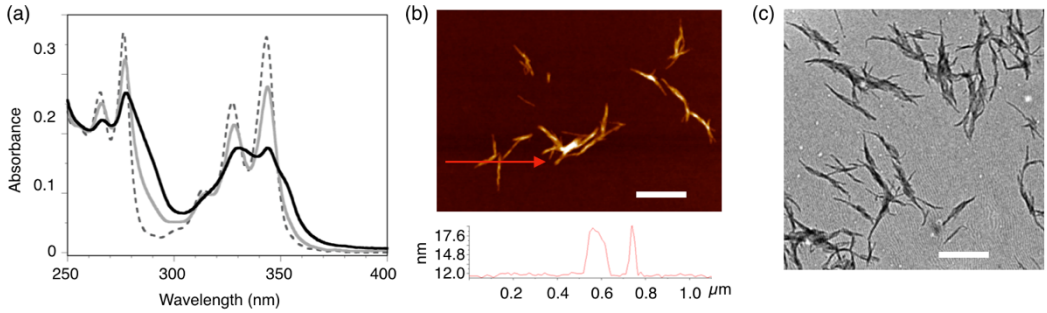


Fig. S7 (a) UV-vis absorption spectra of **2** at 293 K and at a concentration of 5×10^{-6} M in methanol (dashed line), 65/35 methanol/water (gray solid line), and 60/40 methanol/water (black solid line). (b) AFM height image (z scale: 31 nm) of $\mathbf{2}_{Agg}$ cast on a silicon wafer from methanol/water (60/40, *v*/*v*; scale bar: 0.5 μm). A cross-sectional analysis along the red arrow is shown beneath the AFM image. (c) TEM image of $\mathbf{2}_{Agg}$ (scale bar: 0.5 μm).

Temperature-dependent self-assembly of 2 in methanol/water

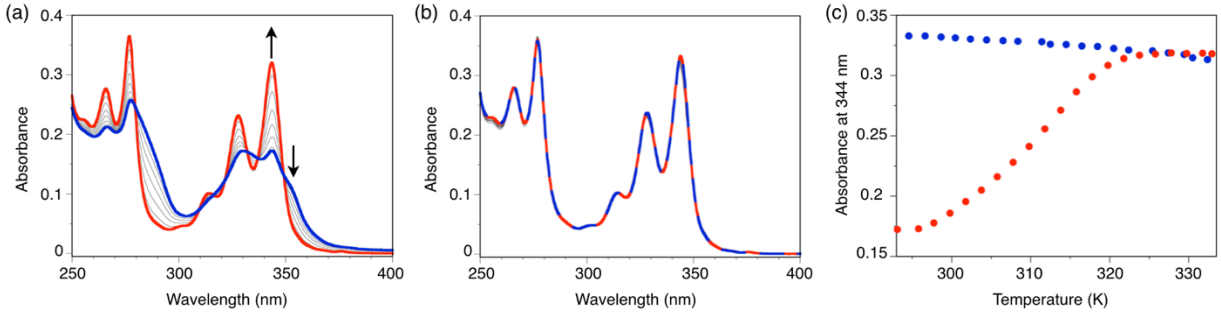


Fig. S8 Spectral changes in UV-vis absorption spectra of **2** in 60/40 methanol/water (5×10^{-6} M) observed during (a) heating process (293 K; blue line, 333 K; red line), and (b) cooling process (293 K; blue dashed line, 333 K; red solid line) at a rate of 1 K min^{-1}. (c) Thermal hysteresis observed during slow heating (red circle) and cooling (blue circle) by monitoring the absorbance change at 344 nm.

Time-dependent self-assembly of 2 in methanol/water

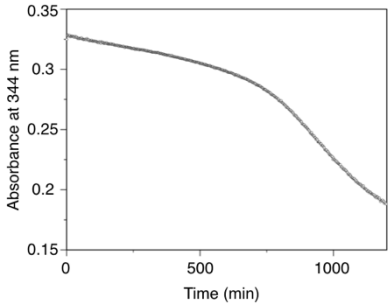


Fig. S9 Time-dependent absorbance change at 344 nm of **2** in 60/40 methanol/water observed after fast cooling from 333 K to 293 K.

Seeded polymerization of 2 in methanol/water

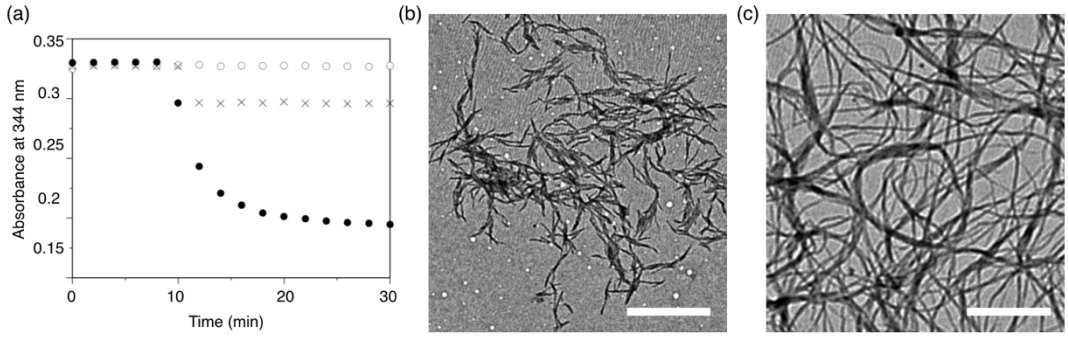


Fig. S10 (a) Time-dependent changes of the absorbance at 344 nm during the supramolecular polymerization of **2** when initiated spontaneously (○) or when initiated upon addition of either a 60/40 methanol/water solution of $\mathbf{2}_{\mathbf{Seed}}$ (0.3 mL; $[\mathbf{2}_{\mathbf{Seeds}}]/[\mathbf{2}_{\mathbf{Mono}}]$ = 1/10; 5×10^{-6} M; ●) or solvent only (0.3 mL; solvent/$[\mathbf{2}_{\mathbf{Mono}}]$ = 1/10; ×) to 3 mL of **2** in 60/40 methanol/water (5×10^{-6} M). TEM images of (b) $\mathbf{2}_{\mathbf{Seed}}$ and (c) $\mathbf{2}_{\mathbf{Agg}}$ obtained after seeded polymerization at $[\mathbf{2}_{\mathbf{Seed}}]/[\mathbf{2}_{\mathbf{Mono}}]$ = 1/10 (scale bar: 1 μm).

UV absorption, CD, and fluorescence spectra

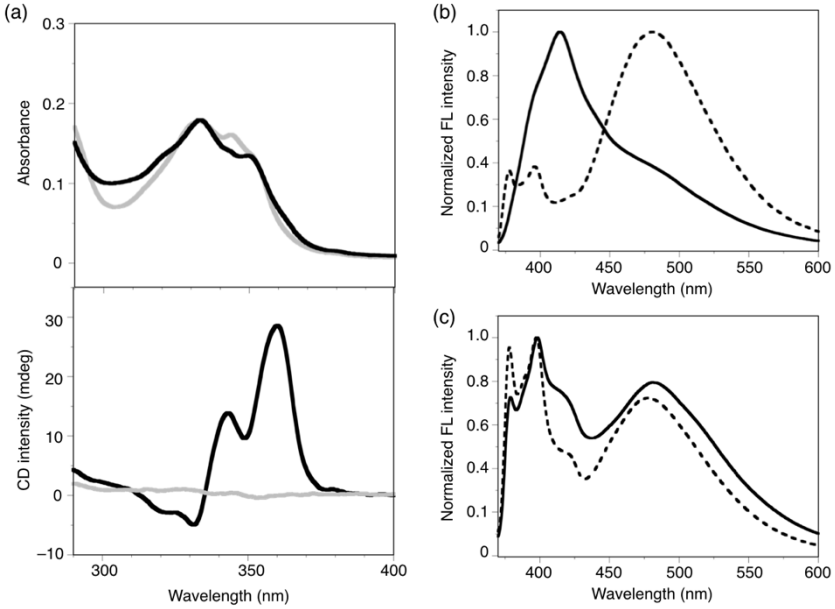


Fig. S11 (a) UV-vis absorption and CD spectra of $\mathbf{1}_{\mathbf{Agg}}$ (black line) and $\mathbf{2}_{\mathbf{Agg}}$ (gray line) in 60/40 methanol/water (5×10^{-6} M). Fluorescence spectra of (b) **1** and (c) **2** in the monomeric state in methanol (dashed line) and in the aggregated state in 60/40 methanol/water (solid line).

FT-IR spectra of 1_{Agg} and 2_{Agg}

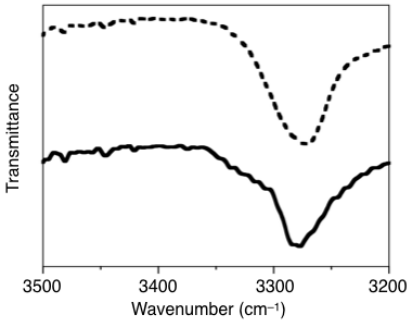


Fig. S12 FT-IR spectra of the dried aggregates of **1** (solid line) and **2** (dashed line). To prepare the samples, seeded supramolecular polymerizations were conducted at a concentration of 5×10^{-6} M in 65/35 methanol/water for **1** and in 60/40 methanol/water (5×10^{-6} M) for **2**. Then, the resultant supramolecular polymers were corrected by centrifuging, and dried by removing methanol under reduced pressure, followed by lyophilization.

Mixing experiment between 1_{Seed} and 2_{Mono}

A mixing experiment between $\mathbf{1}_{Seed}$ and $\mathbf{2}_{Mono}$ was conducted based on the seeding method. For that purpose, a solution of $\mathbf{1}_{Seed}$ was added to a solution of $\mathbf{2}_{Mono}$. The absorbance at 344 nm remained unchanged after addition of $\mathbf{1}_{Seed}$, demonstrating that $\mathbf{1}_{Seed}$ does not promote the assembly of $\mathbf{2}_{Mono}$.

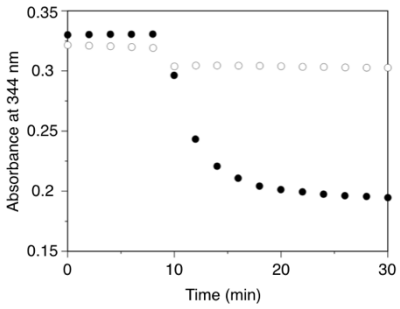


Fig. S13 Time-dependent changes of the absorbance at 344 nm during the supramolecular polymerization of **1** when initiated upon addition of either a 60/40 methanol/water solution of $\mathbf{1}_{Seed}$ (0.3 mL; $[\mathbf{1}_{Seed}]/[\mathbf{2}_{Mono}]$ = 1/10, 5×10^{-6} M, ○) or $\mathbf{2}_{Seed}$ (0.3 mL; $[\mathbf{2}_{Seed}]/[\mathbf{2}_{Mono}]$ = 1/10, 5×10^{-6} M, ●) to 3 mL of $\mathbf{2}_{Mono}$ in 60/40 methanol/water (5×10^{-6} M).

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^{1}H and ^{13}C NMR spectra

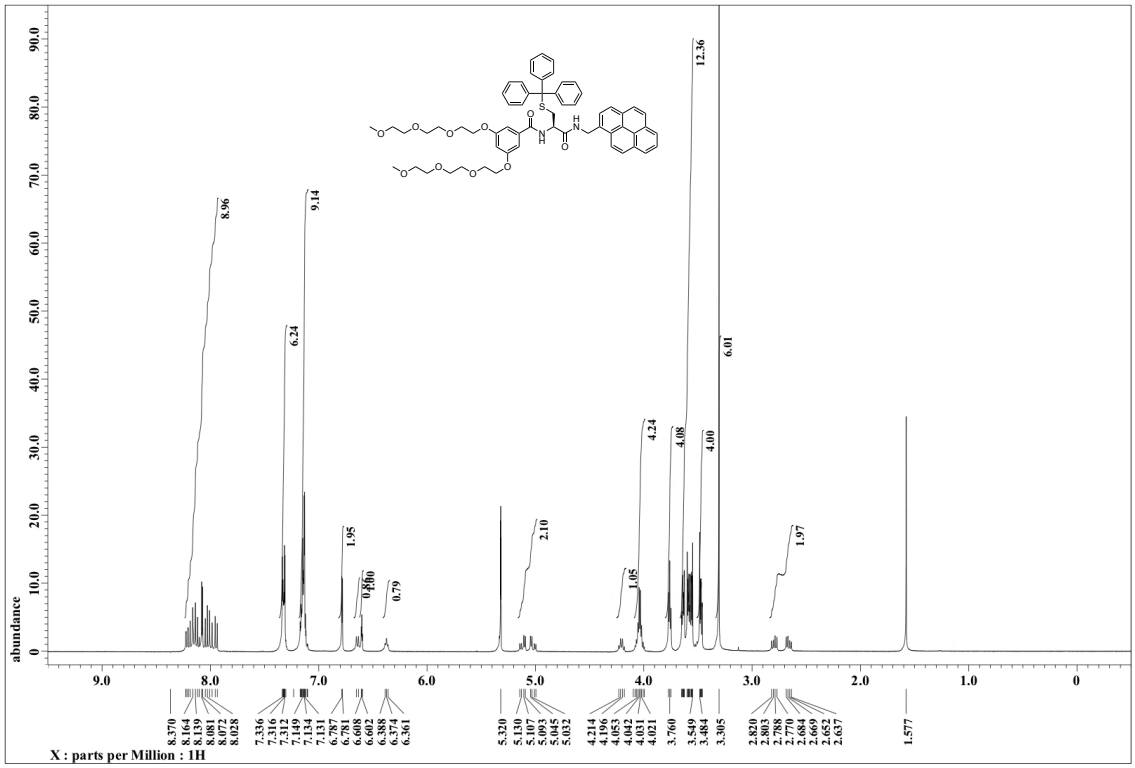

Fig. S14 ^{1}H NMR spectrum of **S3** (400 MHz, CD_2Cl_2).

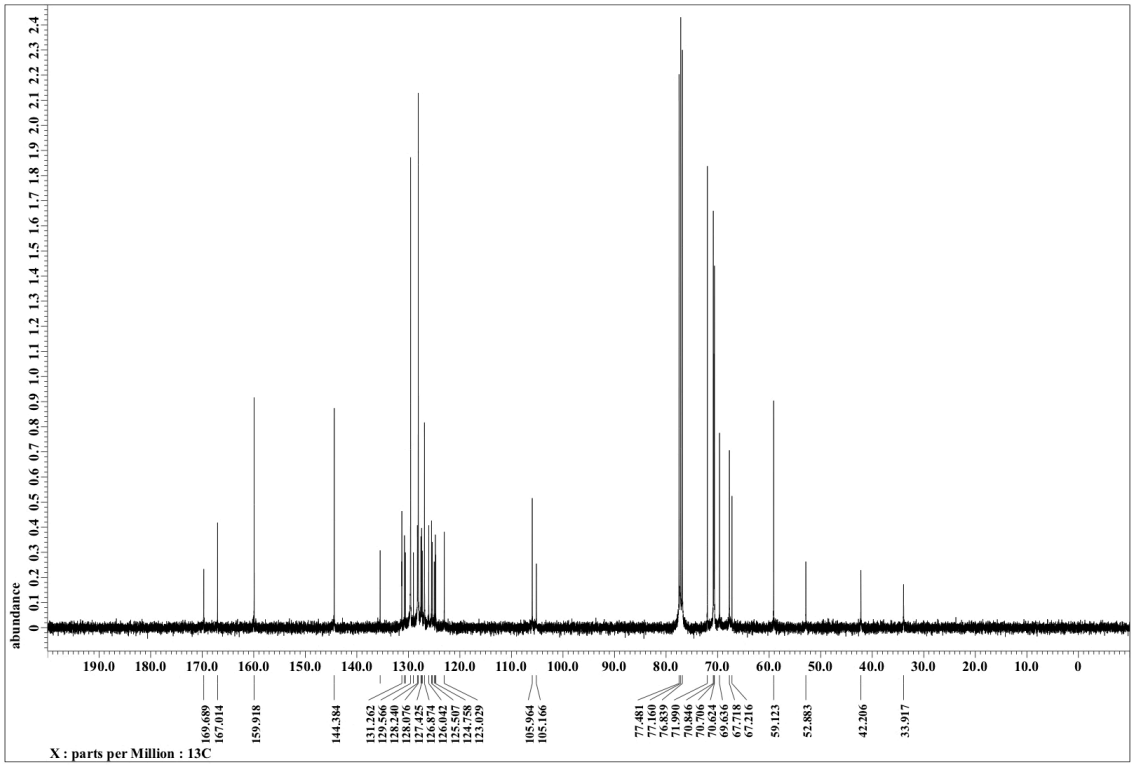

Fig. S15 ^{13}C NMR spectrum of **S3** (100 MHz, $CDCl_3$).

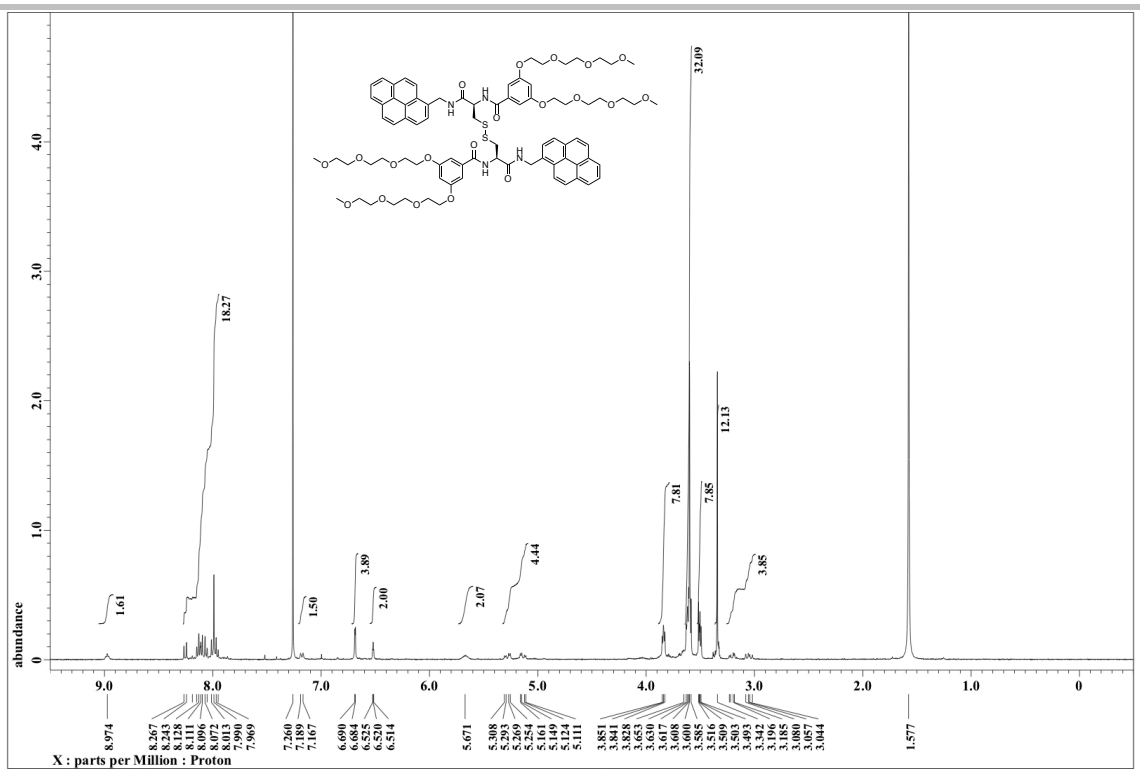

Fig. S16 ^{1}H NMR spectrum of **1** (400 MHz, $CDCl_3$).

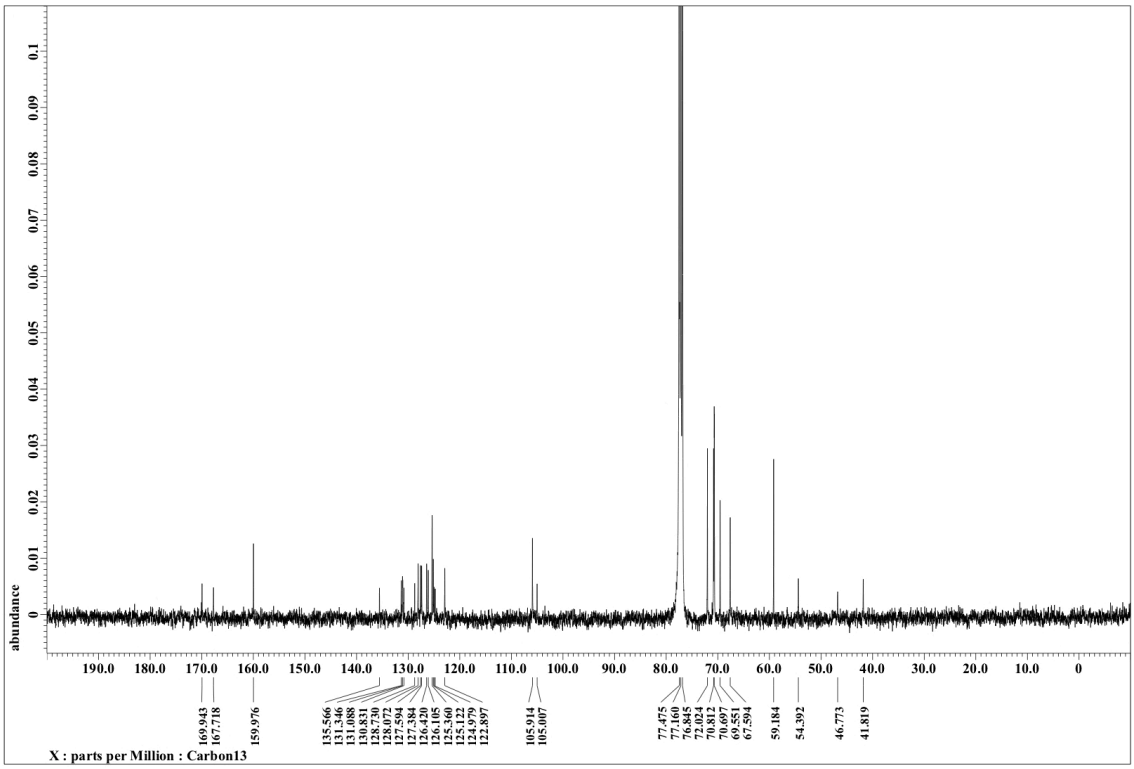

Fig. S17 ^{13}C NMR spectrum of **1** (100 MHz, $CDCl_3$).

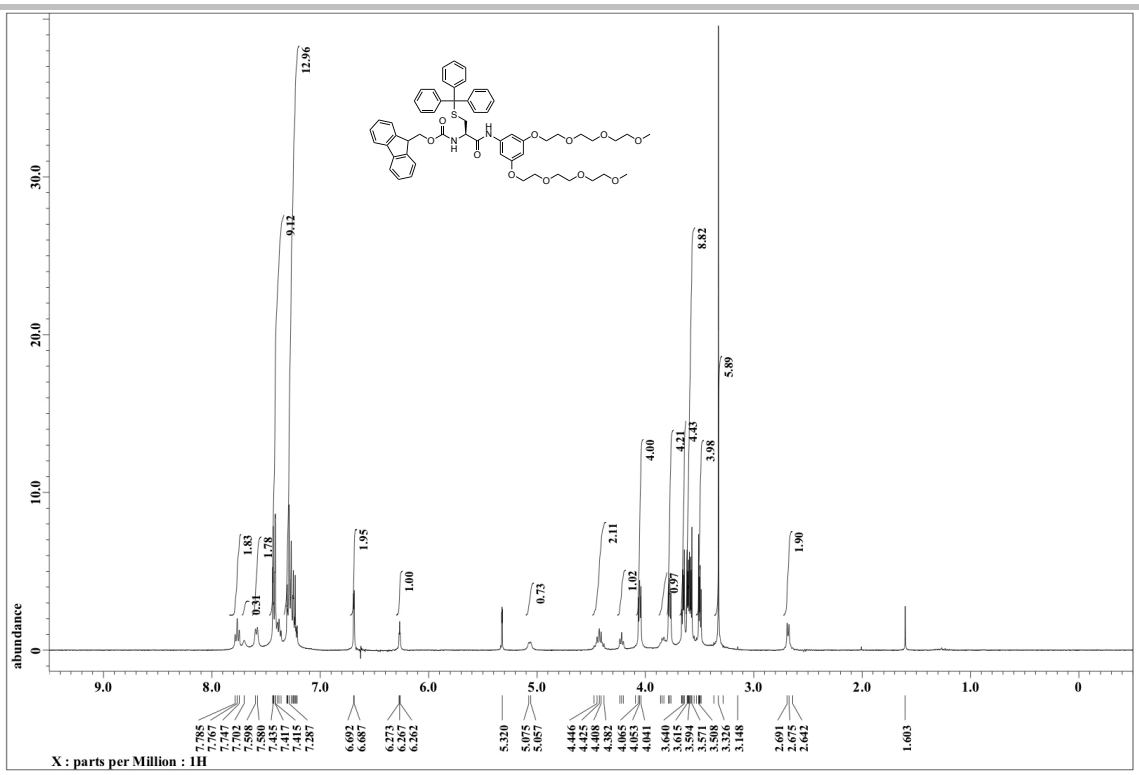

Fig. S18 ^{1}H NMR spectrum of **S5** (400 MHz, CD_2Cl_2).

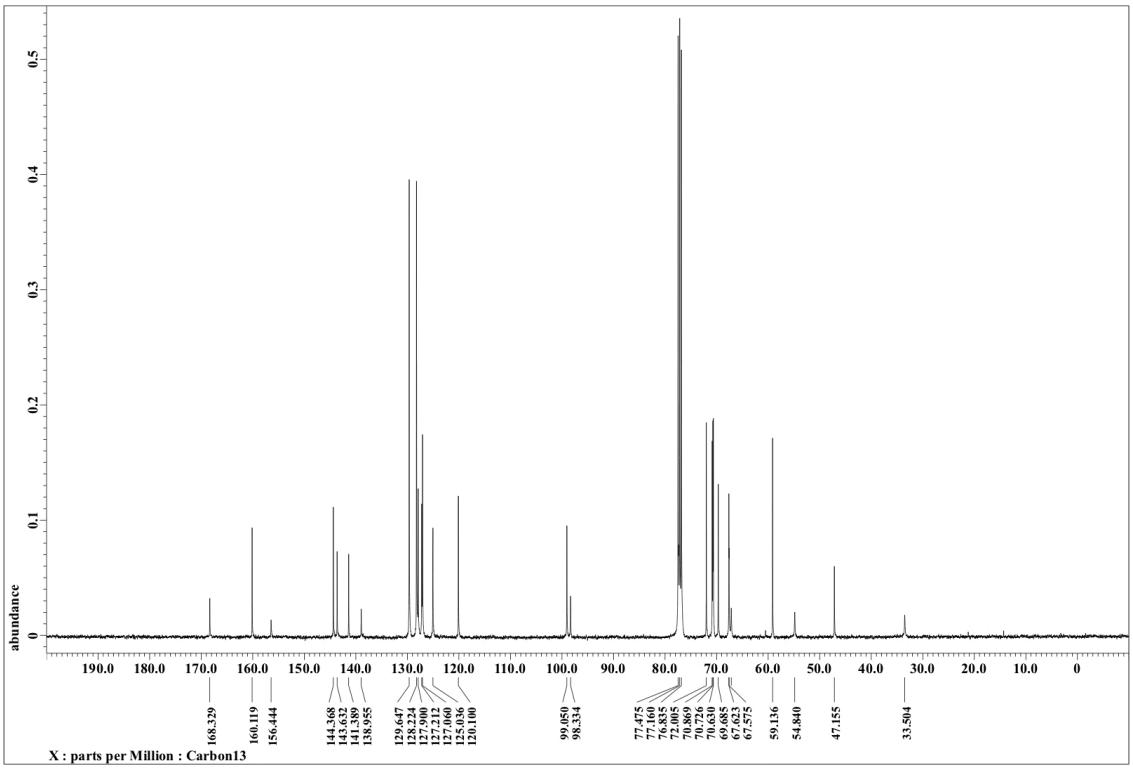

Fig. S19 ^{13}C NMR spectrum of **S5** (100 MHz, $CDCl_3$).

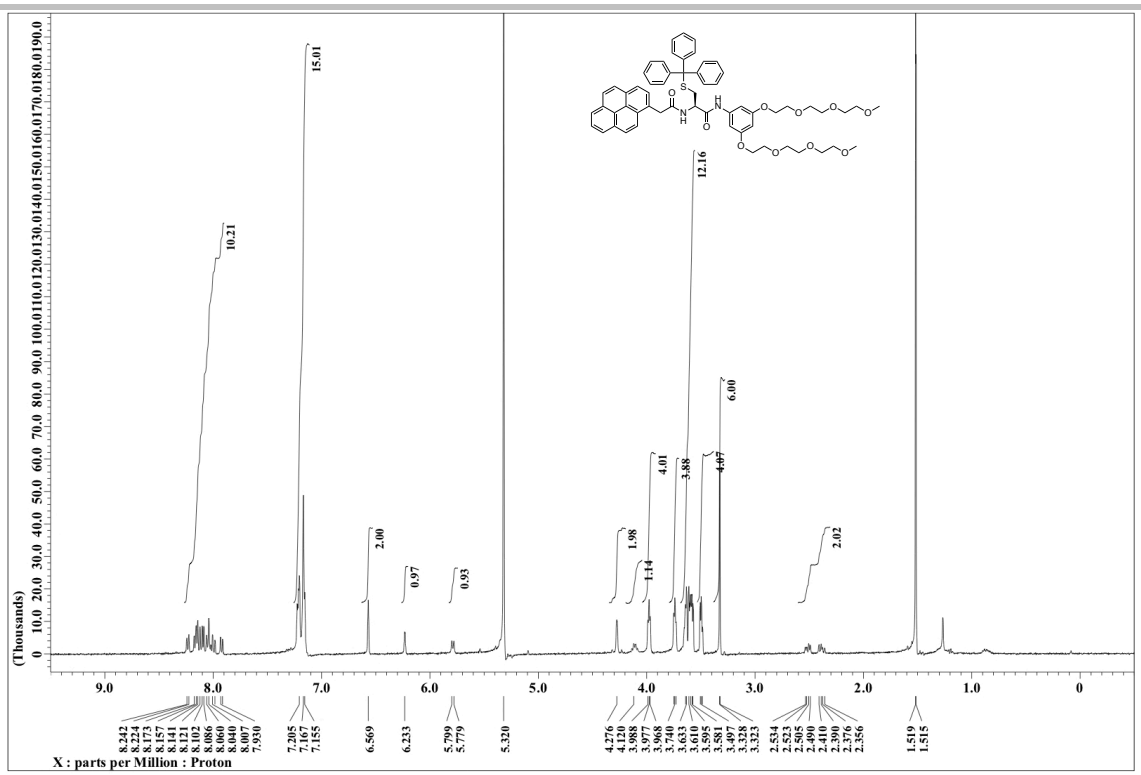

Fig. S20 ^{1}H NMR spectrum of **S7** (400 MHz, CD_2Cl_2).

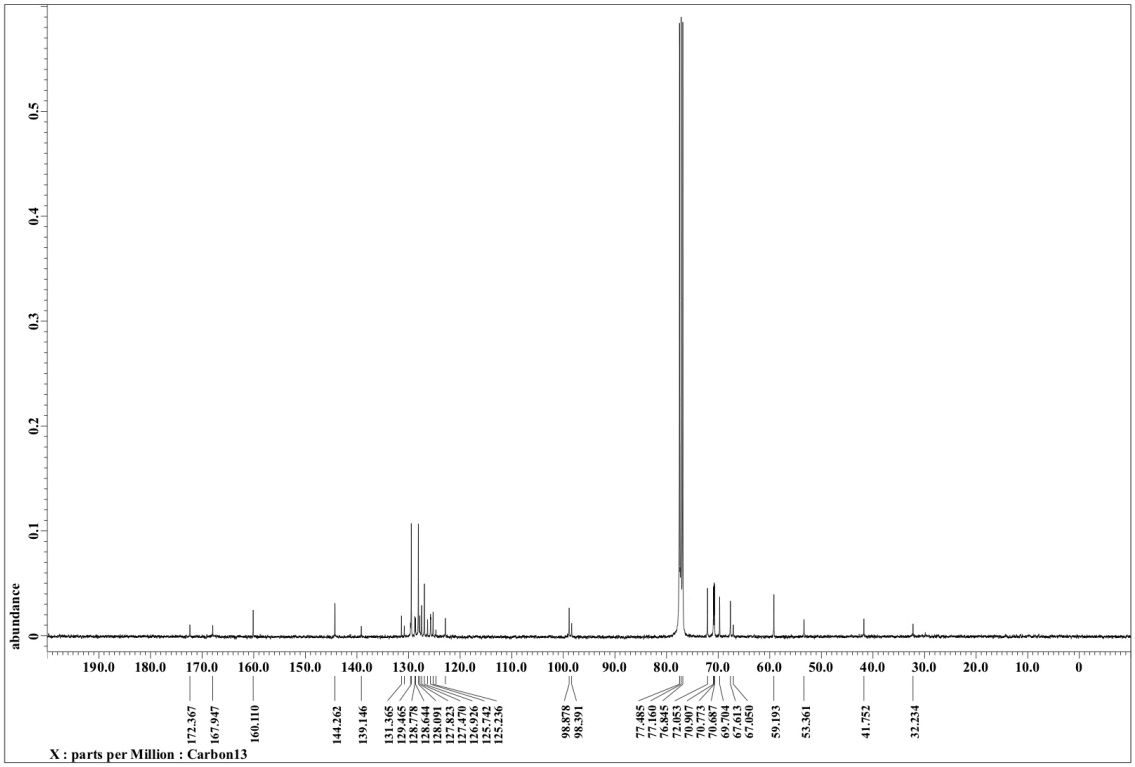

Fig. S21 ^{13}C NMR spectrum of **S7** (100 MHz, $CDCl_3$).

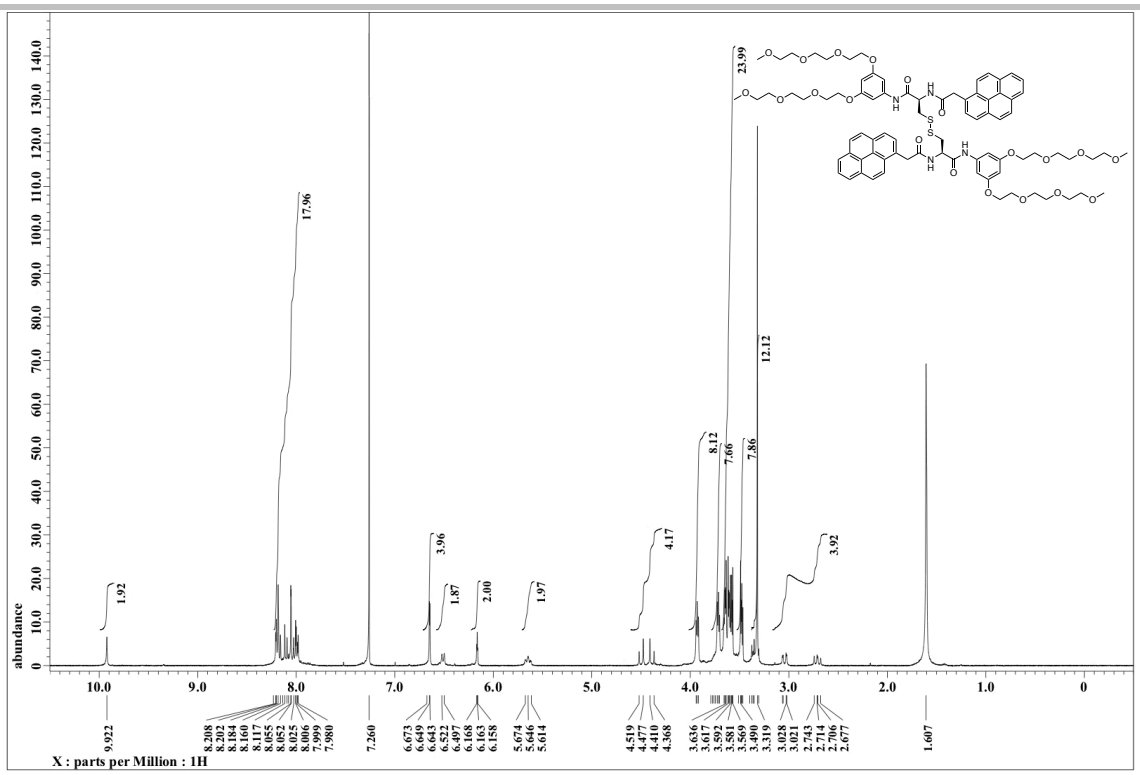

Fig. S22 ^{1}H NMR spectrum of **2** (400 MHz, $CDCl_3$).

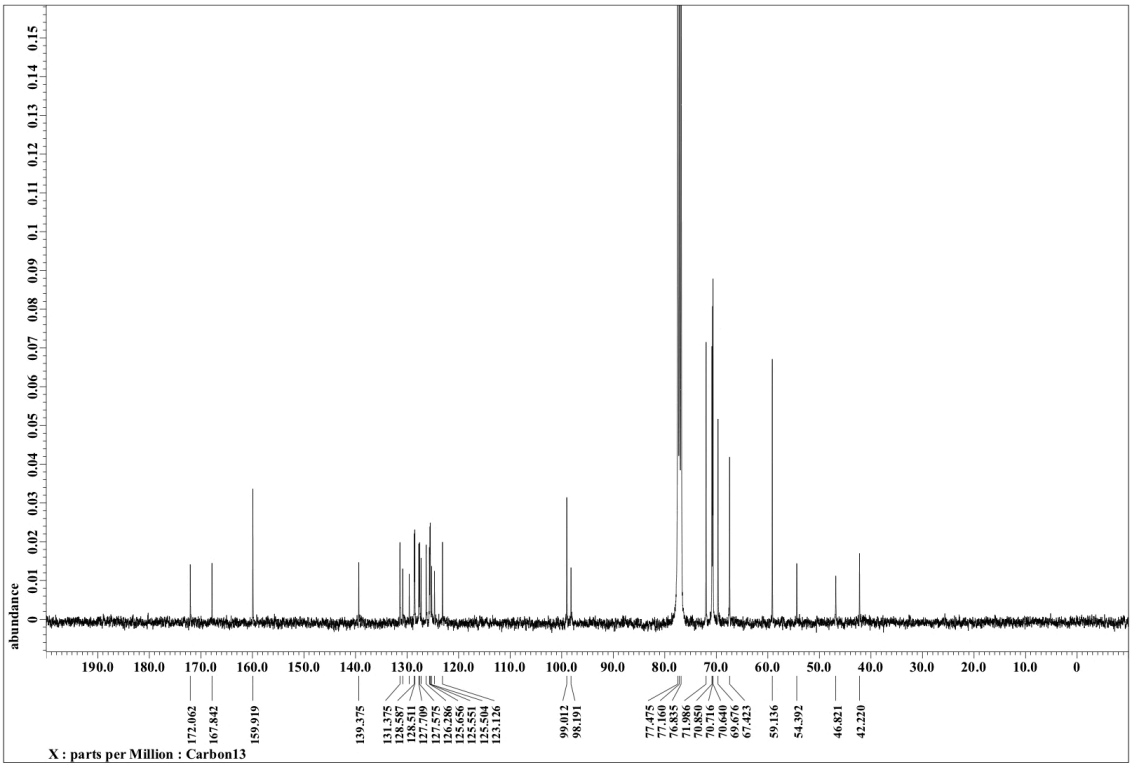

Fig. S23 ^{13}C NMR spectrum of **2** (100 MHz, $CDCl_3$).