

Electronic Supplementary Information

**Stimuli-responsive chiral aggregation-induced emission luminogens
and their circularly polarized luminescence**

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1. Materials and characterization

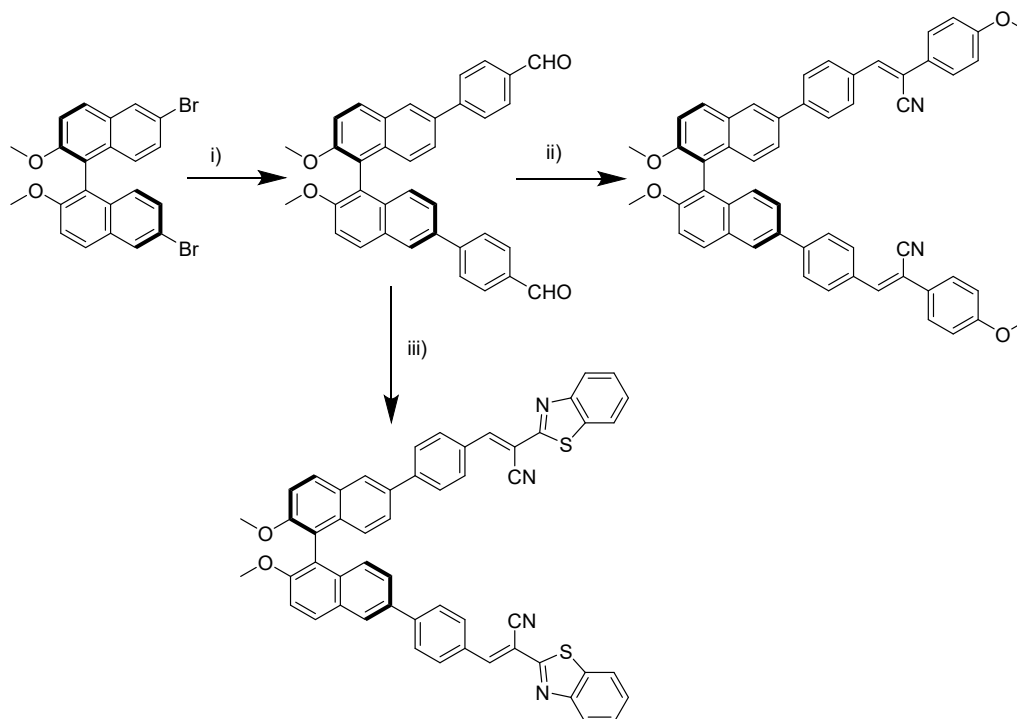
Materials: (S/R)-6,6'-dibromo-2,2'-dimethoxy-1,1'-binaphthalene (**S/RB-Br**), MeI, K₂CO₃, 4-Formylphenylboronic acid, PdCl₂(dppf), p-methoxyphenylacetonitrile, CH₃ONa, Benzothiazole-2-acetonitrile, 4-pentyl-4-biphenylcarbonitrile (5CB), Dichloromethane (DCM), tetrahydrofuran (THF), CH₃OH and toluene were all purchased from Energy Chemical (Shanghai, China). Plastic matrix PMMA were purchased from Energy Chemical (Shanghai, China), PC were purchased from MERYER CO.,LTD (Shanghai, China), PAN were purchased from Shanghai Macklin Biochemical Technology Co., Ltd. (Shanghai, China). All these materials are analytical grade and used as received.

Characterizations and instruments: ¹H NMR, ¹³C NMR spectra, 2D 1H-1H correlation spectroscopy (COSY), nuclear overhauser effect spectroscopy (NOESY) were measured on a Bruker AVANCE III 400MHz, 500MHz or 600MHz spectrometer using CDCl₃ as solvent and tetramethylsilane (TMS, δ = 0) as internal standard. Matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF-MS) were recorded on an Autoflex TOF/TOF MALDI MS. Absorption spectra were taken on a Thermo-fisher Evolution 220 spectrometer. Emission spectra were taken on a Thermo Lumina Fluorescent spectrometer. Quantum yield (QY) was taken on HAMAMATSU absolute pl quantum yield spectrometer C11347. Circular dichroism (CD) spectra were taken on JASCO Corp., J-810. Circularly polarized light (CPL) spectra were taken on JASCO CPL-300. Fluorescence lifetime decay spectra were taken on Hobira DeltaFlex. The sample was allowed to air-dry at 50°C and applied for scanning electron microscope (SEM) measurements using a JSM-7800F electron microscope at an accelerating voltage of 5 kV. The sizes of the nanoaggregates were measured with dynamic light scattering (ZetasizerNano ZSP, Malvern Instruments, Malvern, U.K.).

Preparation of polymer films: chiral AIEgens and the polymer (PMMA, PC or PAN) powder were mixed at a weight ratio of 1 : 40, which was completely dissolved with the appropriate amount of chloroform. Then, the solution was dropped into a channel (1 cm * 1 cm) of the glass plate. The solution was left for evaporation under atmosphere, and then peeled off for further measurement.

Preparation of liquid crystal sample: chiral AIEgens and nematic liquid crystal 5CB were dissolved in the dichloromethane at a weight ratio of 1 : 99. Then the solution was heated at 40 °C on a hot stage and stirred overnight to evaporate DCM. After completely removing the solvent, the mixture was injected into a flat cell consisting of two sandwiched ITO glass with a 8 μm spacer.

2. Synthesis of chiral AIEgens



Scheme S1. Synthetic routes toward chiral AIEgens **SB-CHO**, **SB-CS** and **SB-BT**. Condition: i) 4-Formylphenylboronic acid, PdCl₂(dppf), K₂CO₃, Toluene/MeOH, 75 °C; ii) p-methoxyphenylacetonitrile, MeONa, THF, RT; iii) Benzothiazole-2-acetonitrile, MeOH, NaOH, THF, RT;

Synthesis of (S)-4,4'-(2,2'-dimethoxy-[1,1'-binaphthalene]-6,6'-diyl)dibenzaldehyde (**SB-CHO**)

A mixture of (S)-6,6'-dibromo-2,2'-dimethoxy-1,1'-binaphthalene (**SB-Br**) (1 eq, 3 g, 6.36 mmol), 4-Formylphenylboronic acid (3 eq, 3.8 g, 19 mmol) and K₂CO₃ (6 eq, 5.27 g, 38.16 mmol) in Toluene/MeOH (40 mL/40 mL) was degassed by three freeze-pump-thaw cycles. Added PdCl₂(dppf) (0.1 eq, 0.462 g, 0.636 mmol) when the first freezing finished. After finished three freeze-pump-thaw cycles, purged with N₂, and stirred at 75 °C overnight. After the reaction, dichloromethane and saturated NaCl were used to extract the organic part. The solvent was removed on a rotary evaporator, and the crude product was further purified by silica-gel chromatography using CH₂Cl₂/n-Hexane mixture (2:1, v/v) as eluent. The titled compound **SB-CHO** was obtained as a white solid (2.99 g, 90.1% yield). MALDI-TOF MS (Matrix: DCTB), m/z:

calcd. for $C_{36}H_{26}O_4$: 522.1831 ($[M]^+$). Found: 522.2015 ($[M]^+$). 1H NMR (400 MHz, Chloroform-d) δ (ppm) 10.06 (s, 1H), 8.17 (d, $J = 2.0$ Hz, 1H), 8.09 (d, $J = 9.0$ Hz, 1H), 8.00 – 7.93 (m, 2H), 7.88 – 7.79 (m, 2H), 7.57 – 7.48 (m, 2H), 7.24 (d, $J = 8.8$ Hz, 1H), 3.83 (s, 3H). ^{13}C NMR (126 MHz, Chloroform-d) δ (ppm) 191.93, 155.70, 147.17, 135.00, 134.66, 133.77, 130.36, 130.23, 129.27, 127.63, 126.82, 126.07, 125.70, 119.14, 114.75, 56.82.

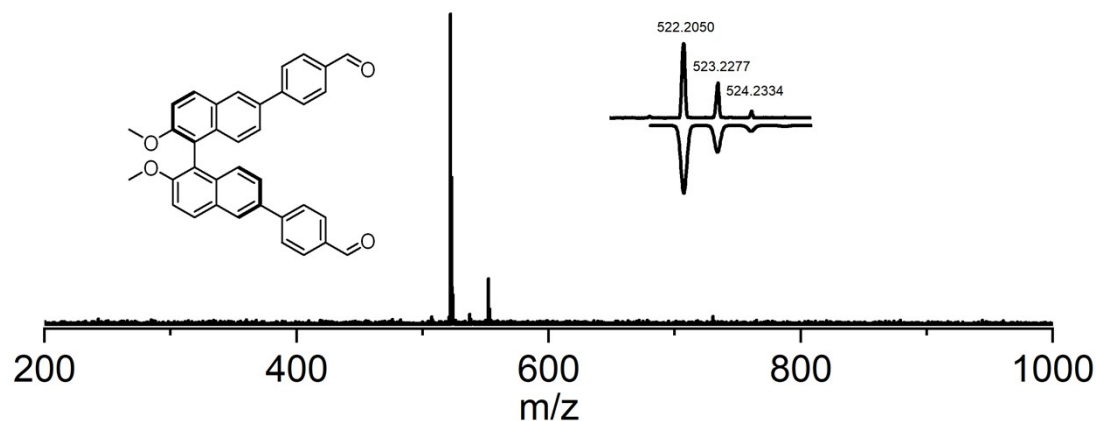


Figure S1. MALDI-TOF mass spectrum of compound **SB-CHO**

Synthesis of 3,3'-((S)-2,2'-dimethoxy-[1,1'-binaphthalene]-6,6'-diyl)bis(4,1-phenylene) bis(2-(4-methoxyphenyl)acrylonitrile) (SB-CS)

To a flask containing **SB-CHO** (1 eq, 0.5 g, 0.96 mmol), p-methoxyphenylacetonitrile (2.5 eq, 0.35 g, 2.4 mmol) and CH_3ONa (10 eq, 0.52 g, 9.6 mmol), were added to the mixed solvents THF(40 mL) and stirred. TLC plate was used to detect whether the reaction was complete (Usually the reaction lasts about one hour). After that, extraction of reaction solution using ice water and DCM. The solvent was removed on a rotary evaporator, and the crude product was further purified by silica-gel chromatography using CH_2Cl_2/n -Hexane mixture (1:1, v/v) as eluent. The titled compound **SB-CS** was obtained as a pale yellow solid (0.396 g, 52.9% yield). MALDI-TOF MS (Matrix: DCTB), m/z : calcd. for $C_{54}H_{40}N_2O_4$: 780.2988 ($[M]^+$). Found: 780.5648 ($[M]^+$). 1H NMR (400 MHz, Chloroform-d) δ (ppm) 8.16 (d, $J = 1.9$ Hz, 1H), 8.08 (d, $J = 9.0$ Hz, 1H), 8.00 – 7.93 (m, 2H), 7.82 – 7.74 (m, 2H), 7.68 – 7.60 (m, 2H), 7.60 – 7.48 (m, 2H), 7.46 (s, 1H), 7.24 (d, $J = 8.7$ Hz, 1H), 7.01 – 6.93 (m, 2H), 3.86 (s, 3H), 3.82 (s, 3H). ^{13}C NMR (101 MHz,

Chloroform-d) δ (ppm) 160.43, 155.48, 142.81, 139.70, 135.00, 133.55, 132.68, 130.07, 129.68, 129.38, 127.46, 127.33, 127.15, 126.19, 126.00, 125.69, 119.28, 118.38, 114.70, 114.47, 110.67, 56.88, 55.47.

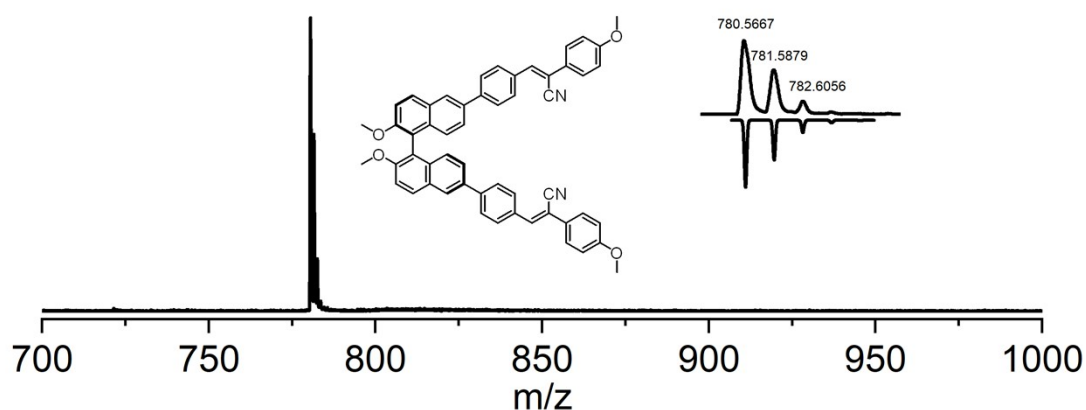


Figure S2. MALDI-TOF mass spectrum of compound **SB-CS**

Synthesis of 3,3'-(((S)-2,2'-dimethoxy-[1,1'-binaphthalene]-6,6'-diyl)bis(4,1-phenylene))bis(2-(benzo[d]thiazol-2-yl)acrylonitrile) (SB-BT)

To a flask containing **SB-CHO** (1 eq, 0.5 g, 0.96 mmol), Benzothiazole-2-acetonitrile (2.5 eq, 0.376 g, 2.4 mmol) and CH_3ONa (10 eq, 0.52 g, 9.6 mmol), were added to the mixed solvents THF(40 mL) and stirred. TLC plate was used to detect whether the reaction was complete (Usually the reaction lasts about 15 minutes). After that, extraction of reaction solution using ice water and DCM. The solvent was removed on a rotary evaporator, and the crude product was further purified by silica-gel chromatography using $\text{CH}_2\text{Cl}_2/\text{n-Hexane}$ mixture (1:1, v/v) as eluent. The titled compound **SB-BT** was obtained as a orange solid (0.192 g, 24.0% yield). MALDI-TOF MS (Matrix: DCTB), m/z: calcd. for $\text{C}_{54}\text{H}_{34}\text{N}_4\text{O}_2\text{S}_2$: 834.2123 ($[\text{M}]^+$). Found: 834.3941 ($[\text{M}]^+$). ^1H NMR (400 MHz, Chloroform-d) δ 8.40 (s, 1H), 8.22 – 8.07 (m, 5H), 7.93 (d, $J = 7.9$ Hz, 1H), 7.89 – 7.82 (m, 2H), 7.60 – 7.51 (m, 3H), 7.50 – 7.42 (m, 1H), 7.26 (d, $J = 8.8$ Hz, 1H), 3.84 (s, 3H). ^{13}C NMR (126 MHz, Chloroform-d) δ (ppm) 163.11, 155.71, 153.45, 146.62, 145.04, 134.89, 134.51, 133.79, 131.17, 131.03, 130.26, 129.32, 127.73, 127.04, 126.60, 126.12, 126.03, 125.54,

123.49, 121.71, 119.19, 116.73, 114.74, 104.62, 56.84, 29.71.

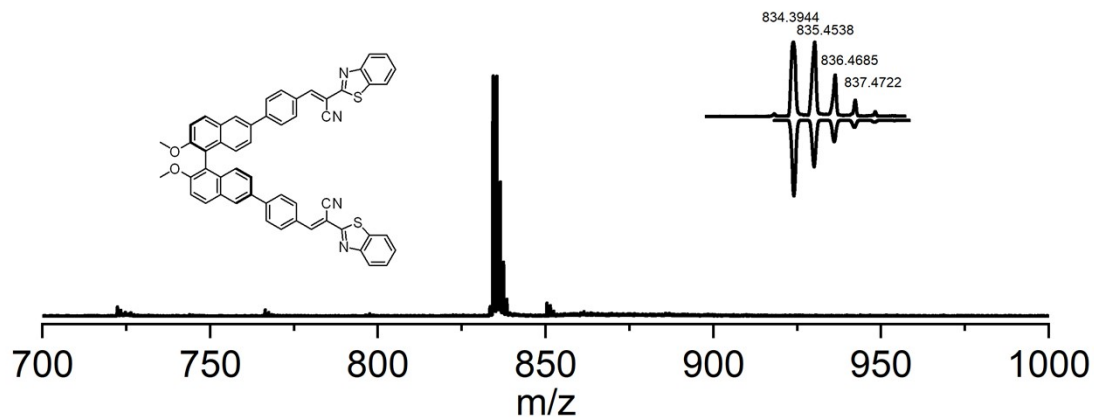


Figure S3. MALDI-TOF mass spectrum of compound SB-BT

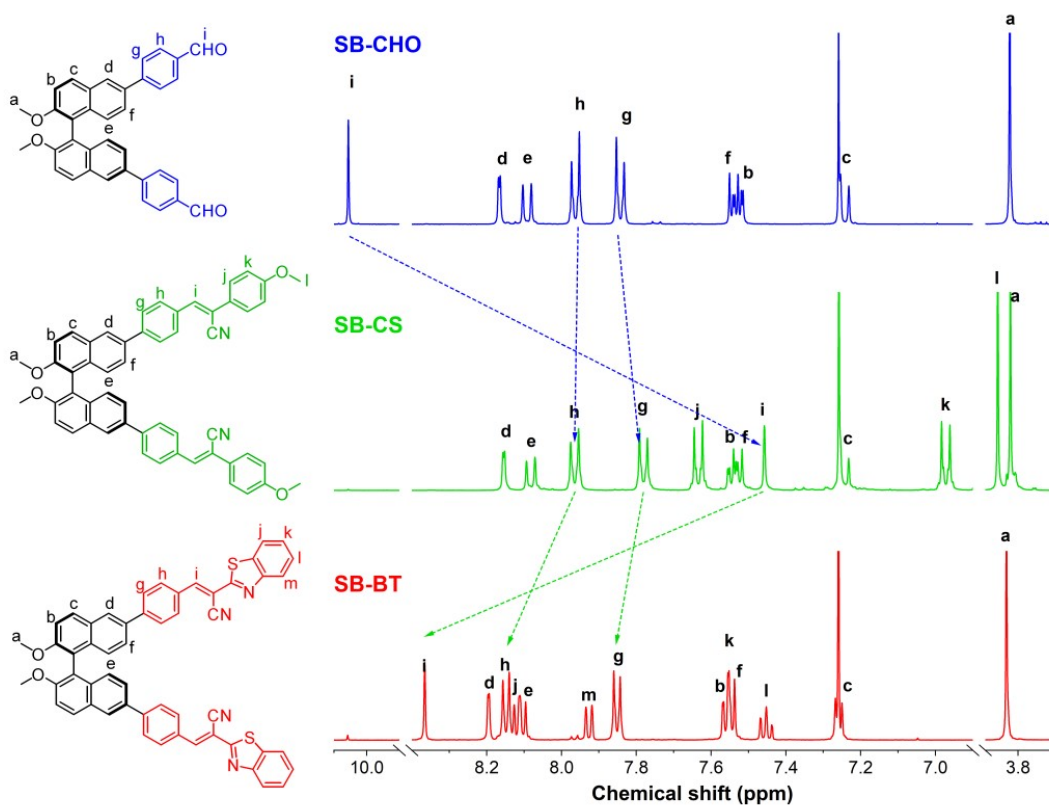
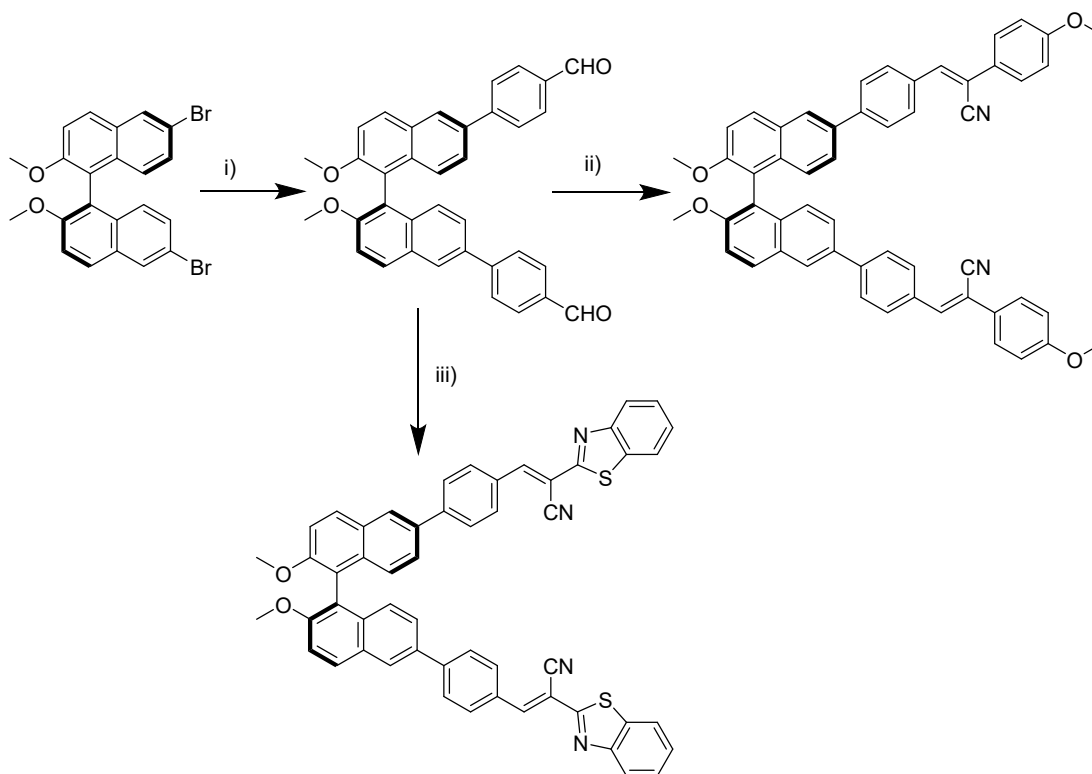


Figure S4. ¹H NMR spectra of compound SB-CHO, SB-CS, and SB-BT in CDCl₃ at 298K.



Scheme S2. Synthetic routes toward chiral AIEgens **RB-CHO**, **RB-CS** and **RB-BT**. Condition: i) 4-Formylphenylboronic acid, PdCl₂(dppf), K₂CO₃, Toluene/MeOH, 75 °C; ii) p-methoxyphenylacetonitrile, MeONa, THF, RT; iii) Benzothiazole-2-acetonitrile, MeOH, NaOH, THF, RT;

Synthesis of (R)-4,4'-(2,2'-dimethoxy-[1,1'-binaphthalene]-6,6'-diyl)dibenzaldehyde (**RB-CHO**)

A mixture of (R)-6,6'-dibromo-2,2'-dimethoxy-1,1'-binaphthalene (**RB-Br**) (1 eq, 3 g, 6.36 mmol), 4-Formylphenylboronic acid (3 eq, 3.8 g, 19 mmol) and K₂CO₃ (6 eq, 5.27 g, 38.16 mmol) in Toluene/MeOH (40 mL/40 mL) was degassed by three freeze-pump-thaw cycles. Added PdCl₂(dppf) (0.1 eq, 0.462 g, 0.636 mmol) when the first freezing finished. After finished three freeze-pump-thaw cycles, purged with N₂, and stirred at 75 °C overnight. After the reaction, dichloromethane and saturated NaCl were used to extract the organic part. The solvent was removed on a rotary evaporator, and the crude product was further purified by silica-gel chromatography using CH₂Cl₂/n-Hexane mixture (2:1, v/v) as eluent. The titled compound **RB-CHO** was obtained as a white solid (3.06 g, 92.2% yield). MALDI-TOF MS (Matrix: DCTB), m/z: calcd. for C₃₆H₂₆O₄: 522.1831 ([M]⁺). Found: 522.1951 ([M]⁺). ¹H NMR (400 MHz, Chloroform-

d) δ (ppm) 10.06 (s, 1H), 8.17 (d, $J = 2.0$ Hz, 1H), 8.09 (d, $J = 9.0$ Hz, 1H), 8.00 – 7.93 (m, 2H), 7.88 – 7.79 (m, 2H), 7.57 – 7.48 (m, 2H), 7.24 (d, $J = 8.8$ Hz, 1H), 3.83 (s, 3H). ^{13}C NMR (126 MHz, Chloroform-d) δ 191.93, 155.70, 147.17, 135.00, 134.66, 133.77, 130.36, 130.23, 129.27, 127.63, 126.82, 126.07, 125.70, 119.14, 114.75, 56.82.

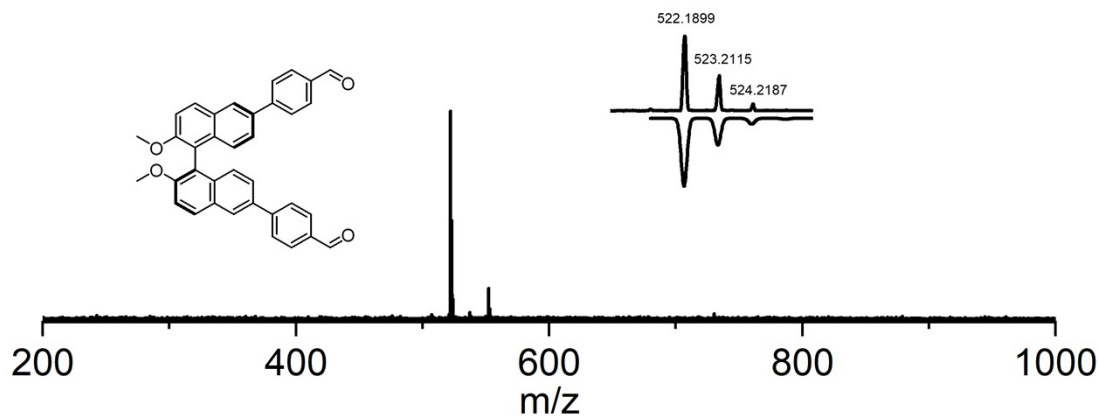


Figure S5. MALDI-TOF mass spectrum of compound **RB-CHO**

Synthesis of 3,3'-(((R)-2,2'-dimethoxy-[1,1'-binaphthalene]-6,6'-diyl)bis(4,1-phenylene)) bis(2-(4-methoxyphenyl)acrylonitrile) (RB-CS)

To a flask containing **RB-CHO** (1 eq, 0.5 g, 0.96 mmol), p-methoxyphenylacetonitrile (2.5 eq, 0.35 g, 2.4 mmol) and CH_3ONa (10 eq, 0.52 g, 9.6 mmol), were added to the mixed solvents THF(40 mL) and stirred. TLC plate was used to detect whether the reaction was complete (Usually the reaction lasts about one hour). After that, extraction of reaction solution using ice water and DCM. The solvent was removed on a rotary evaporator, and the crude product was further purified by silica-gel chromatography using $\text{CH}_2\text{Cl}_2/\text{n-Hexane}$ mixture (1:1, v/v) as eluent. The titled compound **RB-CS** was obtained as a pale yellow solid (0.493 g, 65.8% yield). MALDI-TOF MS (Matrix: DCTB), m/z: calcd. for $\text{C}_{54}\text{H}_{40}\text{N}_2\text{O}_4$: 780.2988 ($[\text{M}]^+$). Found: 780.5312 ($[\text{M}]^+$). ^1H NMR (400 MHz, Chloroform-d) δ (ppm) 8.16 (d, $J = 1.9$ Hz, 1H), 8.08 (d, $J = 9.0$ Hz, 1H), 8.00 – 7.93 (m, 2H), 7.82 – 7.74 (m, 2H), 7.68 – 7.60 (m, 2H), 7.60 – 7.48 (m, 2H), 7.46 (s, 1H), 7.24 (d, $J = 8.7$ Hz, 1H), 7.01 – 6.93 (m, 2H), 3.86 (s, 3H), 3.82 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-d) δ (ppm) 160.43, 155.48, 142.81, 139.70, 135.00, 133.55, 132.68, 130.07, 129.68, 129.38, 127.46, 127.33, 127.15, 126.19, 126.00, 125.69, 119.28, 118.38, 114.70, 114.47, 110.67, 56.88, 55.47.

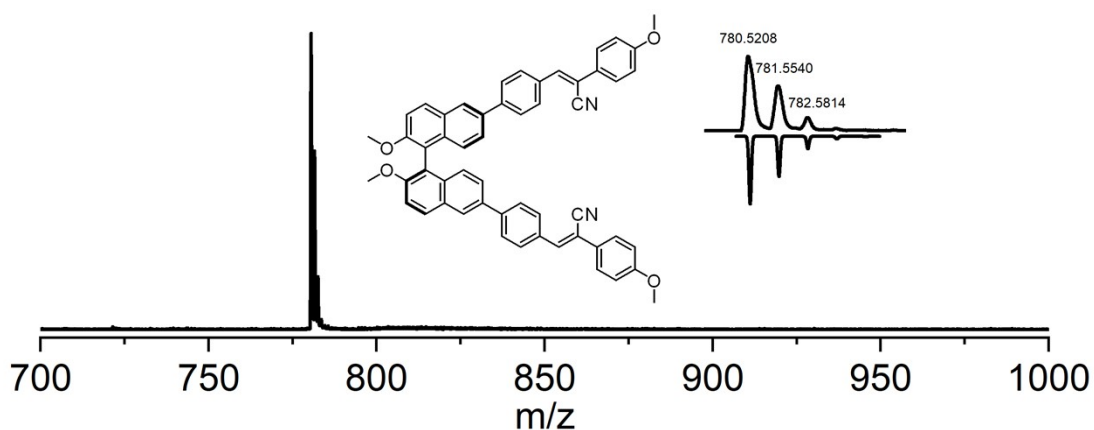


Figure S6. MALDI-TOF mass spectrum of compound **RB-CS**

Synthesis of 3,3'-(((S)-2,2'-dimethoxy-[1,1'-binaphthalene]-6,6'-diyl)bis(4,1-phenylene))bis(2-(benzo[d]thiazol-2-yl)acrylonitrile) (RB-BT)

To a flask containing **RB-CHO** (1 eq, 0.5 g, 0.96 mmol), Benzothiazole-2-acetonitrile (2.5 eq, 0.376 g, 2.4 mmol) and CH_3ONa (10 eq, 0.52 g, 9.6 mmol), were added to the mixed solvents THF(40 mL) and stirred. TLC plate was used to detect whether the reaction was complete (Usually the reaction lasts about 15 minutes). After that, extraction of reaction solution using ice water and DCM. The solvent was removed on a rotary evaporator, and the crude product was further purified by silica-gel chromatography using $\text{CH}_2\text{Cl}_2/\text{n-Hexane}$ mixture (1:1, v/v) as eluent. The titled compound **RB-BT** was obtained as a orange solid (0.288 g, 36.0% yield). MALDI-TOF MS (Matrix: DCTB), m/z: calcd. for $\text{C}_{54}\text{H}_{34}\text{N}_4\text{O}_2\text{S}_2$: 834.2123 ($[\text{M}]^+$). Found: 834.3926 ($[\text{M}]^+$). ^1H NMR (400 MHz, Chloroform-d) δ (ppm) 8.40 (s, 1H), 8.22 – 8.07 (m, 5H), 7.93 (d, J = 7.9 Hz, 1H), 7.89 – 7.82 (m, 2H), 7.60 – 7.51 (m, 3H), 7.50 – 7.42 (m, 1H), 7.26 (d, J = 8.8 Hz, 1H), 3.84 (s, 3H). ^{13}C NMR (126 MHz, Chloroform-d) δ (ppm) 163.11, 155.71, 153.45, 146.62, 145.04, 134.89, 134.51, 133.79, 131.17, 131.03, 130.26, 129.32, 127.73, 127.04, 126.60, 126.12, 126.03, 125.54, 123.49, 121.71, 119.19, 116.73, 114.74, 104.62, 56.84, 29.71.

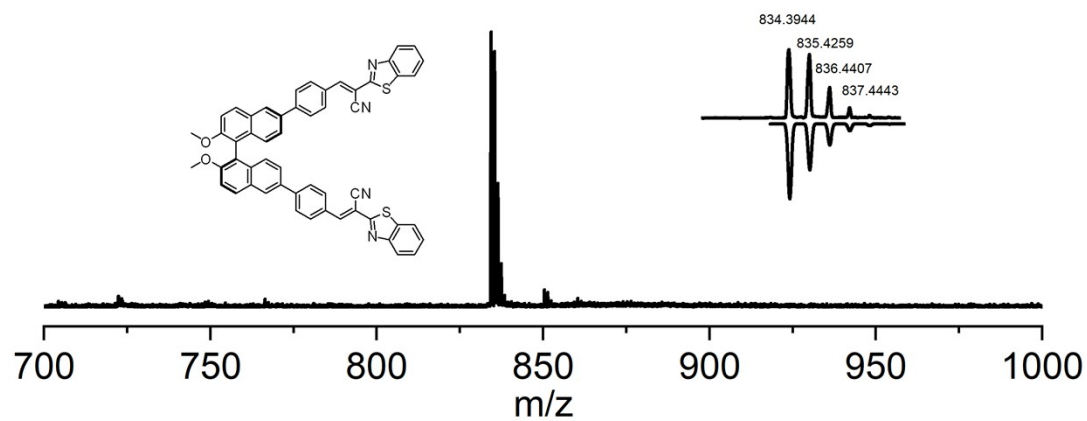


Figure S7. MALDI-TOF mass spectrum of compound **RB-BT**

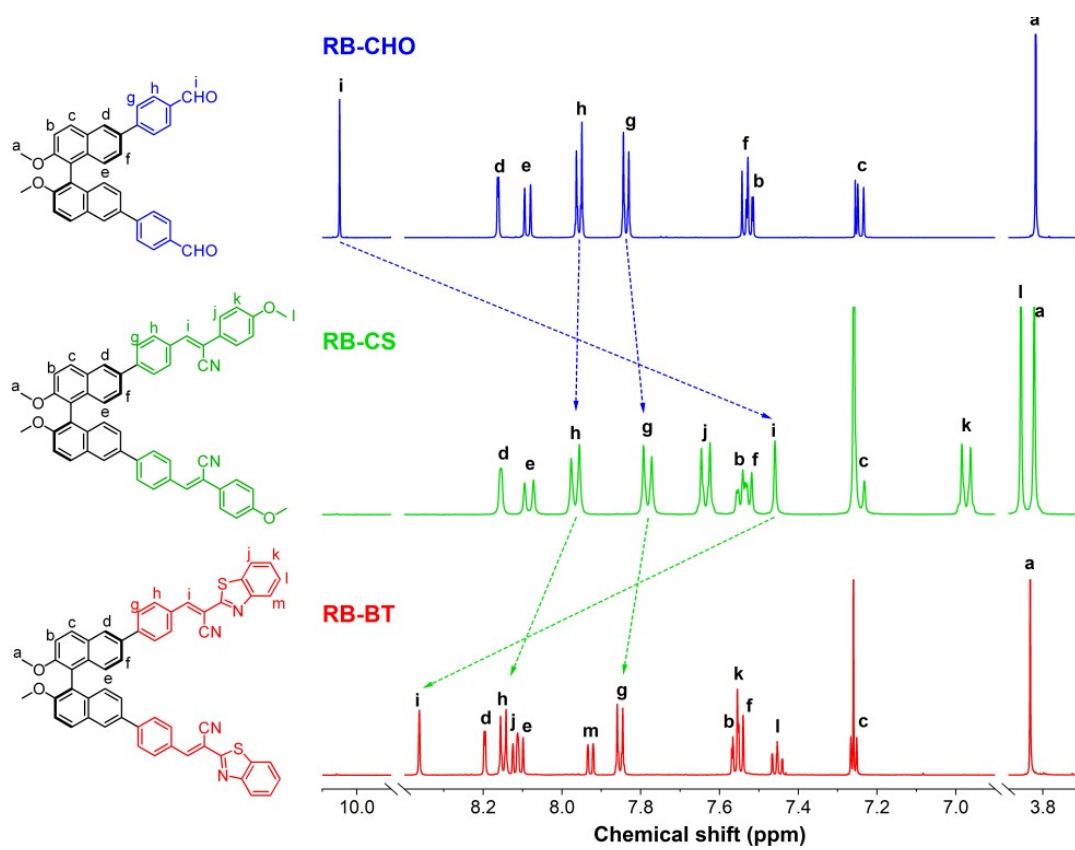


Figure S8. ^1H NMR spectra of compound **RB-CHO**, **RB-CS**, and **RB-BT** in CDCl_3 at 298K.

3. Geometry optimization

For consideration of molecular geometries and electronic levels, all optimized structures and molecular orbitals were calculated within the Gaussian 09 program suite based on density functional theory (DFT) calculations using functional B3LYP with the 6-31G(d) basis set.

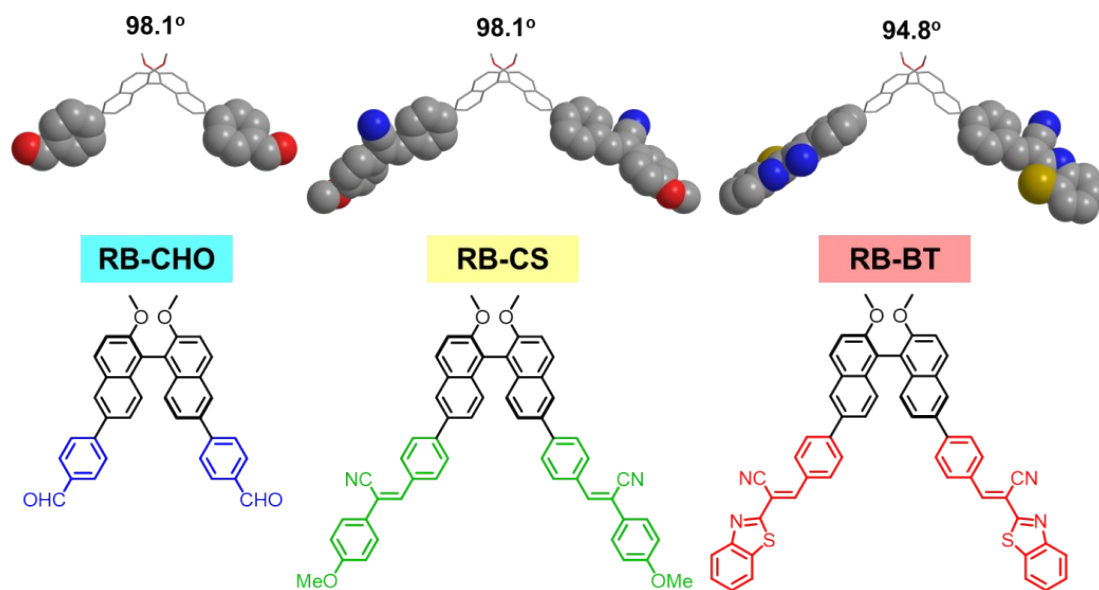


Figure S9. Structure for chiral AIEgens **RB-CHO**, **RB-CS** and **RB-BT** at the B3LYP/6-31G(d) level of theory.

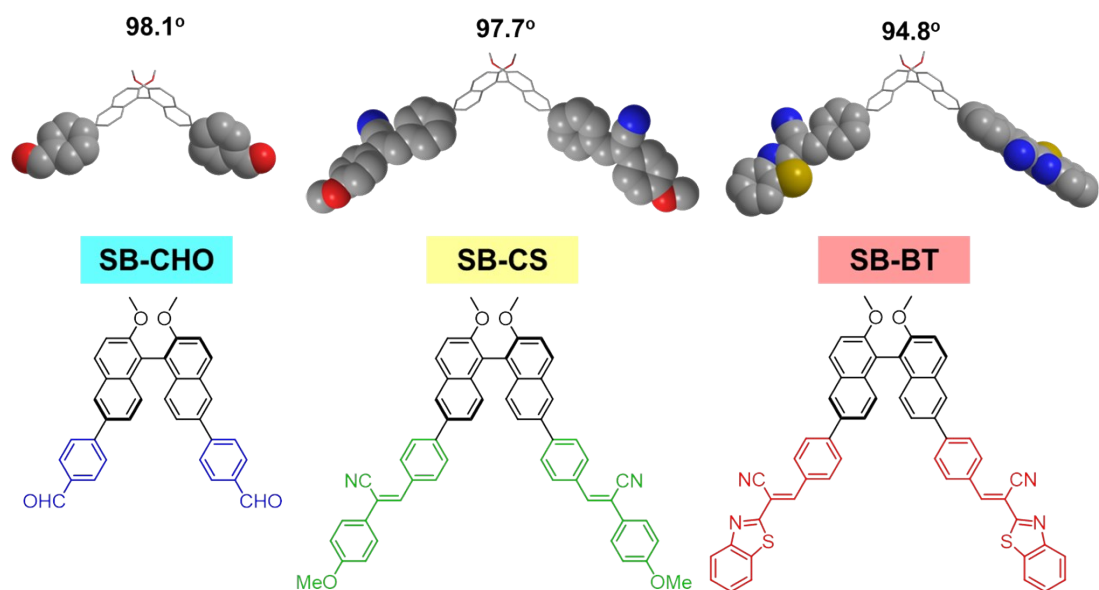


Figure S10. Structure for chiral AIEgens **SB-CHO**, **SB-CS** and **SB-BT** at the B3LYP/6-31G(d) level of theory.

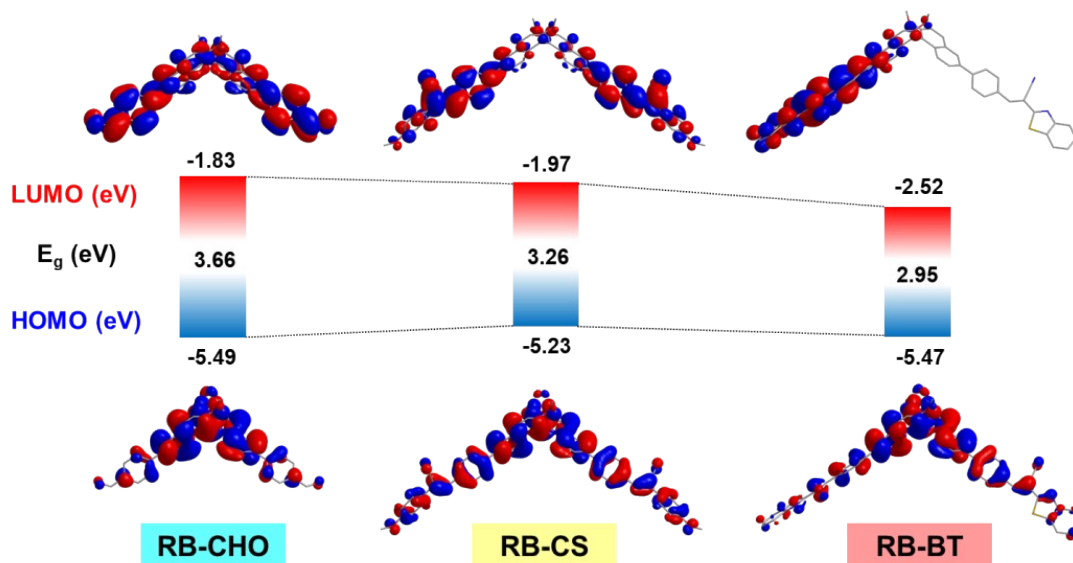


Figure S11. Molecular orbitals and energy levels for chiral AIEgens **RB-CHO**, **RB-CS** and **RB-BT** at the B3LYP/6-31G(d) level of theory.

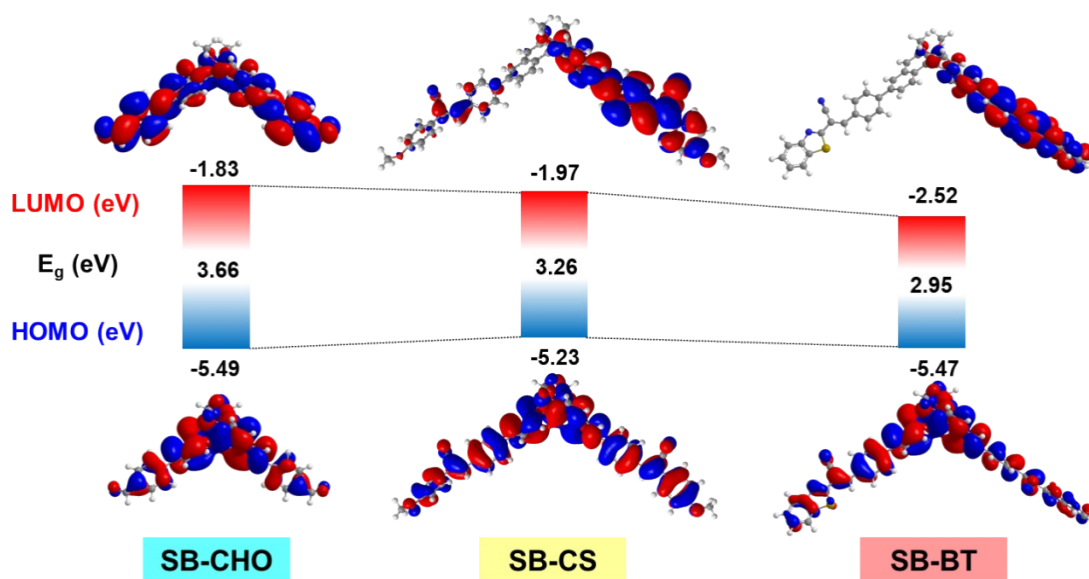


Figure S12. Molecular orbitals and energy levels for chiral AIEgens **SB-CHO**, **SB-CS** and **SB-BT** at the B3LYP/6-31G(d) level of theory.

4. Photo-physical properties

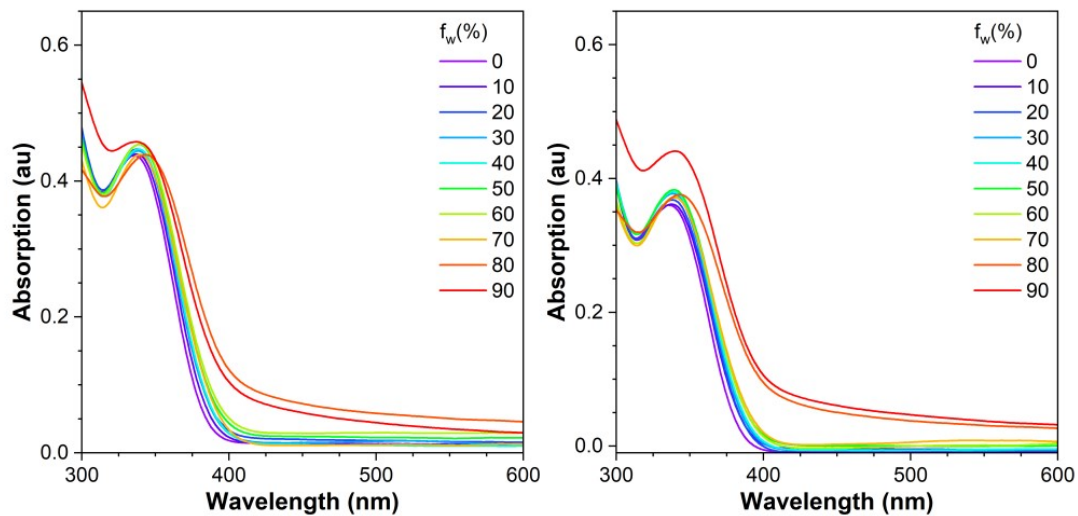


Figure S13. UV-Vis absorption spectra of chiral AIEgen **SB-CHO** (left) and **RB-CHO** (right) in THF solution and THF/H₂O mixture with different water fraction (f_w). Concentration = 10 μ M.

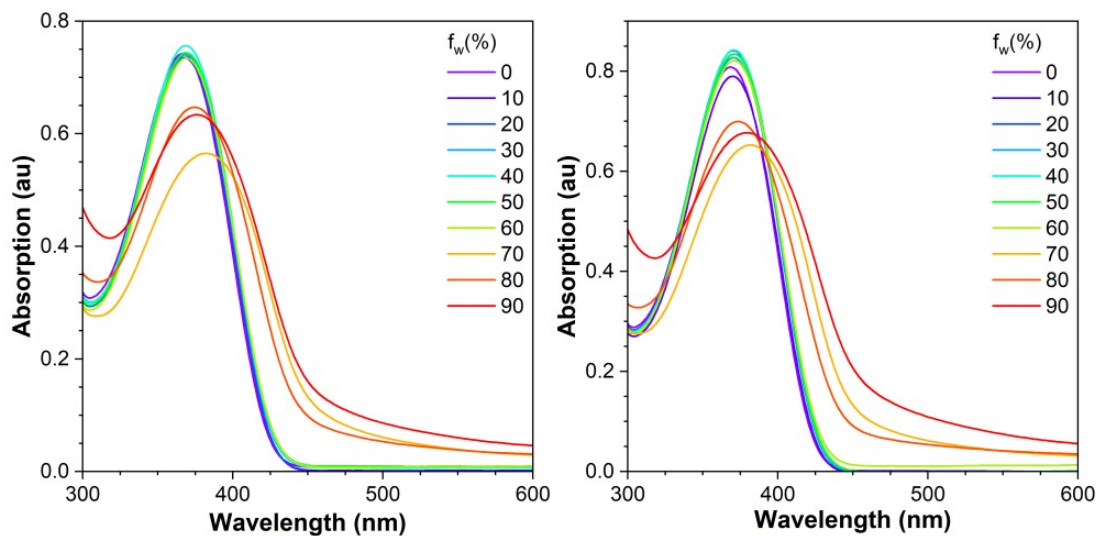


Figure S14. UV-Vis absorption spectra of chiral AIEgen **SB-CS** (left) and **RB-CS** (right) in THF solution and THF/H₂O mixture with different water fraction (f_w). Concentration = 10 μ M.

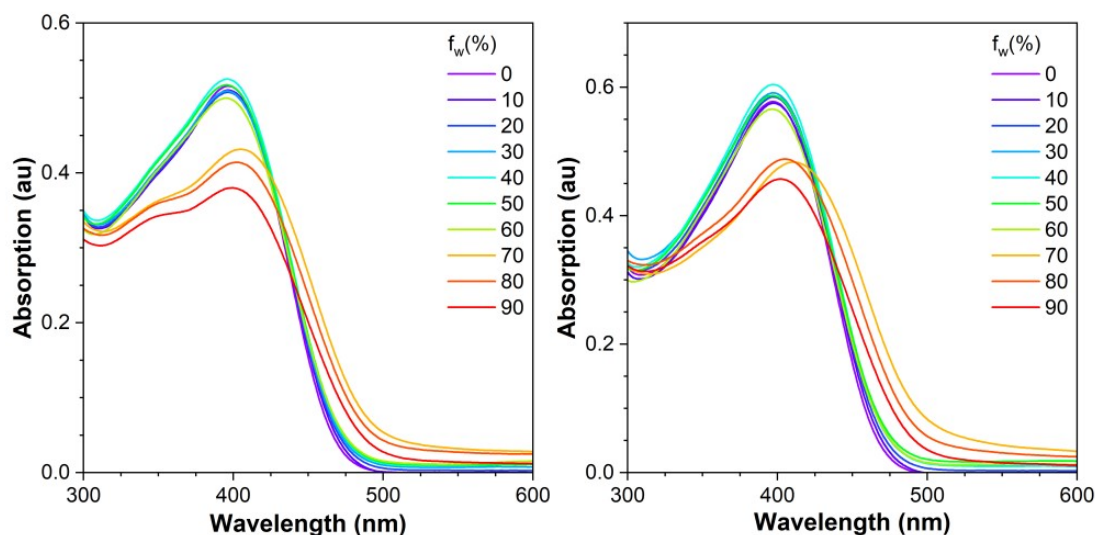


Figure S15. UV-Vis absorption spectra of chiral AIEgen **SB-BT** (left) and **RB-BT** (right) in THF solution and THF/H₂O mixture with different water fraction (f_w). Concentration = 10 μ M.

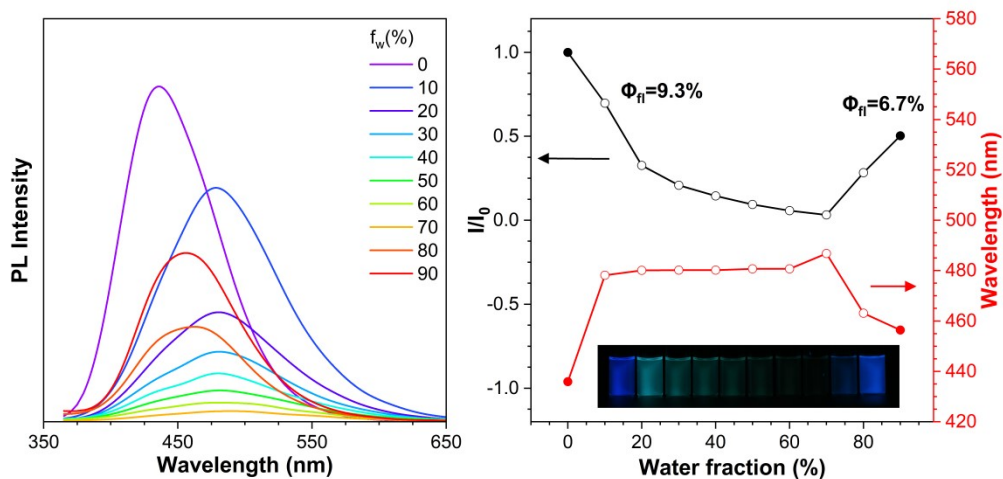


Figure S16. PL spectra (left) and change in the PL intensity (right) of chiral AIEgen **SB-CHO** in THF and THF/water mixtures with different water fraction (f_w). I_0 is the luminescence intensity in THF. I is the luminescence intensity in different THF/H₂O mixture. Black line: luminescence intensity. Red line: emission wavelength. Concentration = 10 μ M. λ_{ex} = 340 nm.

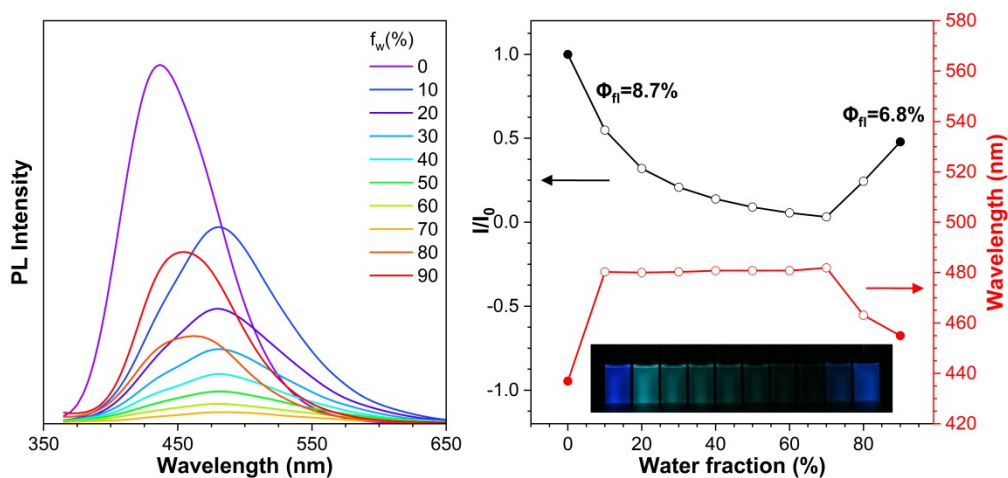


Figure S17. PL spectra (left) and change in the PL intensity (right) of chiral AIEgen **RB-CHO** in THF and THF/water mixtures with different water fraction (f_w). I_0 is the maximal PL intensity in THF. I is the luminescence intensity in different THF/H₂O mixture. Black line: luminescence intensity. Red line: emission wavelength. Concentration = 10 μ M. λ_{ex} = 340 nm.

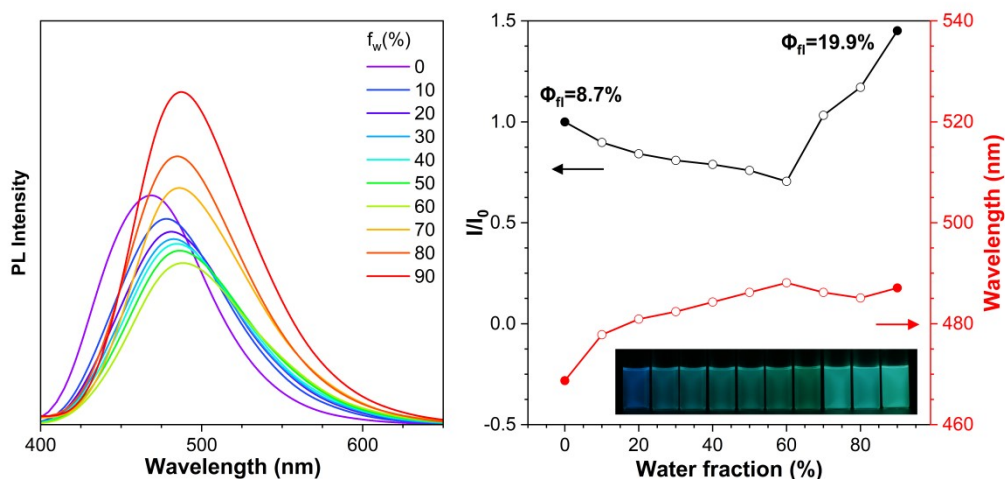


Figure S18. PL spectra (left) and change in the PL intensity (right) of chiral AIEgen **SB-CS** in THF and THF/water mixtures with different water fraction (f_w). I_0 is the maximal PL intensity in THF. I is the luminescence intensity in different THF/H₂O mixture. Black line: luminescence intensity. Red line: emission wavelength. Concentration = 10 μ M. λ_{ex} = 370 nm.

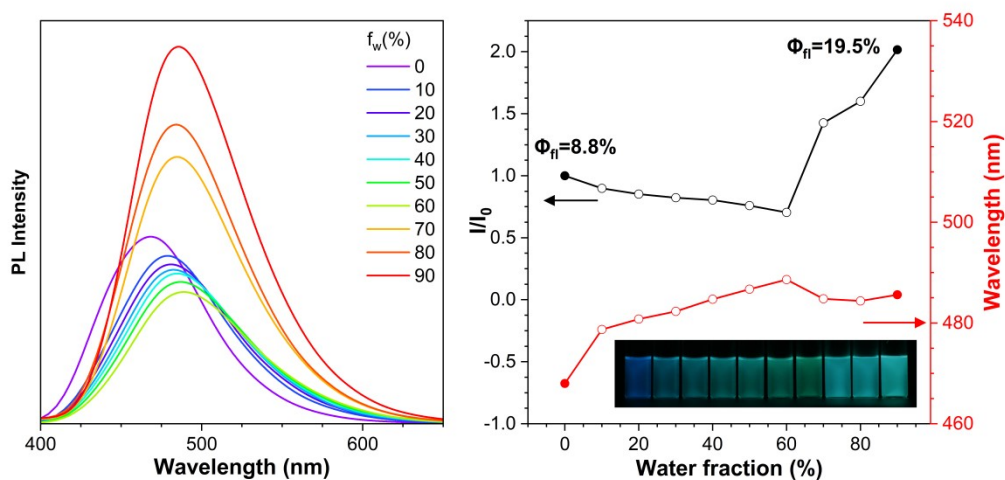


Figure S19. PL spectra (left) and change in the PL intensity (right) of chiral AIEgen **RB-CS** in THF and THF/water mixtures with different water fraction (f_w). I_0 is the maximal PL intensity in THF. I is the luminescence intensity in different THF/H₂O mixture. Black line: luminescence intensity. Red line: emission wavelength. Concentration = 10 μ M. λ_{ex} = 370 nm.

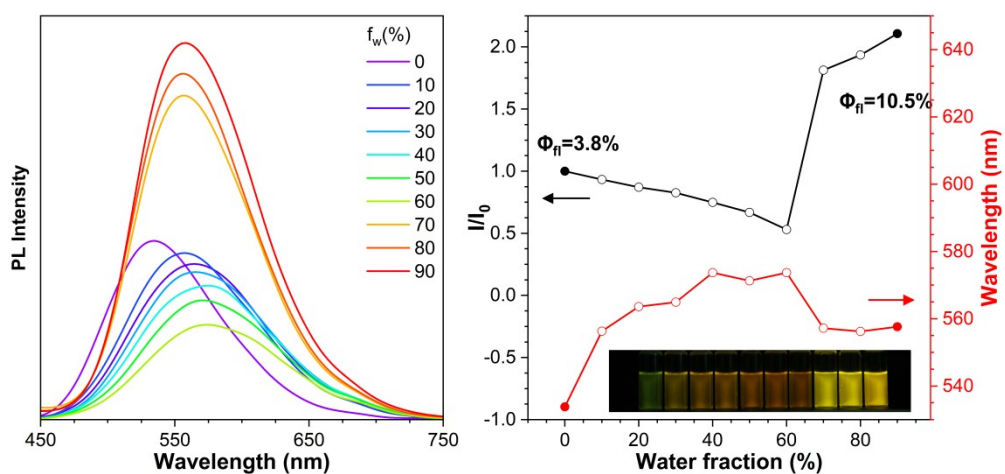


Figure S20. PL spectra (left) and change in the PL intensity (right) of chiral AIEgen **SB-BT** in THF and THF/water mixtures with different water fraction (f_w). I_0 is the maximal PL intensity in THF. I is the luminescence intensity in different THF/H₂O mixture. Black line: luminescence intensity. Red line: emission wavelength. Concentration = 10 μ M. λ_{ex} = 400 nm.

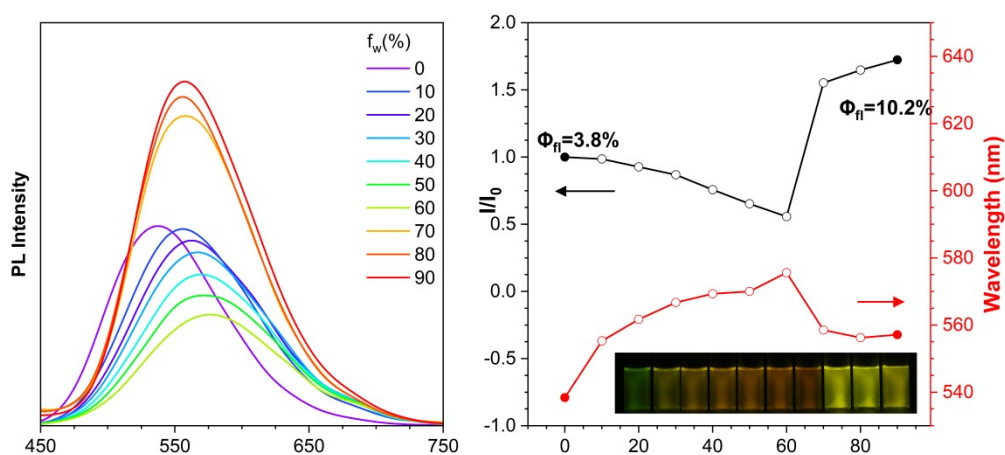


Figure S21. PL spectra (left) and change in the PL intensity (right) of chiral AIEgen **RB-BT** in THF and THF/water mixtures with different water fraction (f_w). I_0 is the maximal PL intensity in THF. I is the luminescence intensity in different THF/H₂O mixture. Black line: luminescence intensity. Red line: emission wavelength. Concentration = 10 μ M. λ_{ex} = 400 nm.

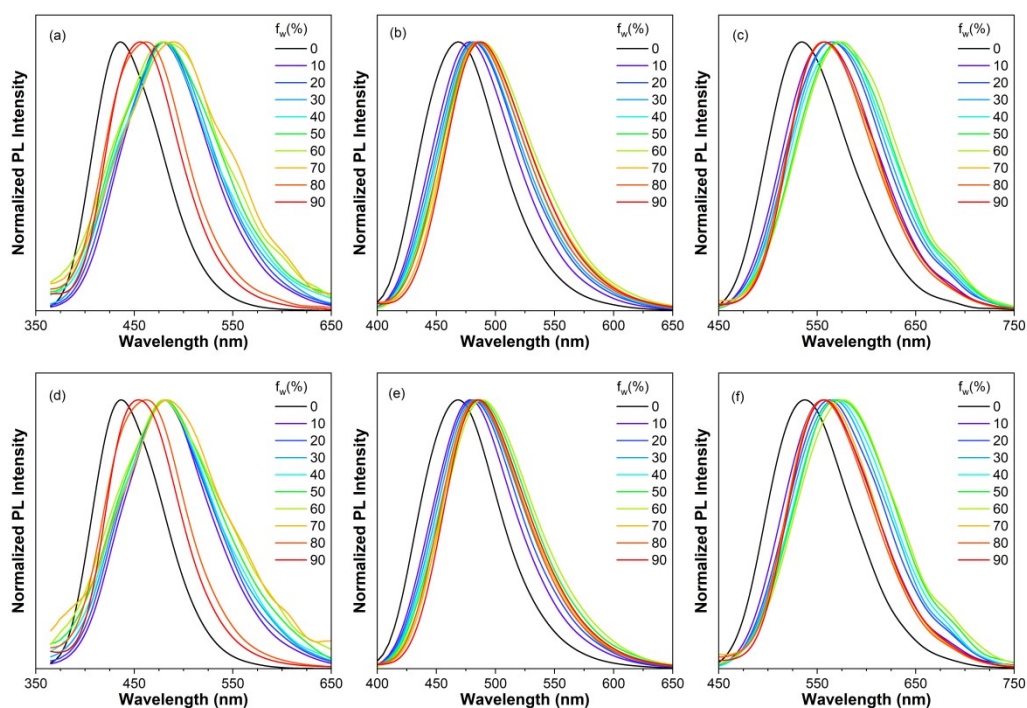


Figure S22. Normalized PL spectra of chiral AIEgens in THF and THF/water mixtures with different water fraction (f_w). Concentration = 10 μ M. Excitation wavelength: 340 nm for **SB-CHO** (a) and **RB-CHO** (b); 370 nm for **SB-CS** (c) and **RB-CS** (d); 400 nm for **SB-BT** (e) and **RB-BT** (f).

Table S1. Basic photophysical properties of three pairs of chiral fluorophores.

Sample	λ_{abs} (nm) ^[a]	THF		$F_w = 90\%$		solid		2.5% @ PMMA		1% @ 5CB	
		$\lambda_{\text{em}}(\text{nm})$ ^[b]	QY (%) ^[c]	$\lambda_{\text{em}}(\text{nm})$	QY(%)	$\lambda_{\text{em}}(\text{nm})$	QY(%)	$\lambda_{\text{em}}(\text{nm})$	QY(%)	$\lambda_{\text{em}}(\text{nm})$	QY(%)
SB-CHO	335	436	9.3	456	6.7	469	28.6	432	6.3	445	33.8
RB-CHO	336	437	8.7	454	6.8	465	26.9	432	6.4	446	27.2
SB-CS	367	468	8.7	487	19.9	482	52.2	455	70.3	473	48.3
RB-CS	369	468	8.8	486	19.5	477	55.8	457	68.8	472	54.7
SB-BT	397	535	3.8	558	10.5	581	27.5	508	27.7	524	14.4
RB-BT	397	537	3.8	557	10.2	578	30.7	507	27.5	526	14.9

[a] Maximum absorption wavelength in THF solution or THF/H₂O mixture ($f_w=90\%$) with concentration at 10 μM , whereas the in-apparent shoulder peak was not marked. [b] Maximum emission wavelength in THF solution,

THF/H₂O mixture ($f_w=90\%$) with concentration at 10 μM , or solid state. [c] Absolute emission quantum yield (QY/%) measured by Hamamatsu Absolute PL quantum yield spectrometer C11347.

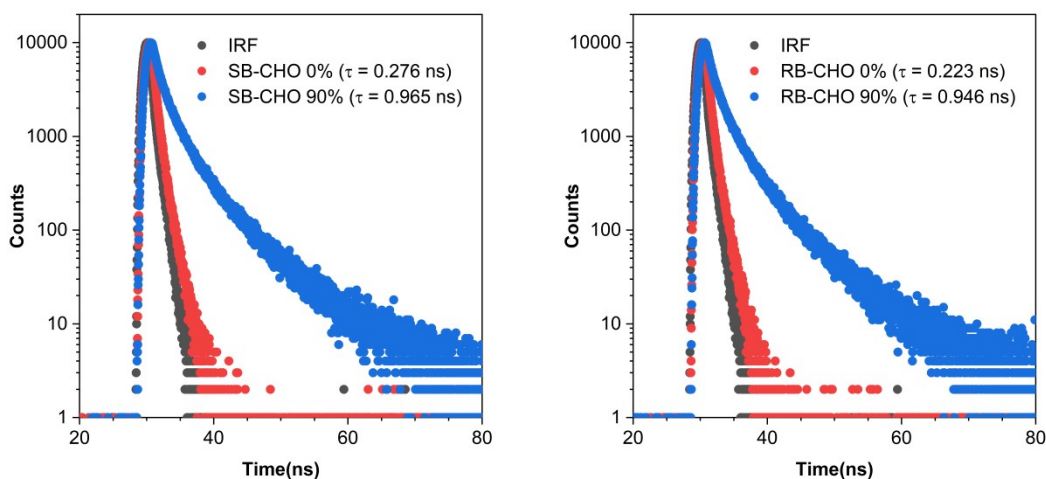


Figure S23. The fluorescence lifetime of **SB-CHO** (left) and **RB-CHO** (right) in THF (red point) and THF/water mixtures ($f_w = 90\%$) (blue point). Concentration = 10 μM . Fitting by $f(t) = A + B_1 \cdot \exp(-t/\tau_1) + B_2 \cdot \exp(-t/\tau_2) + B_3 \cdot \exp(-t/\tau_3)$.

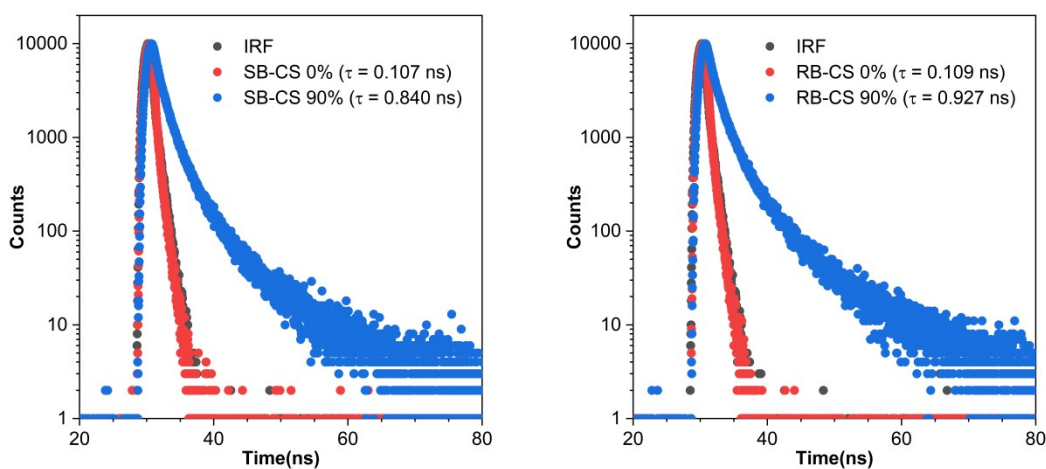


Figure S24. The fluorescence lifetime of **SB-CS** (left) and **RB-CS** (right) in THF (red point) and THF/water mixtures ($f_w = 90\%$) (blue point). Concentration = 10 μM . Fitting by $f(t) = A + B_1 \cdot \exp(-t/\tau_1) + B_2 \cdot \exp(-t/\tau_2) + B_3 \cdot \exp(-t/\tau_3)$.

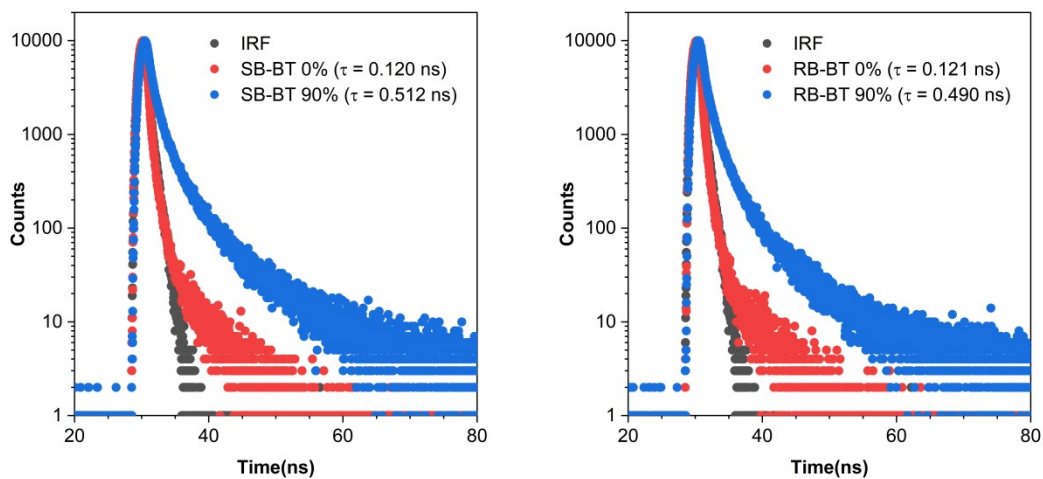


Figure S25. The fluorescence lifetime of **SB-BT** (left) and **RB-BT** (right) in THF (red point) and THF/water mixtures ($f_w = 90\%$) (blue point). Concentration = $10 \mu\text{M}$. Fitting by $f(t) = A + B_1 \cdot \exp(-t/\tau_1) + B_2 \cdot \exp(-t/\tau_2) + B_3 \cdot \exp(-t/\tau_3)$.

Table S2. Fitting parameters of lifetime for chiral fluorophores.^[a]

	τ_1/ns	τ_2/ns	τ_3/ns	B_1	B_2	B_3	$\tau_{\text{avg}}/\text{ns}^{[b]}$	χ^2
SB-CHO 0%	1.84E-01	2.78E-01	1.42E+00	1.37E-02	9.43E-02	1.11E-03	0.277589	1.001
SB-CHO 90%	2.47E+00	4.73E-01	7.25E+00	9.23E-03	4.38E-02	1.22E-03	0.964513	1.0005
RB-CHO 0%	2.22E-01	2.24E-01	1.32E+00	-3.25E+00	3.35E+00	1.52E-03	0.223187	1.001
RB-CHO 90%	2.49E+00	4.63E-01	7.38E+00	9.28E-03	4.46E-02	1.13E-03	0.946274	1.0043
SB-CS 0%	1.05E-01	1.07E-01	6.61E-01	-1.86E+01	1.86E+01	-8.50E-03	0.106503	0.9964
SB-CS 90%	5.12E-01	2.12E+00	7.82E+00	4.44E-02	8.85E-03	4.58E-04	0.839745	0.9983
RB-CS 0%	1.08E-01	1.10E-01	6.52E-01	-2.83E+01	2.83E+01	-9.29E-03	0.109084	1.0025
RB-CS 90%	5.32E-01	2.30E+00	8.22E+00	4.28E-02	9.01E-03	6.22E-04	0.926913	0.9979
SB-BT 0%	1.22E-01	1.19E-01	1.59E+00	-5.35E+00	5.78E+00	-2.08E-03	0.120423	1.0022
SB-BT 90%	2.19E+00	3.40E-01	8.58E+00	5.50E-03	7.29E-02	4.10E-04	0.512217	0.9957
RB-BT 0%	3.78E-02	1.22E-01	1.24E-01	-6.63E-01	1.35E+01	-1.28E+01	0.120998	0.9987
RB-BT 90%	2.19E+00	3.40E-01	8.99E+00	5.13E-03	7.45E-02	2.87E-04	0.490051	1.0038

^[a]The fluorescence lifetime of chiral AIEgens is fitting by $f(t) = A + B_1 \cdot \exp(-t/\tau_1) + B_2 \cdot \exp(-t/\tau_2) + B_3 \cdot \exp(-t/\tau_3)$ and their fitting parameters is show above.

$$^{[b]}\tau_{\text{avg}} = \frac{(|B_1| \cdot \tau_1 + |B_2| \cdot \tau_2 + |B_3| \cdot \tau_3)}{(|B_1| + |B_2| + |B_3|)}$$

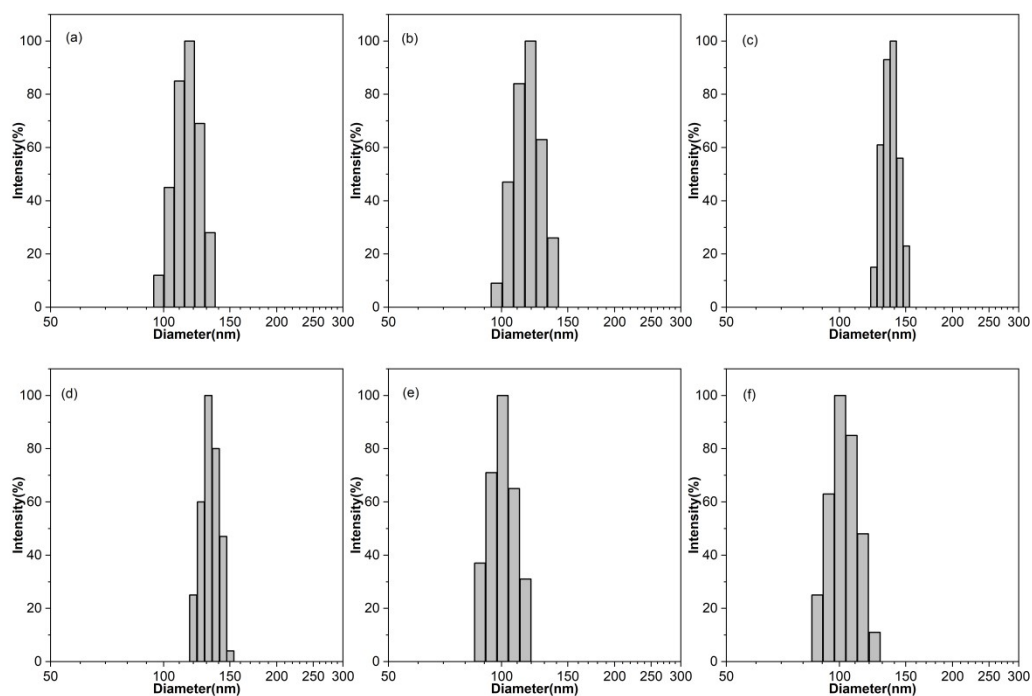


Figure S26. DLS spectra of chiral AIEgens **SB-CHO** (a), **RB-CHO** (b), **SB-CS** (c), **RB-CS** (d), **SB-BT** (e) and **RB-BT** (f) in THF/water mixtures ($f_w = 90\%$). Concentration = $10 \mu\text{M}$.

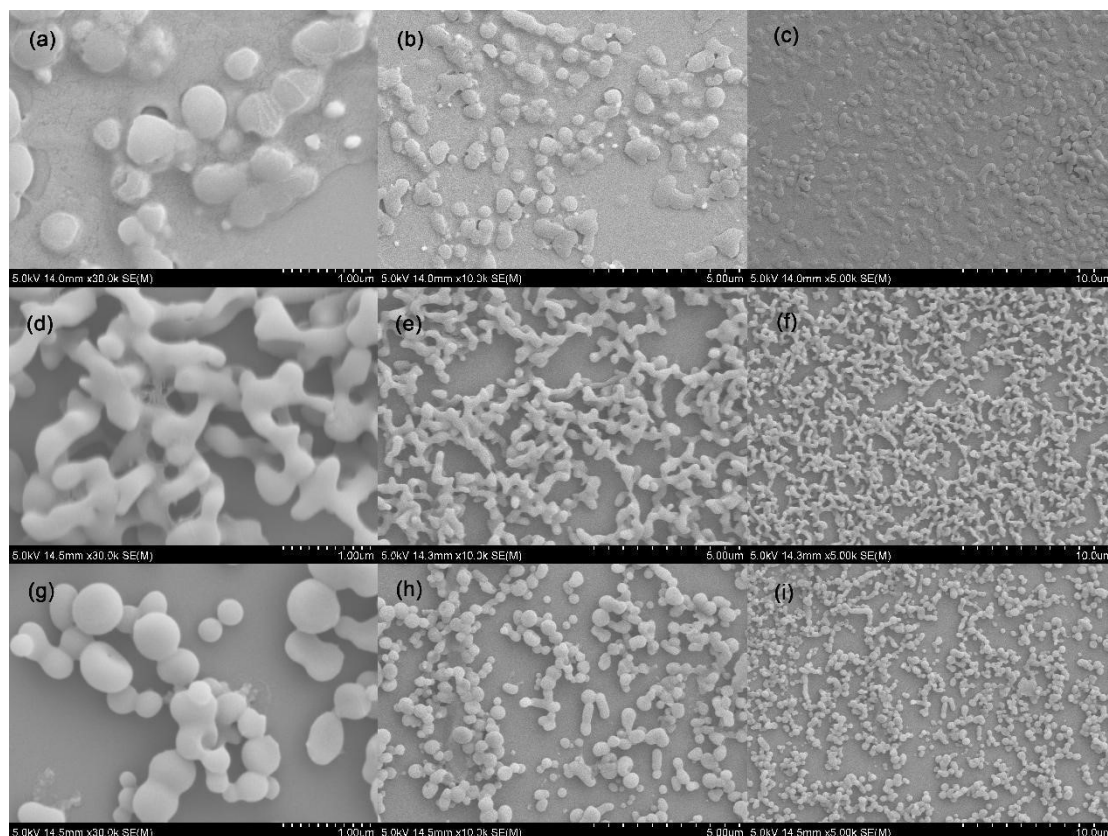


Figure S27. SEM images of chiral AIEgens **SB-CHO** (a-c), **SB-CS** (d-f), **SB-BT** (g-i) in THF- H_2O mixture ($f_w = 90\%$).

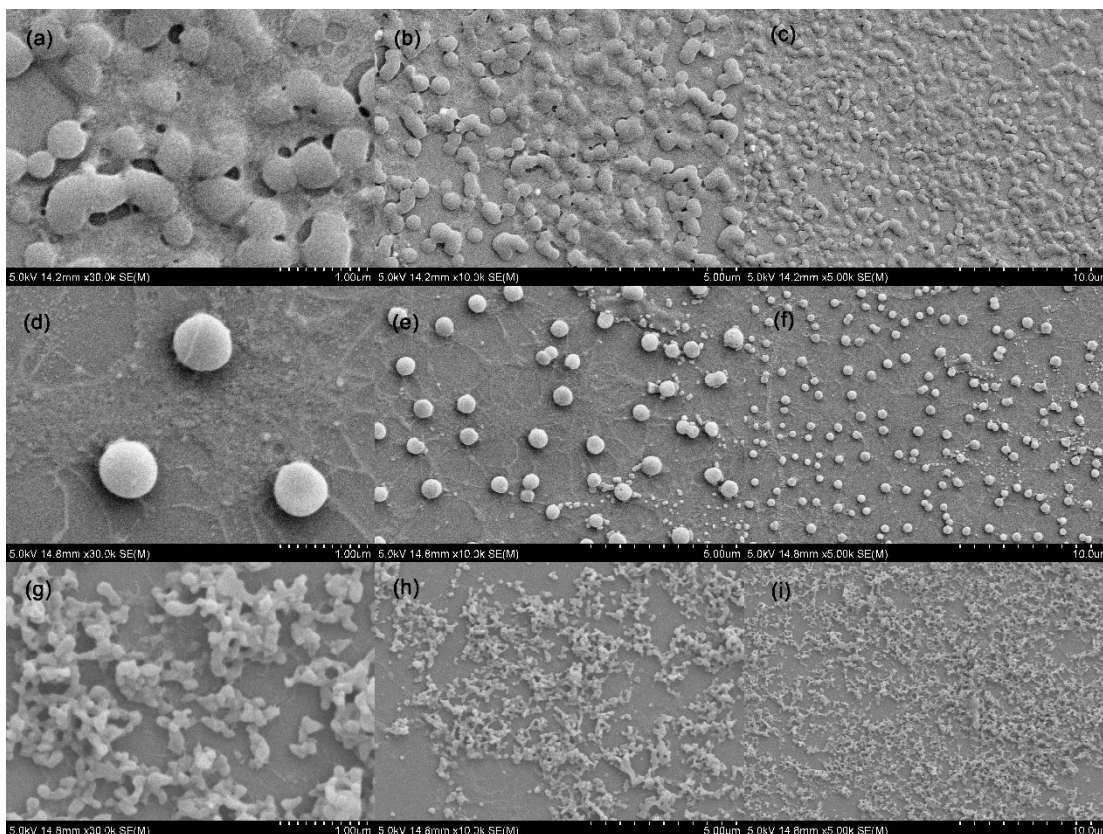


Figure S28. SEM images of chiral AIEgens **RB-CHO** (a-c), **RB-CS** (d-f), **RB-BT** (g-i) in THF-H₂O mixture ($f_w = 90\%$).

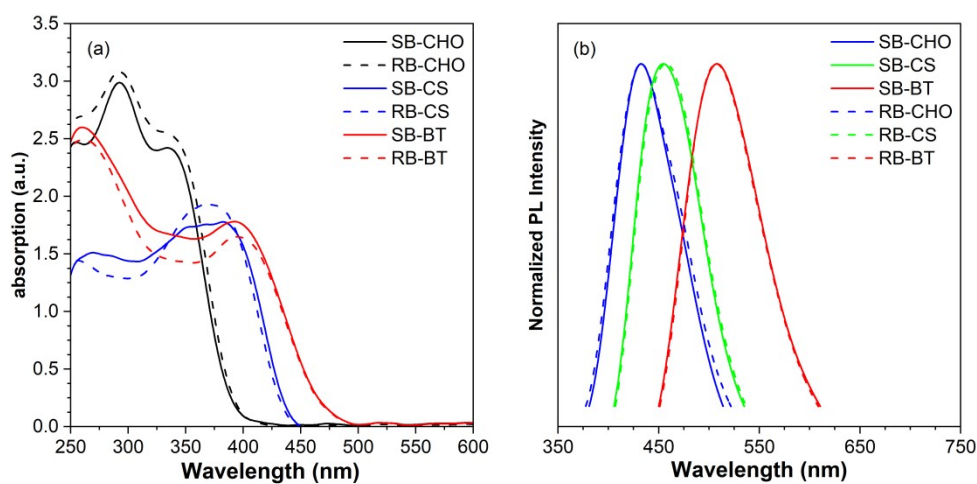


Figure S29. UV-vis spectra (a) and PL spectra (b) of chiral AIEgens in PMMA (2.5% weight by weight). Excitation wavelength: 340 nm for **SB-CHO** and **RB-CHO**; 370 nm for **SB-CS** and **RB-CS**; 400 nm for **SB-BT** and **RB-BT**.

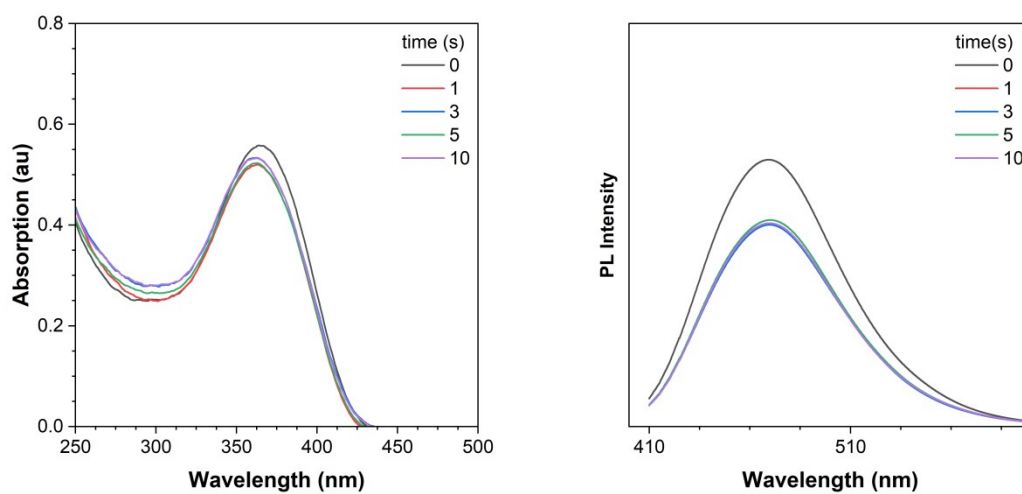


Figure S30. UV-Vis absorption spectra (left) and PL spectra (right) of chiral AIEgen **SB-CS** in THF after UV light irradiation (365nm) for 15 second. Concentration = 10 μ M. λ_{ex} = 370 nm.

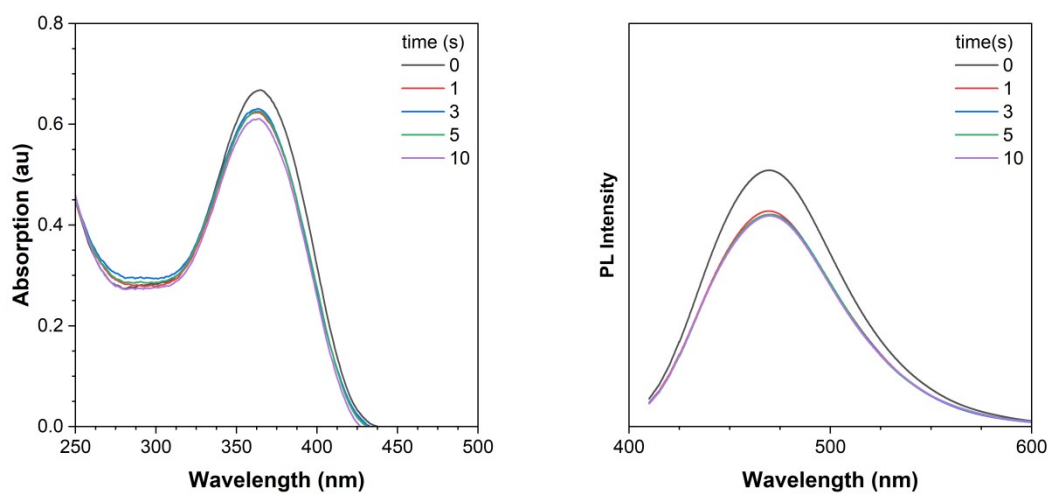


Figure S31. UV-Vis absorption spectra (left) and PL spectra (right) of chiral AIEgen **RB-CS** in THF after UV light irradiation (365nm) for 15 second. Concentration = 10 μ M. λ_{ex} = 370 nm.

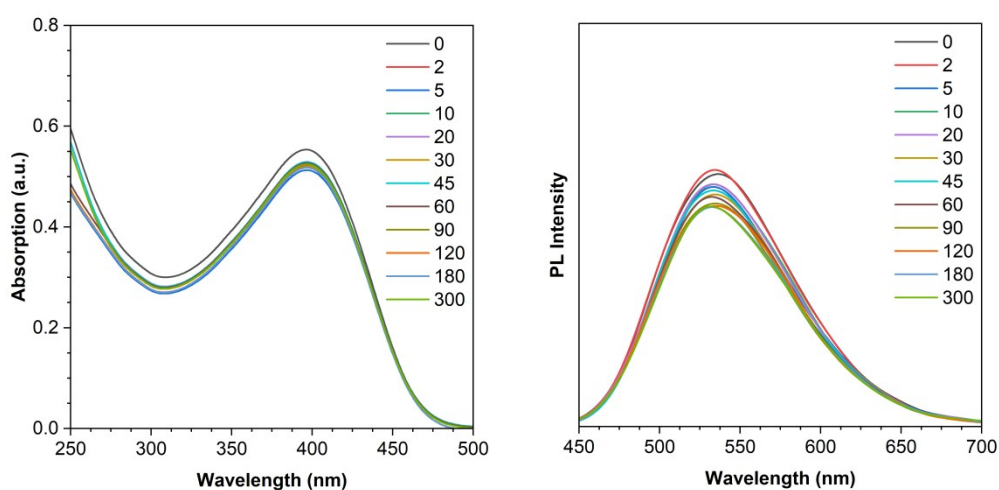


Figure S32. UV-Vis absorption spectra (left) and PL spectra (right) of chiral AIEgen **RB-BT** in THF after UV light irradiation (365nm) for 5 min. Concentration = 10 μM . λ_{ex} = 400 nm.

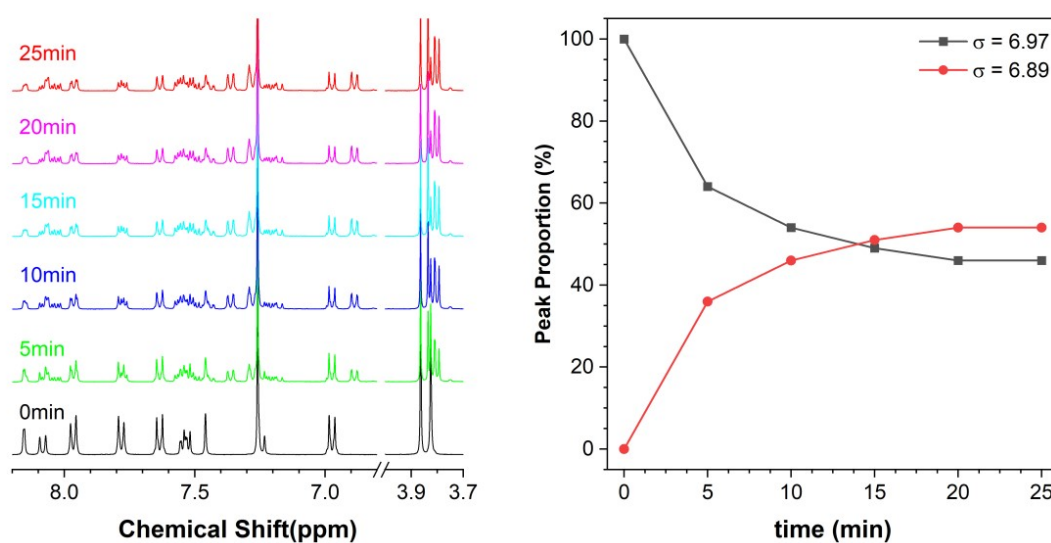


Figure S33. ^1H NMR spectra of chiral AIEgen **SB-CS** in CDCl_3 (left) with UV light irradiation and changes of peak area (right) along with irradiation time. Concentration = 1 mM.

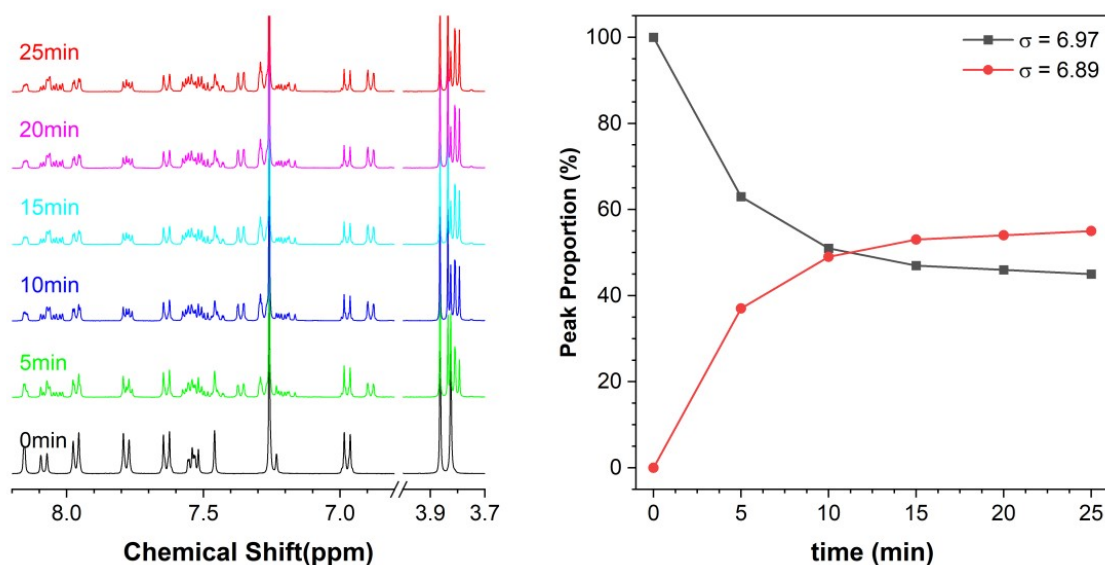


Figure S34. ¹H NMR spectra of chiral AIEgen **RB-CS** in CDCl₃ (left) with UV light irradiation and changes of peak area (right) along with irradiation time. Concentration = 1 mM.

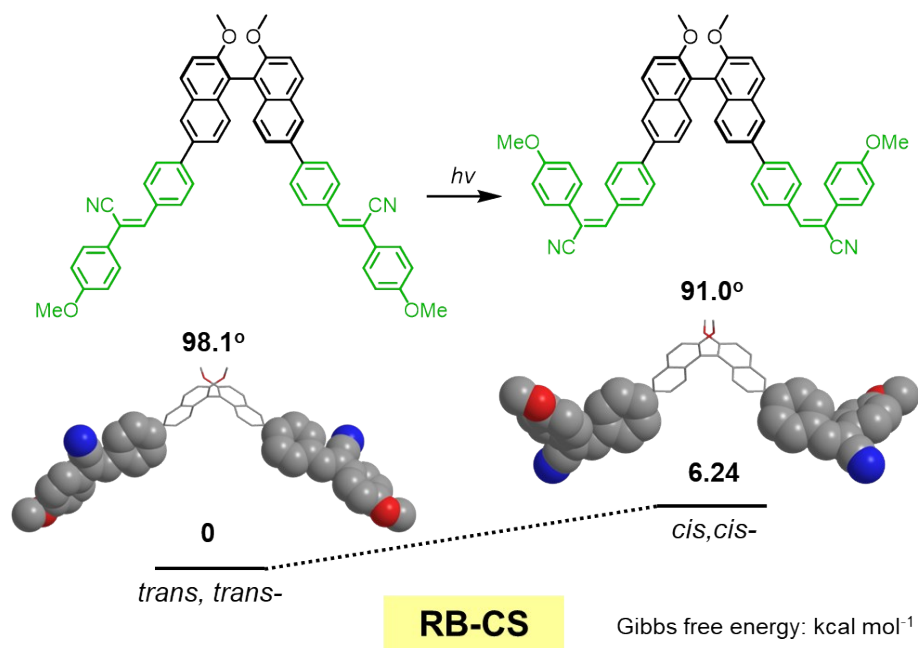


Figure S35. Optimized geometry for the *(trans, trans)*-isomer and *(cis, cis)*-isomer of chiral AIEgens **RB-CS** at the B3LYP/6-31G(d) level of theory.

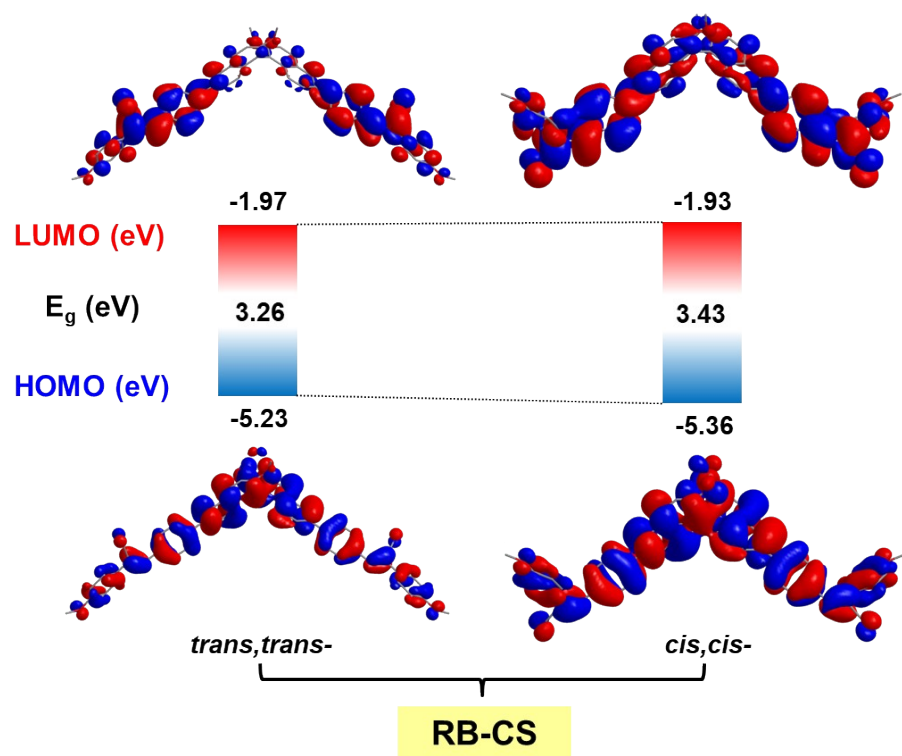


Figure S36. Molecular orbitals and energy levels for the (*trans, trans*)-isomer and (*cis, cis*)-isomer of chiral AIEgens **RB-CS** at the B3LYP/6-31G(d) level of theory.

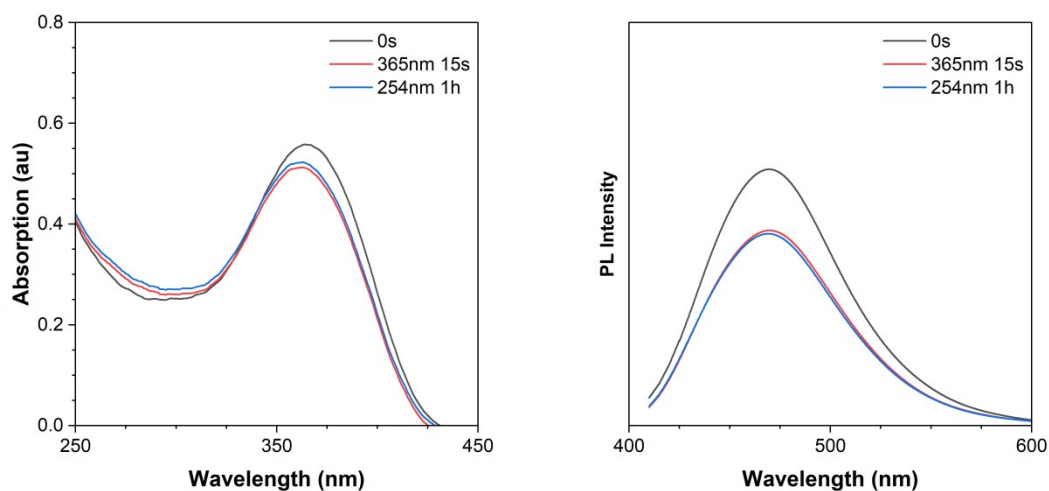


Figure S37. UV-Vis absorption spectra (left) and PL spectra (right) of chiral AIEgen **SB-CS** in THF after UV light irradiation (365nm) for 15 second and subsequent UV light irradiation (254nm) for 1 hour. Concentration = 10 μ M. λ_{ex} = 370 nm.

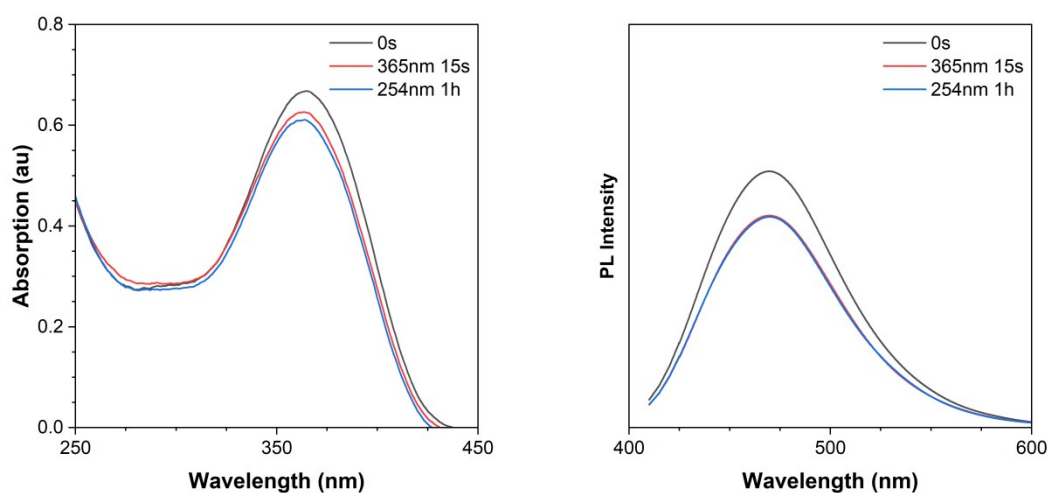


Figure S38. UV-Vis absorption spectra (left) and PL spectra (right) of chiral AIEgen **RB-CS** in THF after UV light irradiation (365nm) for 15 second and subsequent UV light irradiation (254nm) for 1 hour. Concentration = 10 μ M. λ_{ex} = 370 nm.

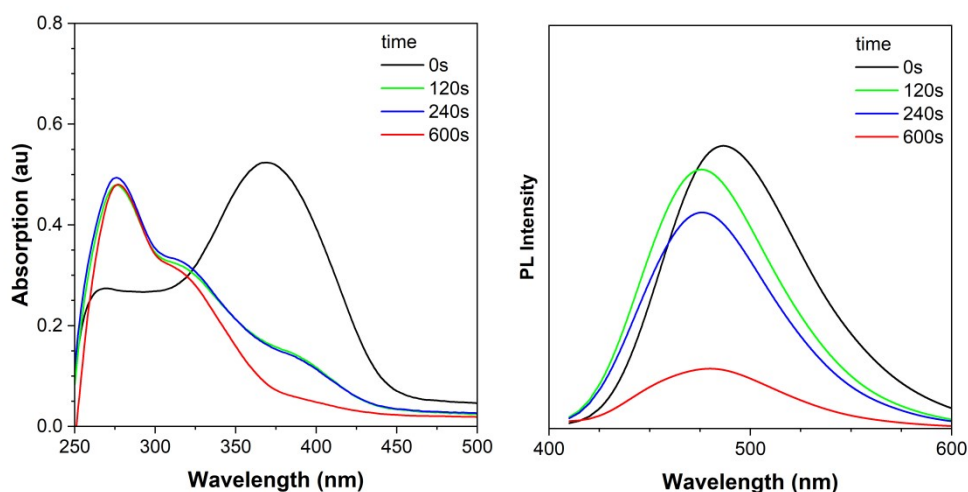


Figure S39. UV-Vis absorption spectra (left) and PL spectra (right) of chiral AIEgen **SB-CS** in THF/water mixtures ($f_w = 90\%$) after UV light irradiation (365nm) for 10min. Concentration = 10 μM . $\lambda_{\text{ex}} = 370 \text{ nm}$.

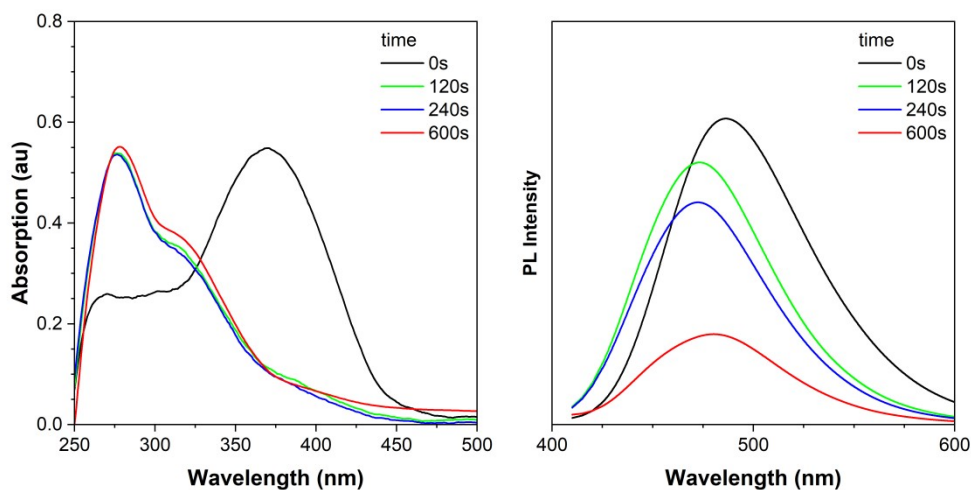


Figure S40. UV-Vis absorption spectra (left) and PL spectra (right) of chiral AIEgen **RB-CS** in THF/water mixtures ($f_w = 90\%$) after UV light irradiation (365nm) for 10min. Concentration = 10 μM . $\lambda_{\text{ex}} = 370 \text{ nm}$.

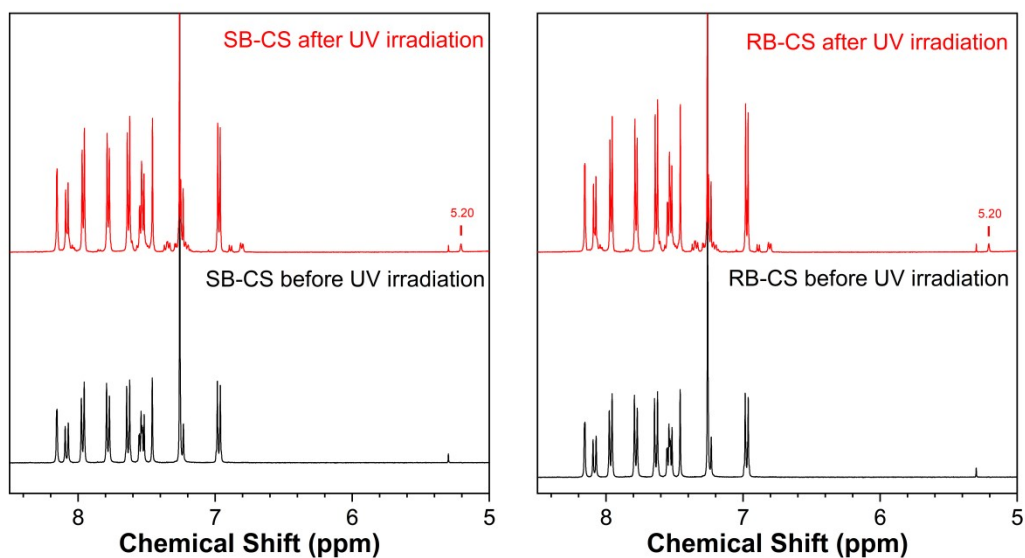


Figure S41. ^1H NMR spectra of S/RB-CS in CDCl_3 , which was previously irradiated for 24h in the neat film. Film of S/RB-CS on a glass sheet was placed at the distance of 1cm from the light source, which could emit 365 nm UV light (3W).

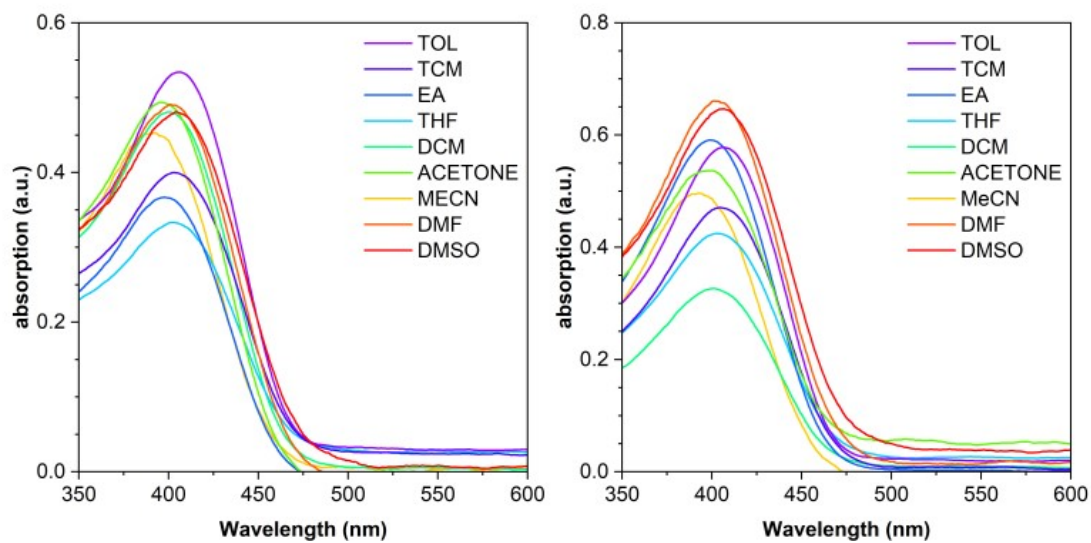


Figure S42. UV-Vis absorption spectra of chiral AIEgens **SB-BT** (left) and **RB-BT** (right) in different solution. Concentration = 10 μM .

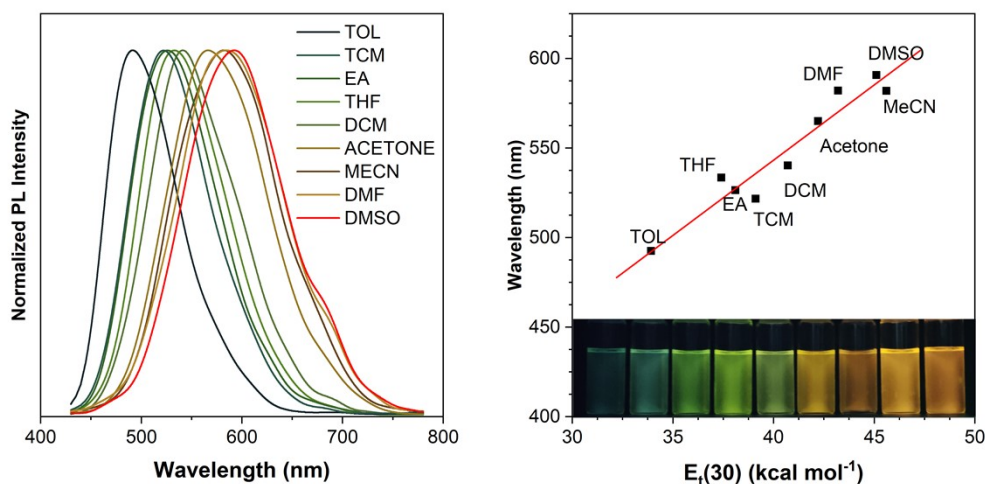


Figure S43. PL spectra (left) and solvatochromism with photo (right) of chiral AIEgen **SB-BT** in different solution. Concentration = 10 μM . The solvent in the inset is as shown below (from left to right): TOL for toluene, TCM for chloroform, EA for ethylacetate, THF for tetrahydrofuran, DCM for dichloromethane, AC for acetone, ACN for acetonitrile, DMF for N,N-dimethylformamide, DMSO for dimethyl sulfoxide. $\lambda_{\text{ex}} = 400 \text{ nm}$.

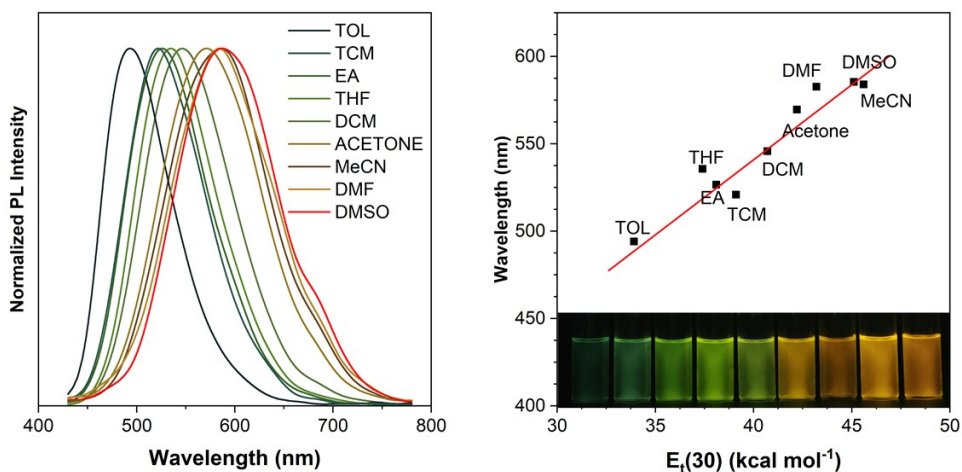


Figure S44. PL spectra (left) and solvatochromism with photo (right) of chiral AIEgen **RB-BT** in different solution. Concentration = 10 μM . The solvent in the inset is as shown below (from left to right): TOL for toluene, TCM for chloroform, EA for ethylacetate, THF for tetrahydrofuran, DCM for dichloromethane, AC for acetone, ACN for acetonitrile, DMF for N,N-dimethylformamide, DMSO for dimethyl sulfoxide. $\lambda_{\text{ex}} = 400 \text{ nm}$.

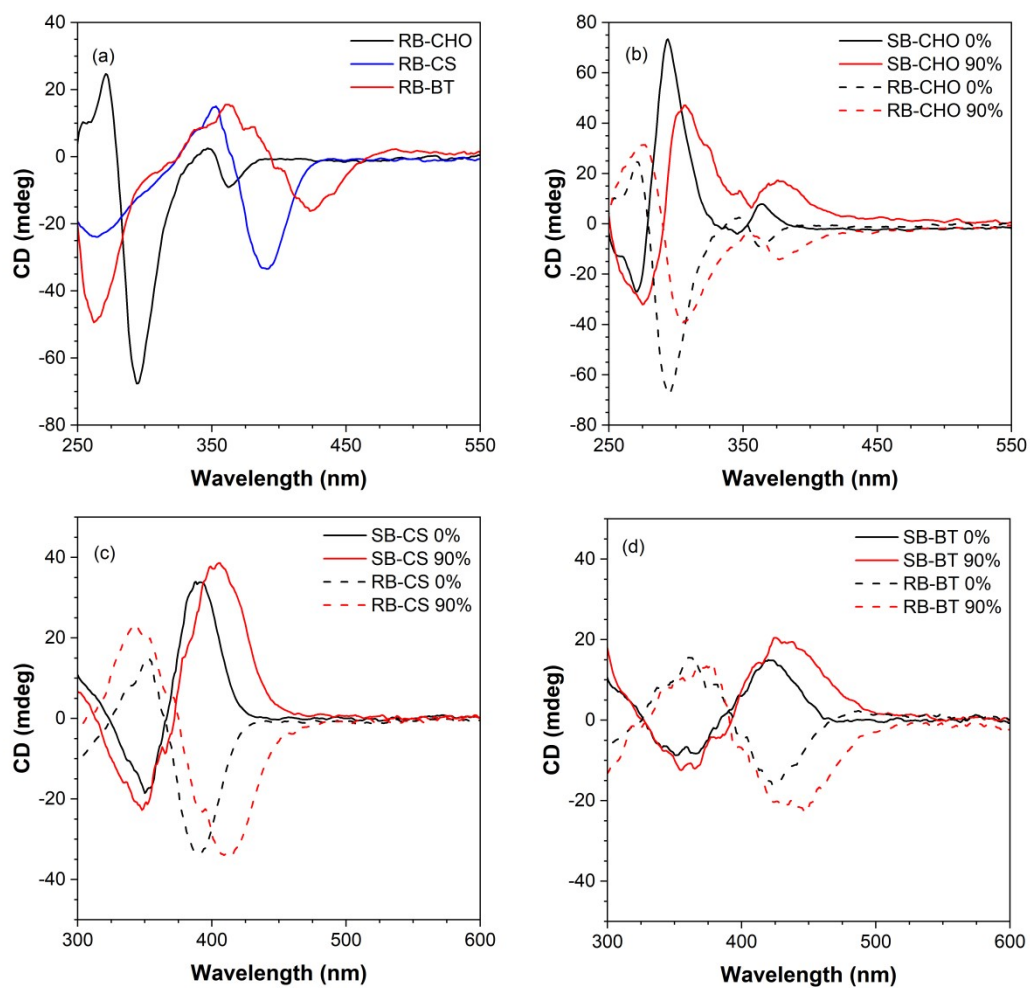


Figure S45. CD spectra of chiral AIEgens **RB-CHO**, **RB-CS** and **RB-BT** in THF (a). CD spectra of chiral AIEgens **R/SB-CHO** (b), **R/SB-CS** (c) and **R/SB-BT** (d) in THF and THF/water mixtures ($f_w = 90\%$). Concentration = 50 μM .

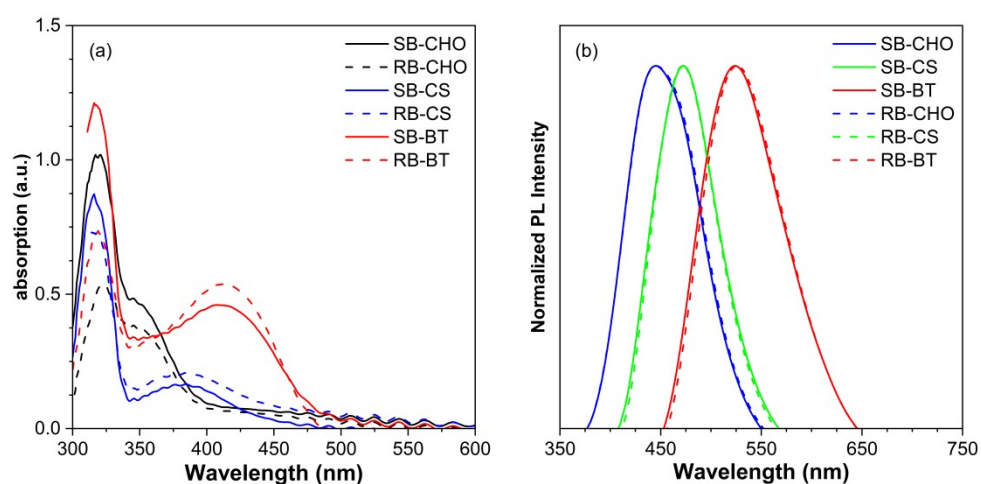


Figure S46. UV-vis spectra (a) and PL spectra (b) of chiral AIEgens in LC (1% weight by weight). Excitation wavelength: 340 nm for **SB-CHO** and **RB-CHO**; 370 nm for **SB-CS** and **RB-CS**; 400 nm for **SB-BT** and **RB-BT**.

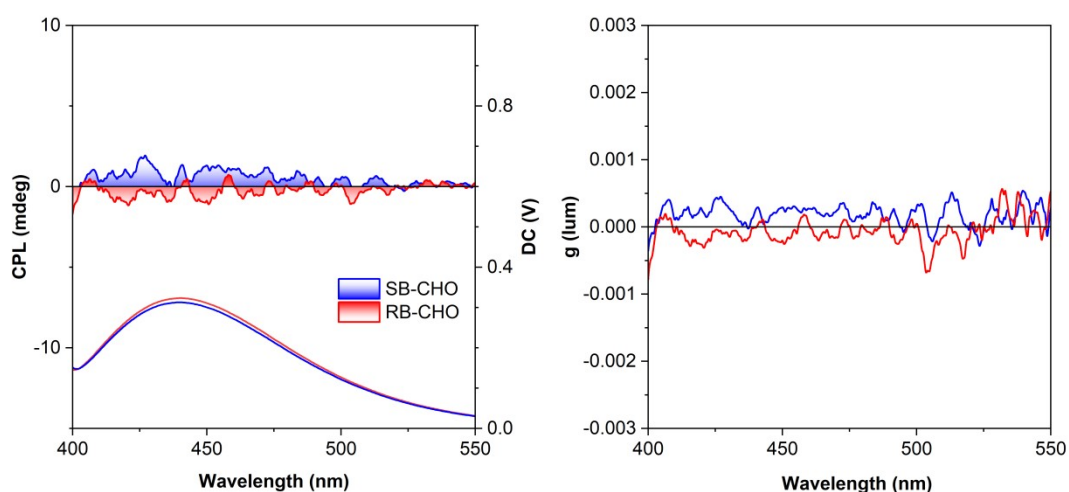


Figure S47. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-CHO** in THF. Concentration = 10 μ M. λ_{ex} = 340 nm.

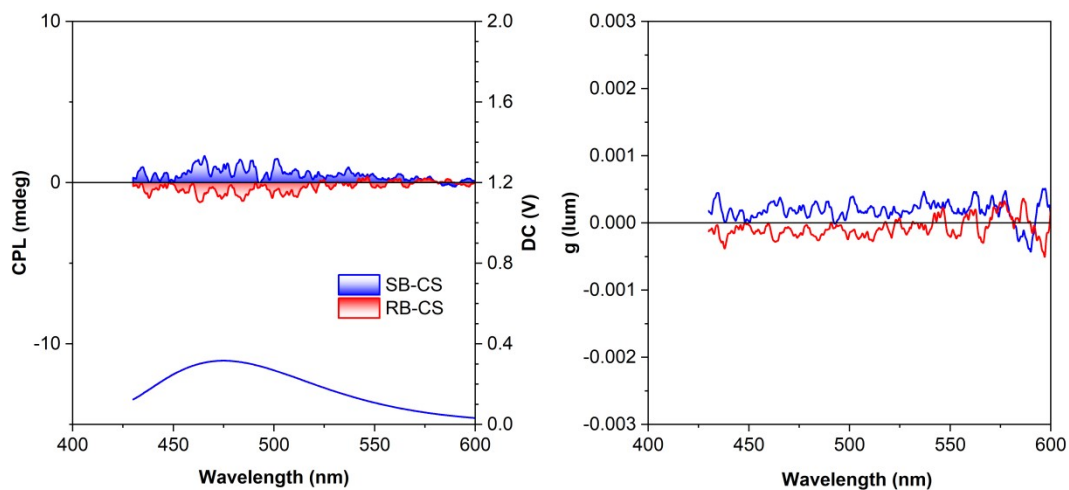


Figure S48. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens S/RB-CS in THF. Concentration = 10 μM . λ_{ex} = 370 nm.

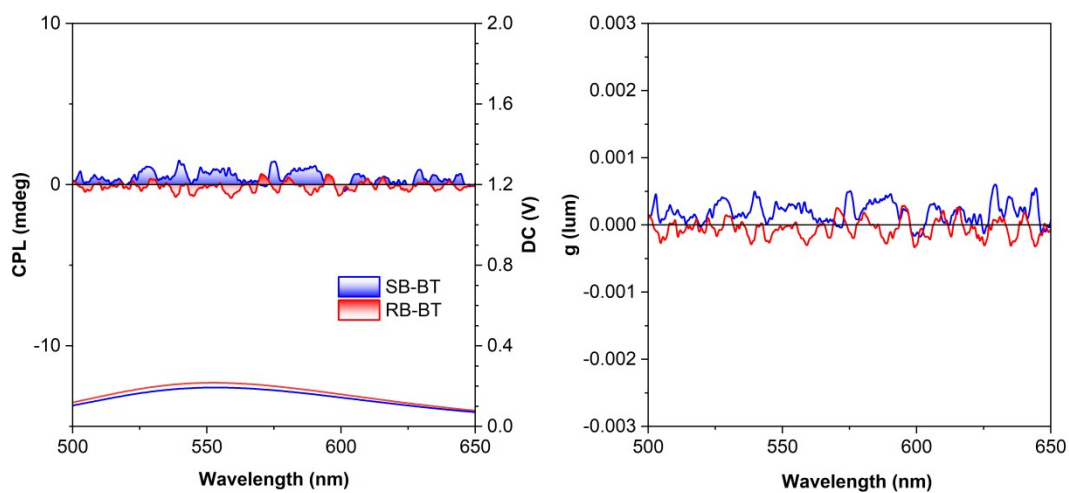


Figure S49. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens S/RB-BT in THF. Concentration = 10 μM . λ_{ex} = 400 nm.

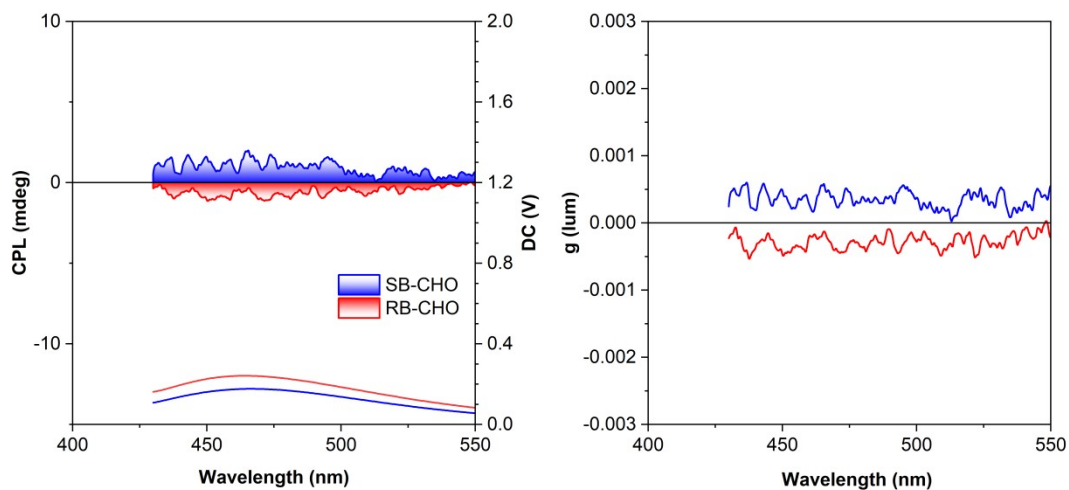


Figure S50. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-CHO** in THF/water mixtures ($f_w = 90\%$). Concentration = 10 μM . $\lambda_{\text{ex}} = 340$ nm.

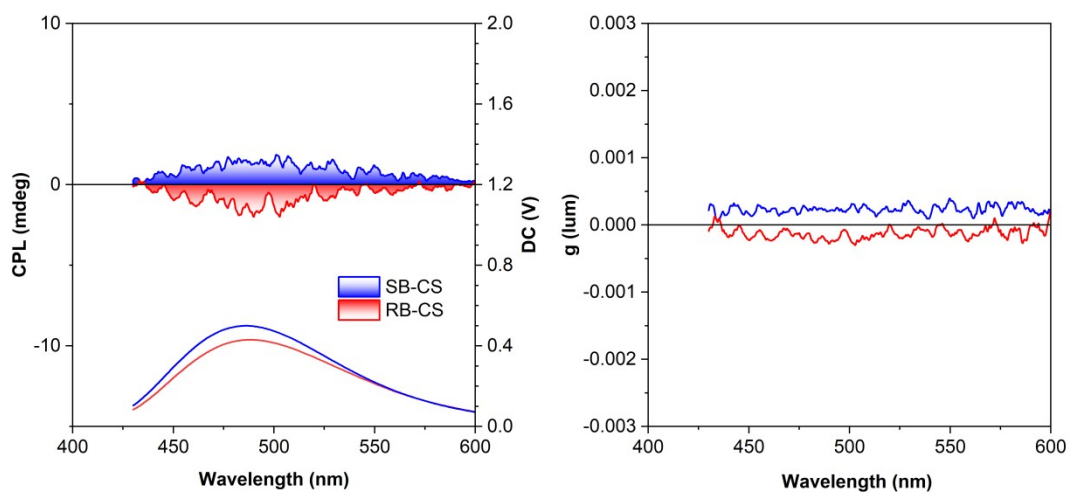


Figure S51. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-CS** in THF/water mixtures ($f_w = 90\%$). Concentration = 10 μM . $\lambda_{\text{ex}} = 370$ nm.

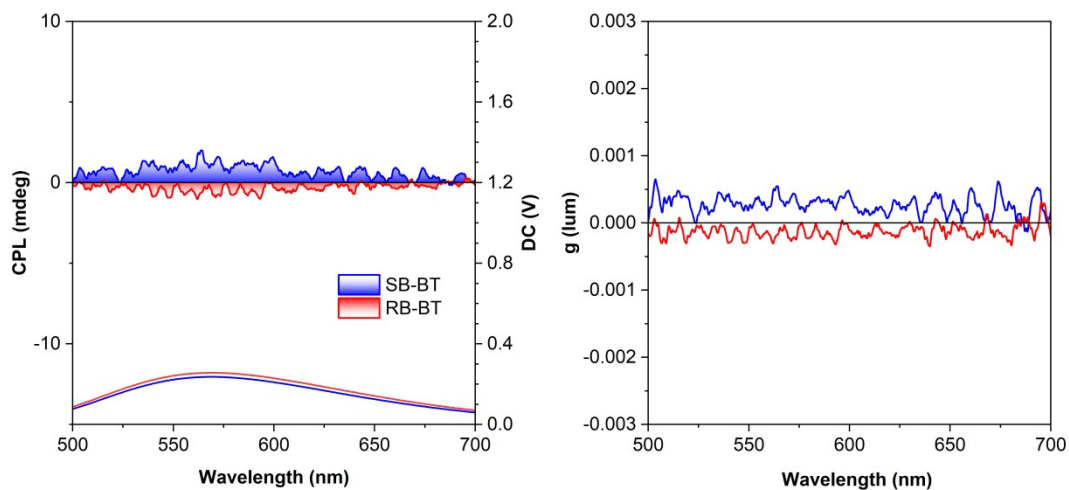


Figure S52. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-BT** in THF/water mixtures ($f_w = 90\%$). Concentration = 10 μM . $\lambda_{\text{ex}} = 400$ nm.

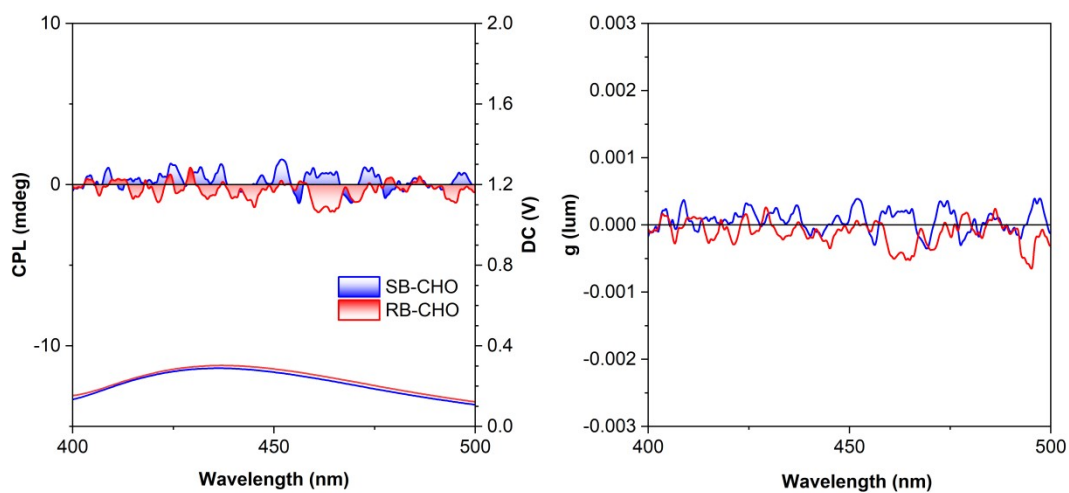


Figure S53. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-CHO** in PMMA (2.5% weight by weight). $\lambda_{\text{ex}} = 340$ nm.

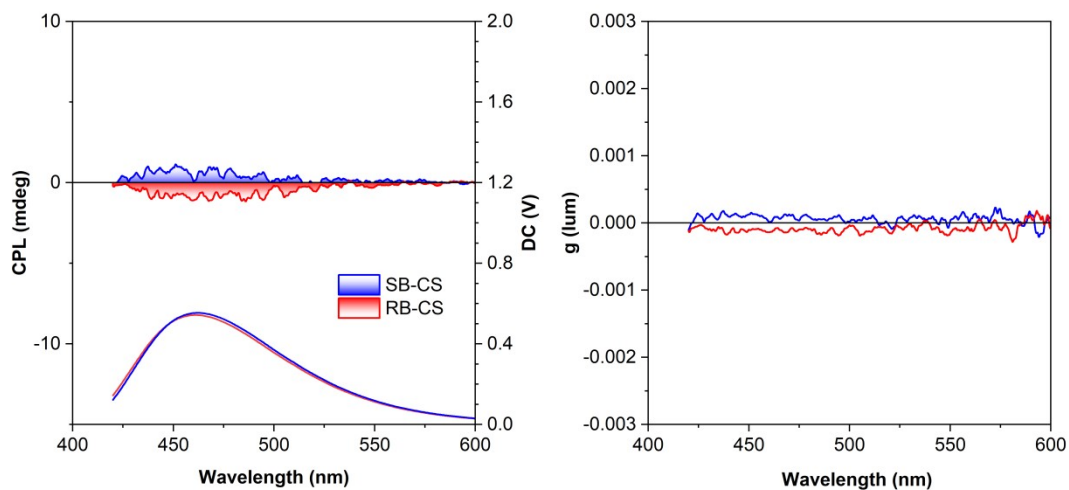


Figure S54. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-CS** in PMMA (2.5% weight by weight). $\lambda_{ex} = 370$ nm.

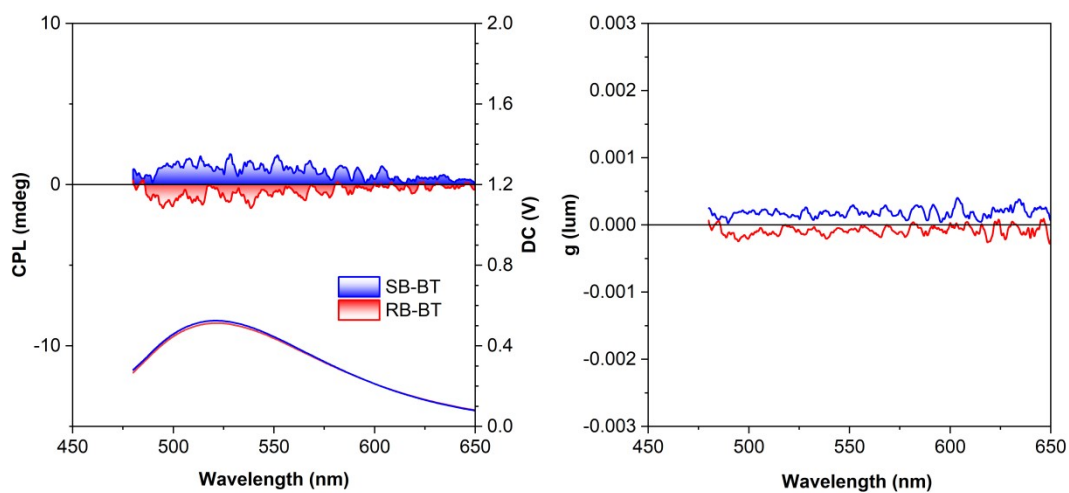


Figure S55. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-BT** in PMMA (2.5% weight by weight). $\lambda_{ex} = 400$ nm.

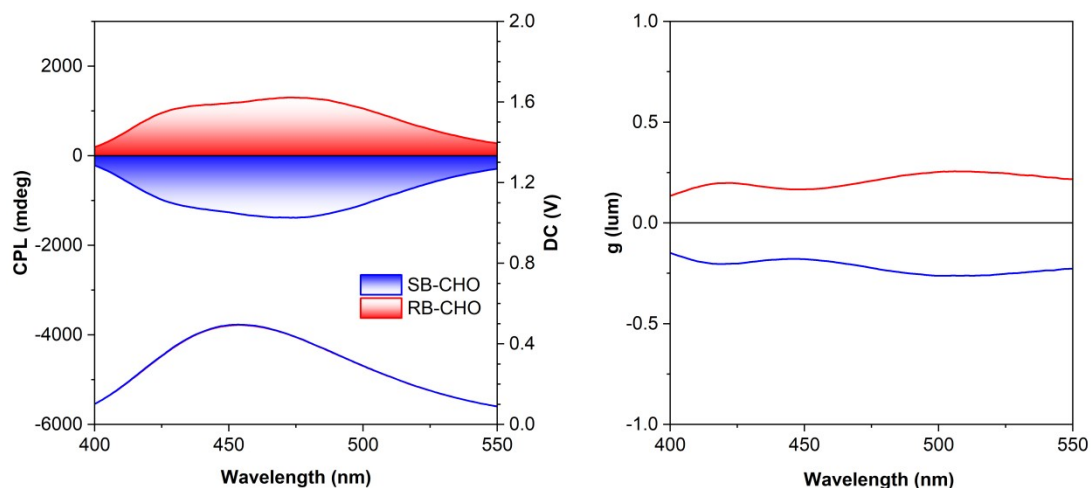


Figure S56. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-CHO** in 5CB (1% weight by weight). $\lambda_{\text{ex}} = 340$ nm.

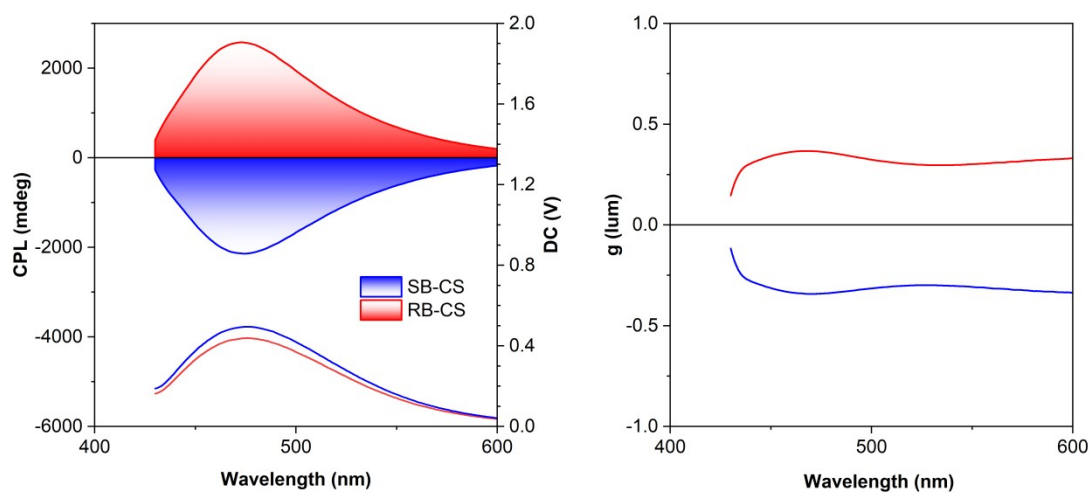


Figure S57. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-CS** in 5CB (1% weight by weight). $\lambda_{\text{ex}} = 370$ nm.

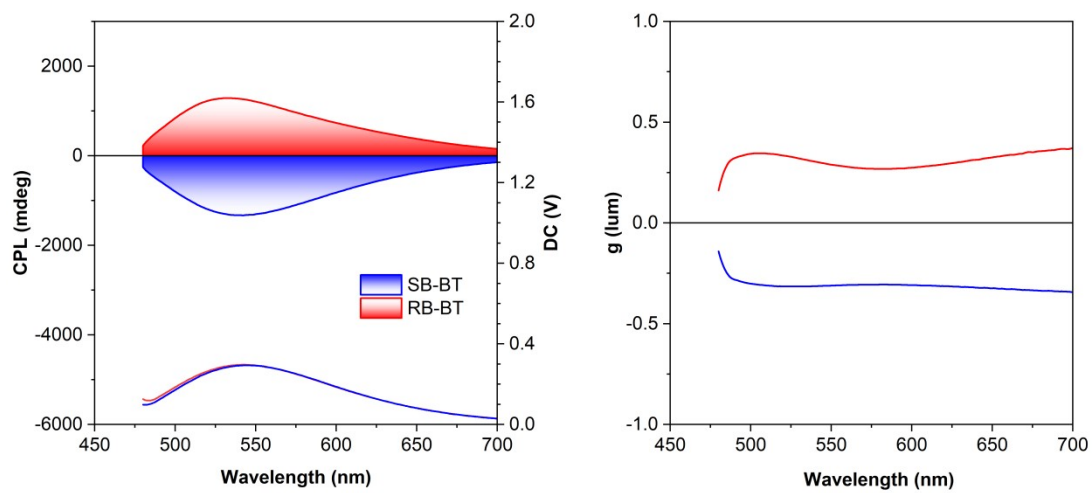


Figure S58. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-BT** in 5CB (1% weight by weight). $\lambda_{ex} = 400$ nm.

Table S3. Chiral photophysical properties of three pairs of chiral fluorophores in different substrate

	λ_{ex} (nm)	THF		$F_w = 90\%$		2.5% @ PMMA		2.5% @ PC		2.5% @ PAN		1% @ 5CB	
		λ_{em} (nm)	g_{lum}	λ_{em} (nm)	g_{lum}	λ_{em} (nm)	g_{lum}	λ_{em} (nm)	g_{lum}	λ_{em} (nm)	g_{lum}	λ_{em} (nm)	g_{lum}
SB-CHO	340	440	2.54E-4	464	5.13E-4	437	3.05E-4	—	—	—	—	454	-0.184
RB-CHO	340	440	-2.24E-4	466	-2.18E-4	436	-1.79E-4	—	—	—	—	453	0.167
SB-CS	370	475	2.68E-4	488	2.25E-4	461	1.85E-5	—	—	—	—	476	-0.340
RB-CS	370	475	-1.94E-4	486	-1.78E-4	462	-1.09E-4	—	—	—	—	475	0.363
SB-BT	400	552	2.66E-4	570	3.06E-4	522	1.47E-4	531	5.22E-4	569	-4.00E-4	542	-0.313
RB-BT	400	554	-1.08E-5	569	-1.19E-4	521	-3.77E-5	527	-8.50E-4	562	3.41E-4	544	0.298

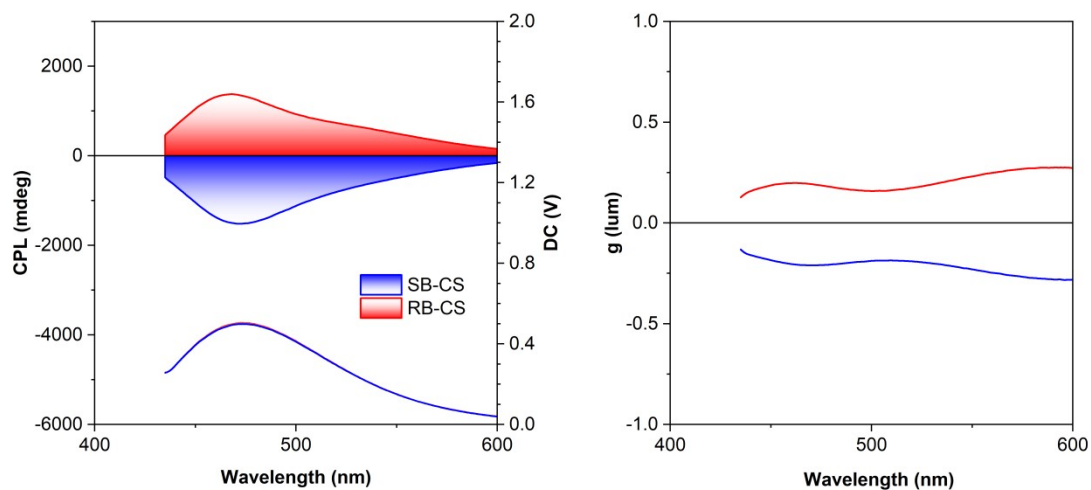


Figure S59. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-CS** in 5CB after UV light irradiation (365nm) for 30min (1% weight by weight). $\lambda_{ex} = 370$ nm.

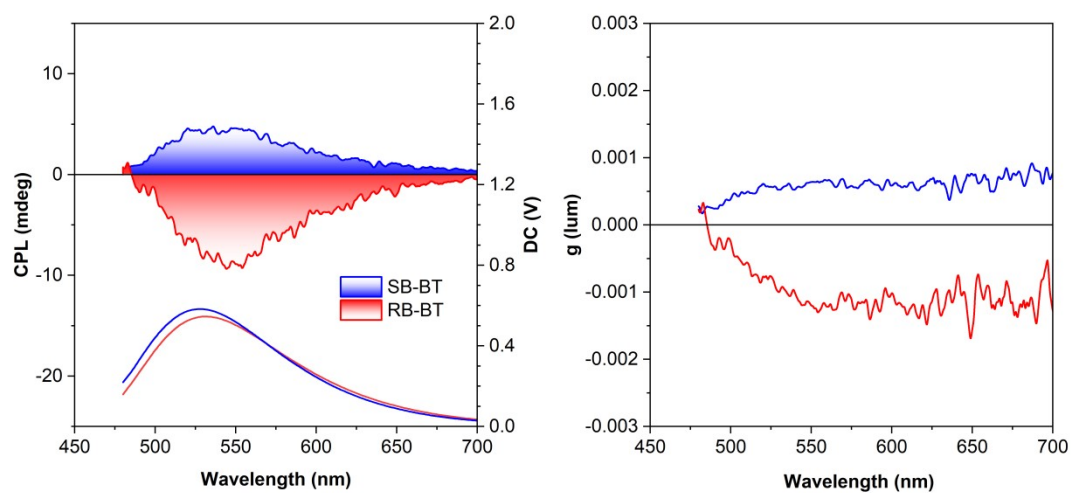


Figure S60. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-BT** in PC (2.5% weight by weight). $\lambda_{ex} = 400$ nm.

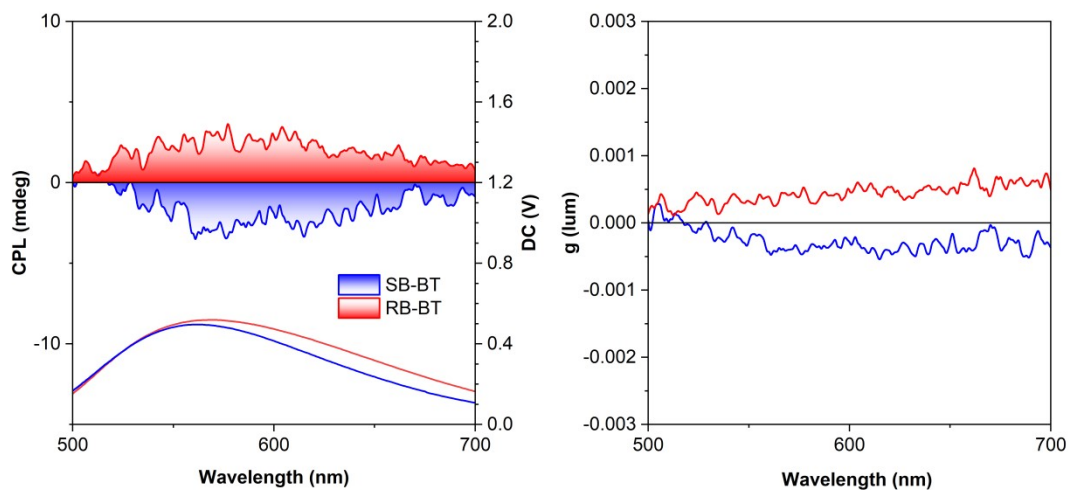


Figure S61. CPL spectra (left) and g_{lum} -factor (right) of chiral AIEgens **S/RB-BT** in PAN (2.5% weight by weight). $\lambda_{ex} = 400$ nm.

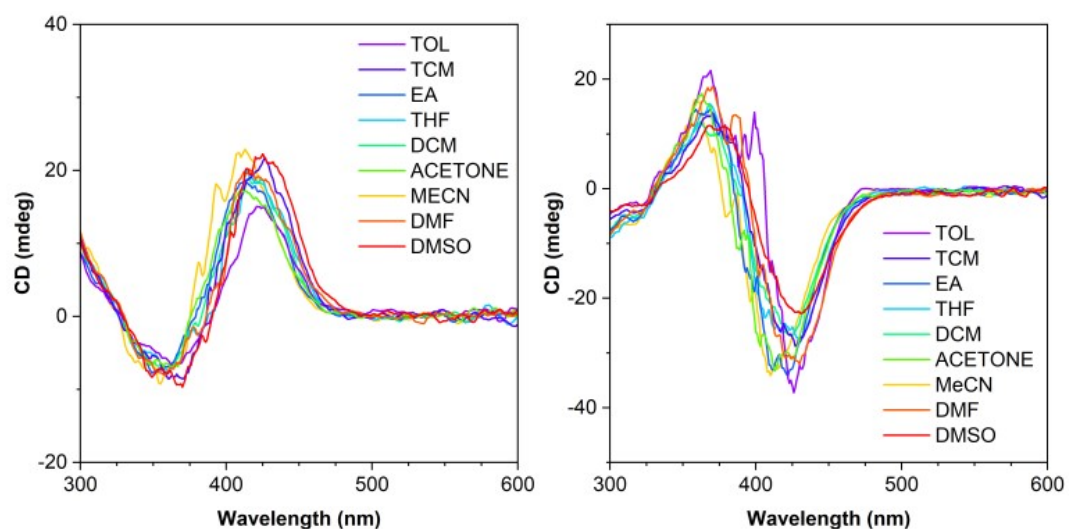


Figure S62. CD spectra of chiral AIEgens **SB-BT** (left) and **RB-BT** (right) in different solution. Concentration = 50 μ M.

Table S4. Fluorescence quantum yield of chiral fluorophores **S/RB-BT** in different polymers

	2.5% @ PMMA	2.5% @ PC	2.5% @ PAN
SB-BT	27.7%	21.3%	11.0%
RB-BT	27.5%	20.9%	10.2%

5. NMR spectra

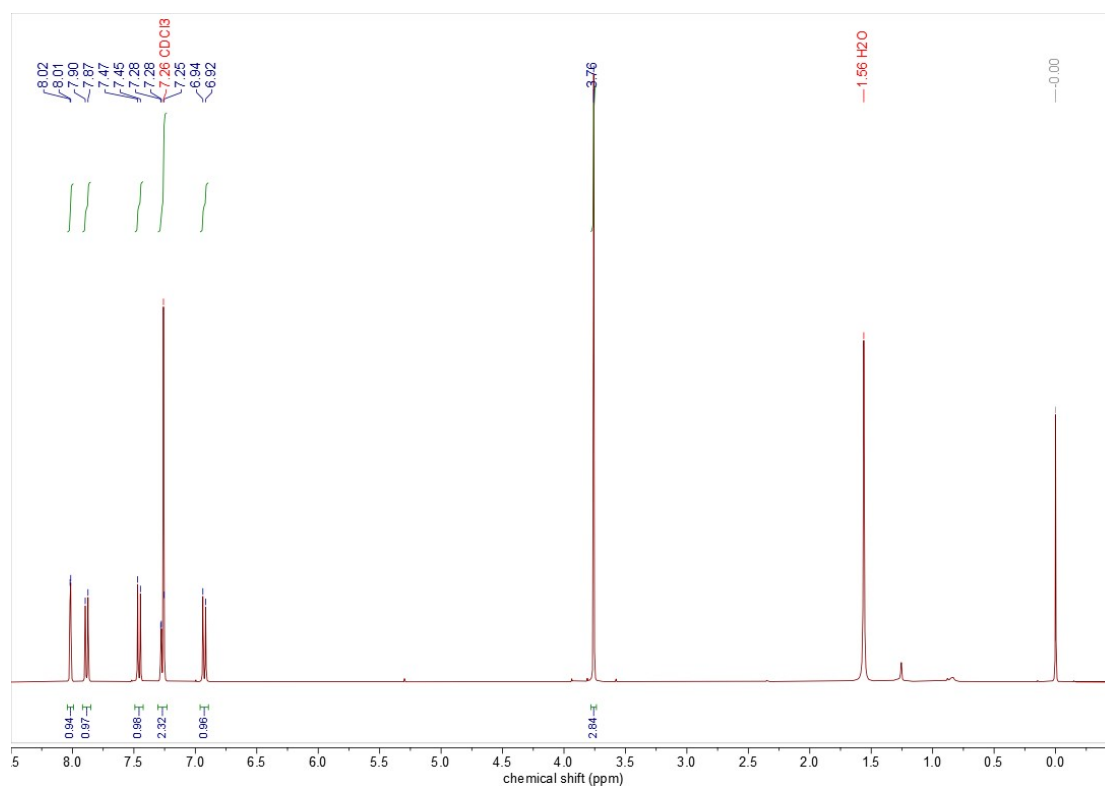


Figure S63. ¹H NMR spectrum of compound SB-Br in CDCl₃ at 298 K.

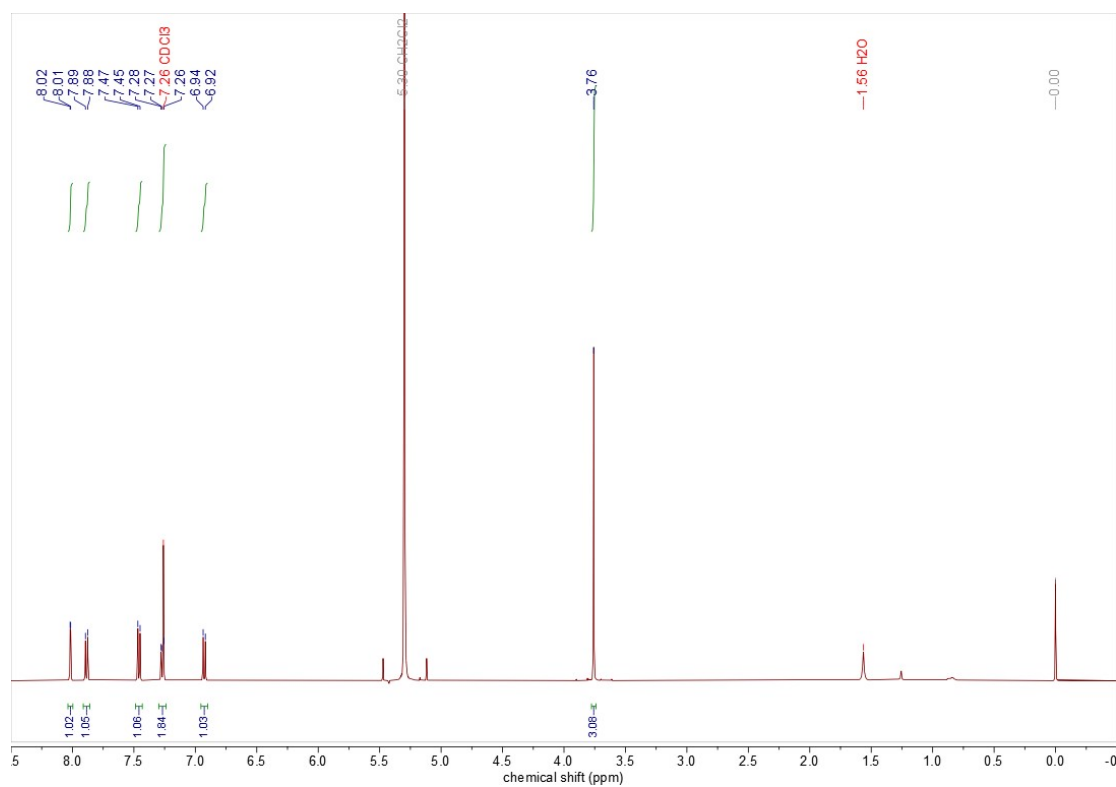


Figure S64. ¹H NMR spectrum of compound RB-Br in CDCl₃ at 298 K.

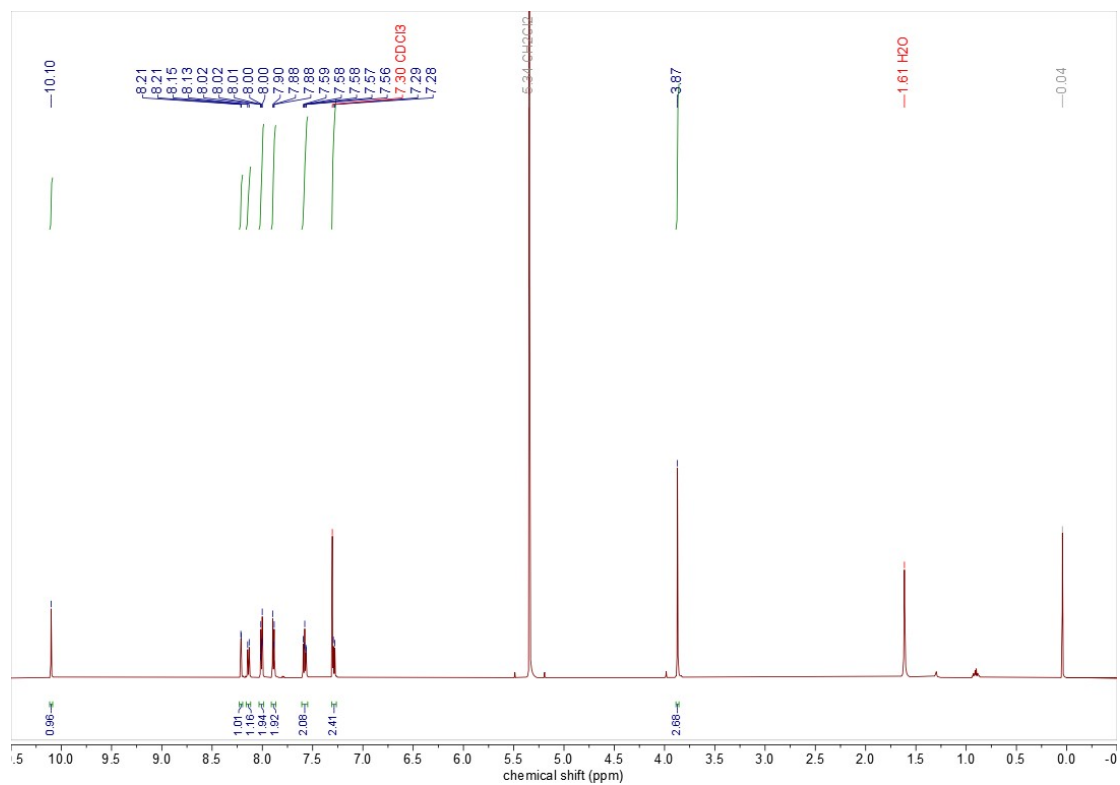


Figure S67. ^1H NMR spectrum of compound **RB-CHO** in CDCl_3 at 298 K.

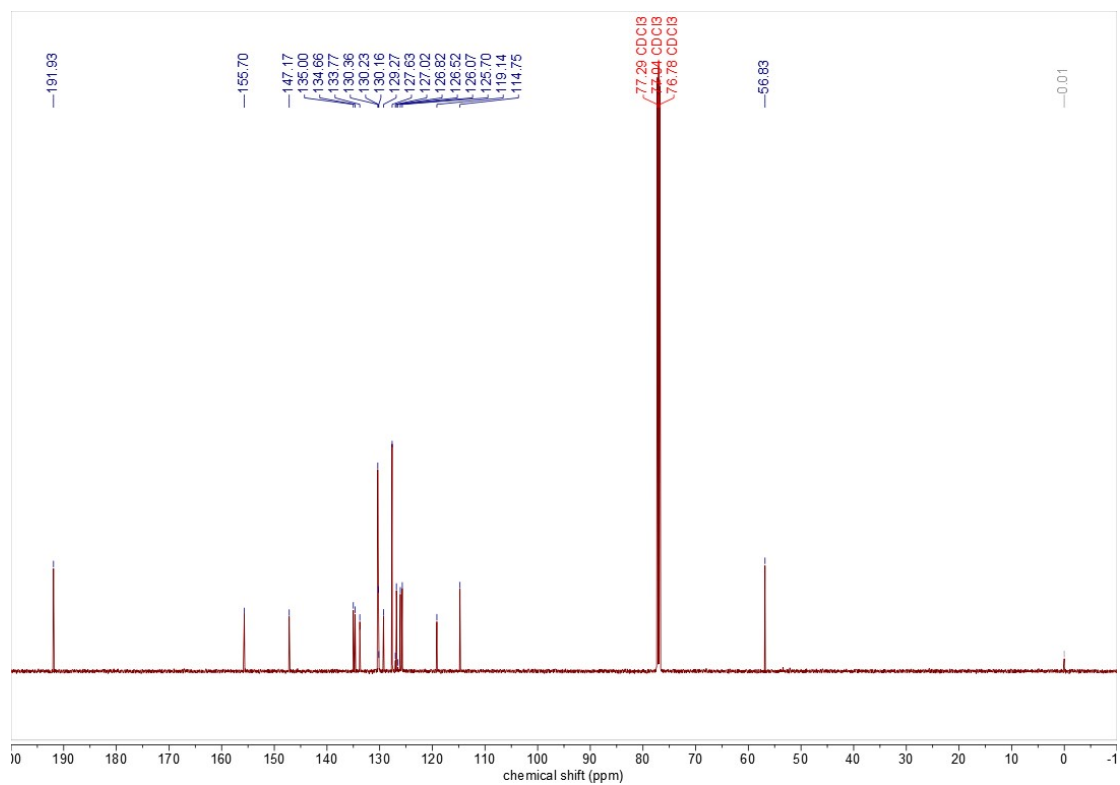


Figure S68. ^{13}C NMR spectrum of compound **RB-CHO** in CDCl_3 at 298 K.

7 H NMR

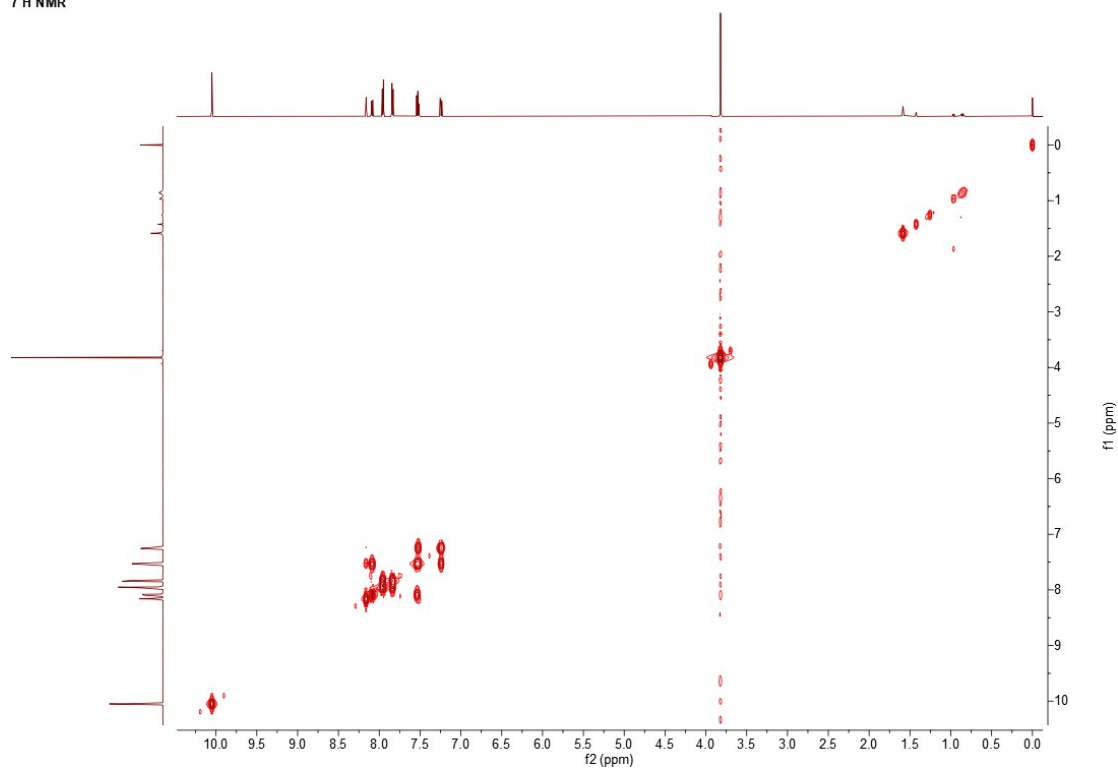


Figure S69. COSY spectrum of compound **RB-CHO** in CDCl_3 at 298 K.

7 H NMR

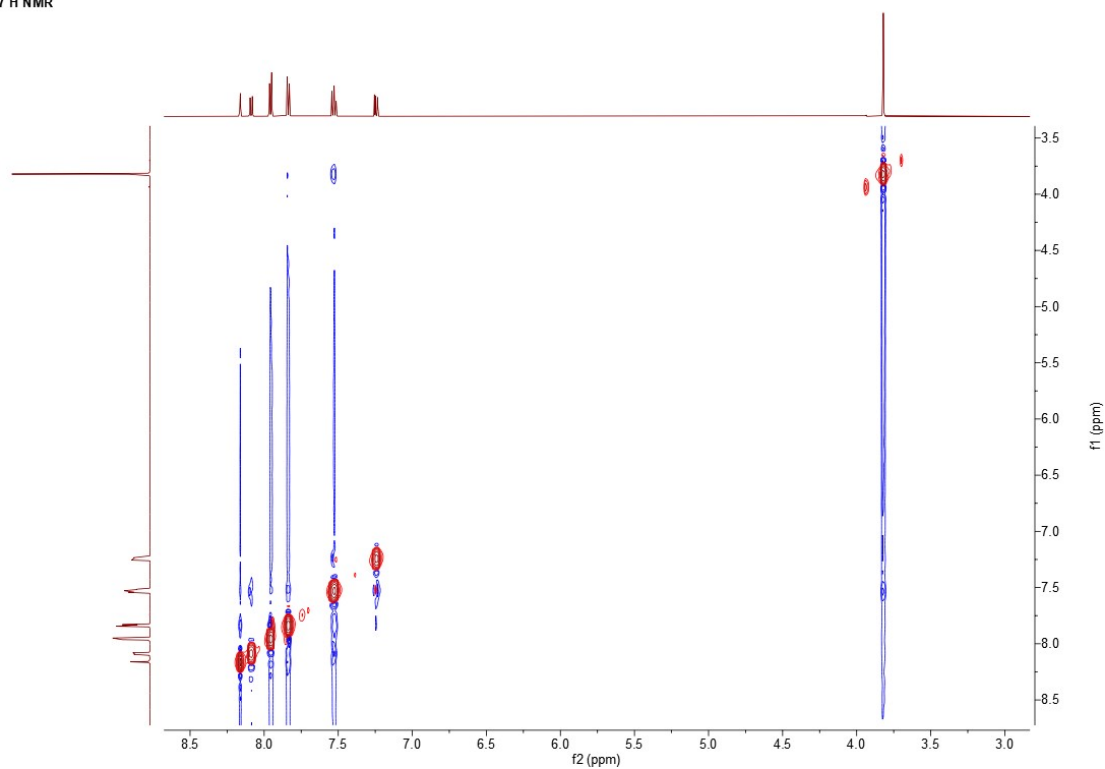


Figure S70. NOESY spectrum of compound **RB-CHO** in CDCl_3 at 298 K.

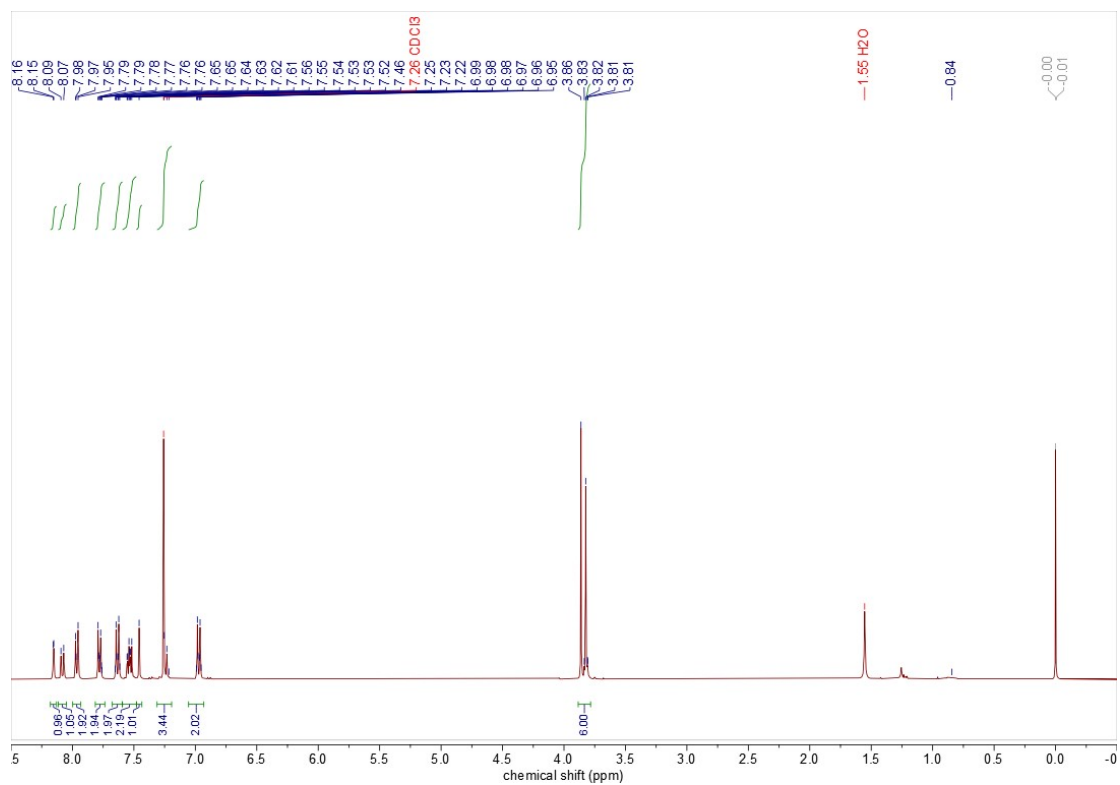


Figure S71. ¹H NMR spectrum of compound **SB-CS** in CDCl₃ at 298 K.

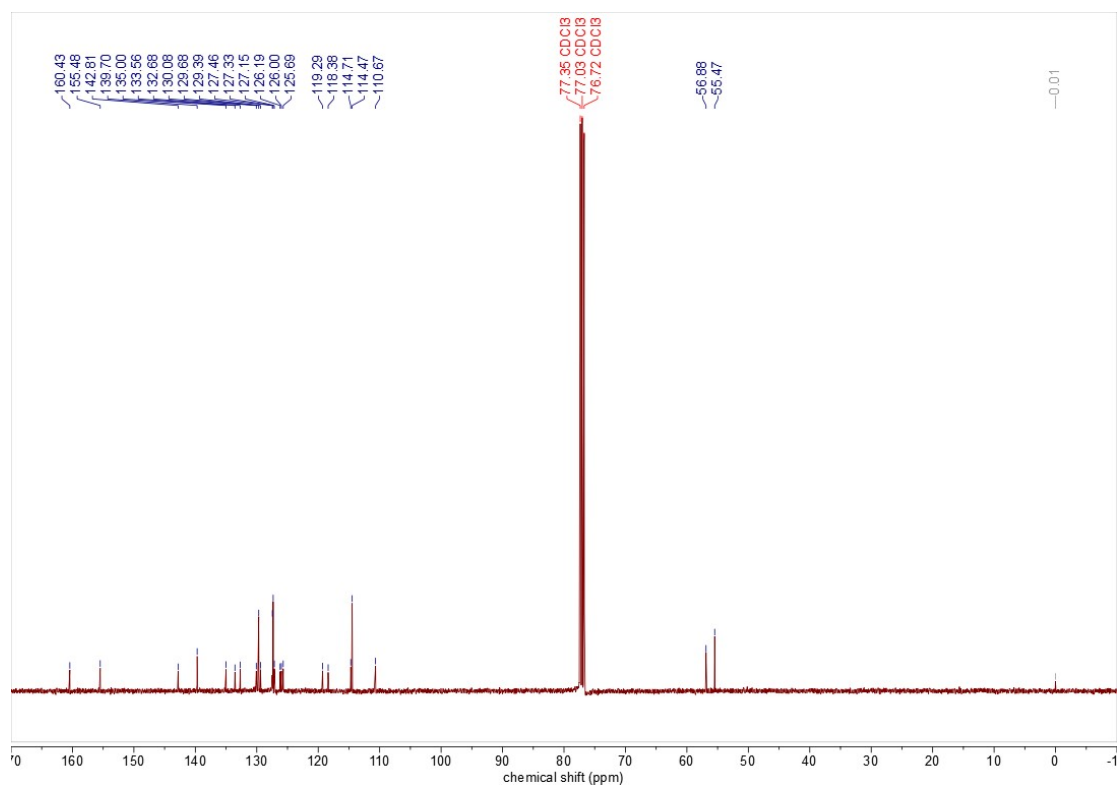


Figure S72. ¹³C NMR spectrum of compound **SB-CS** in CDCl₃ at 298 K.

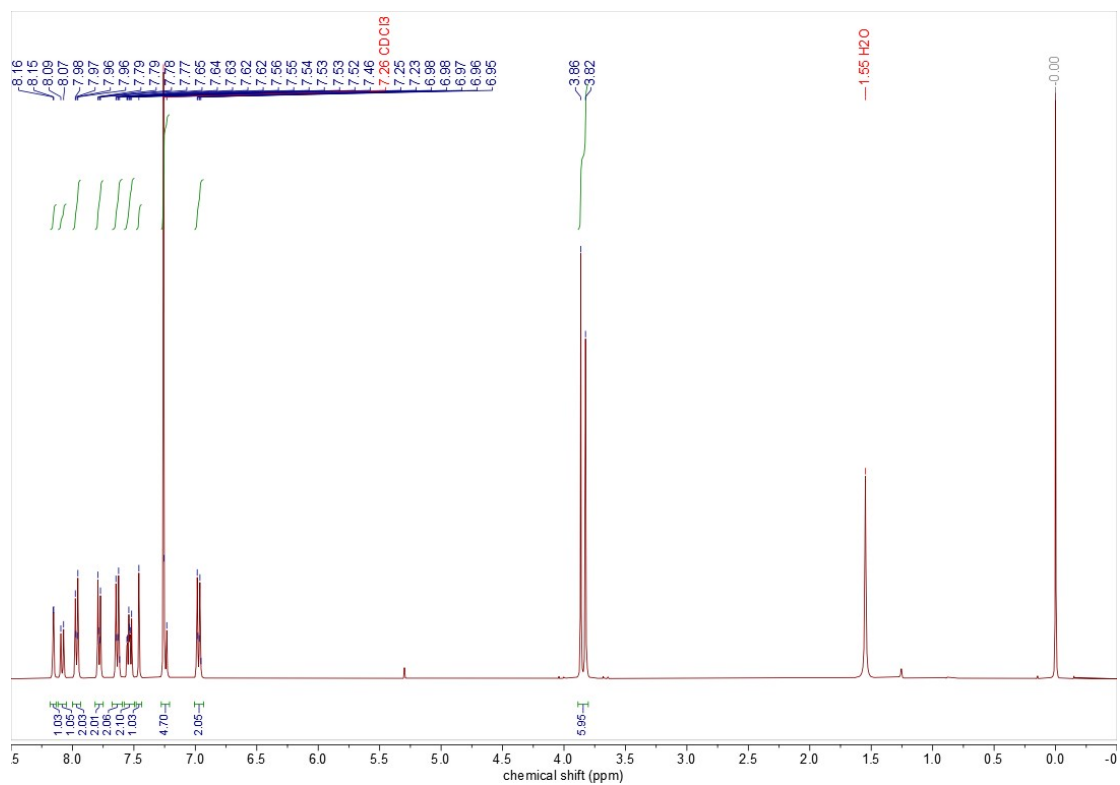


Figure S73. ¹H NMR spectrum of compound **RB-CS** in CDCl₃ at 298 K.

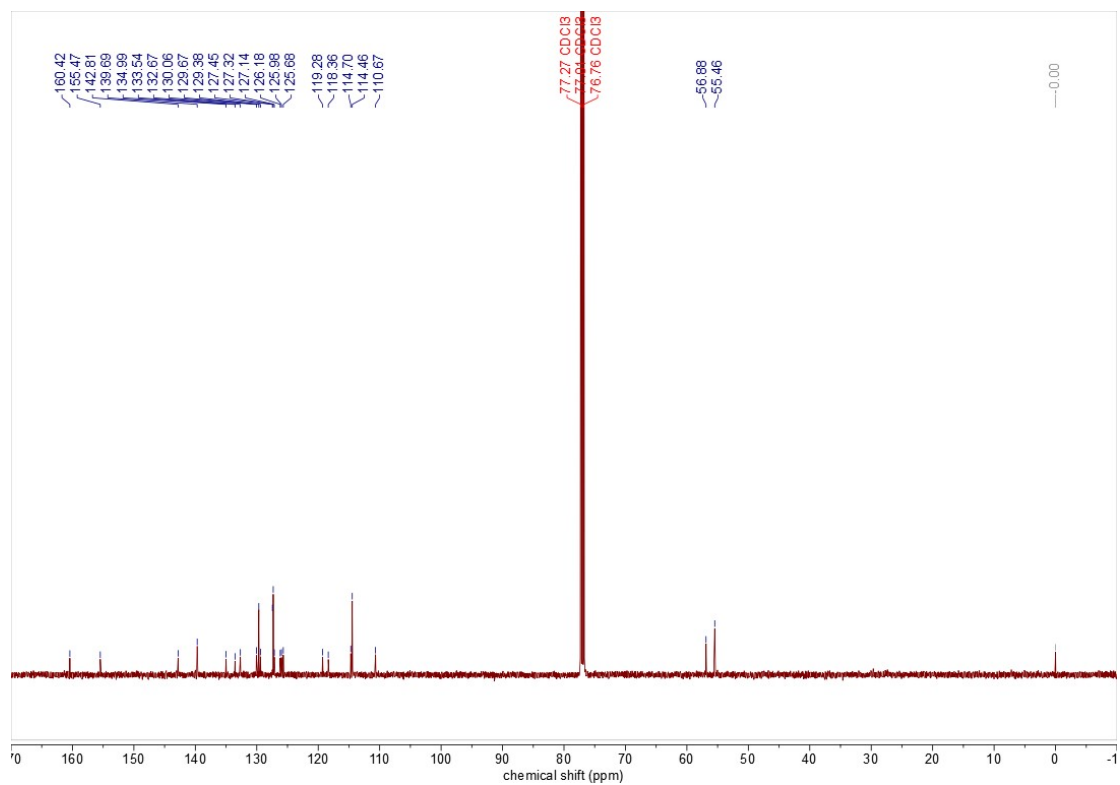


Figure S74. ¹³C NMR spectrum of compound **RB-CS** in CDCl₃ at 298 K.

7 H NMR

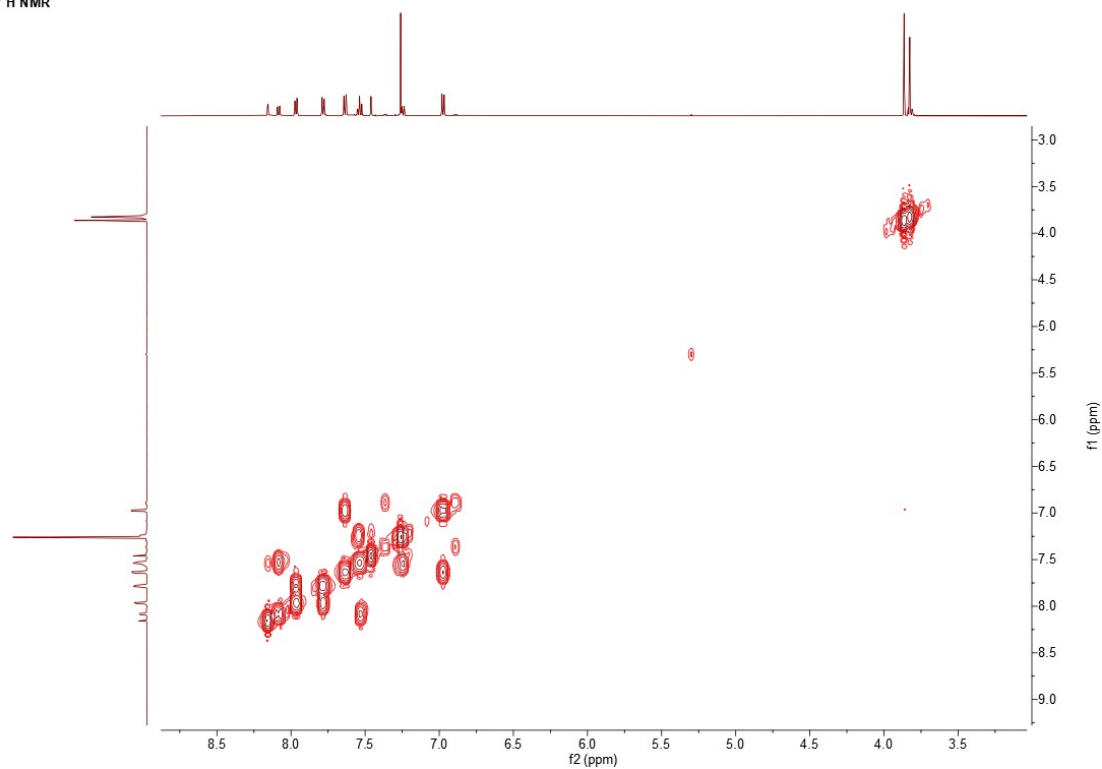


Figure S75. COSY spectrum of compound **RB-CS** in CDCl_3 at 298 K.

7 H NMR

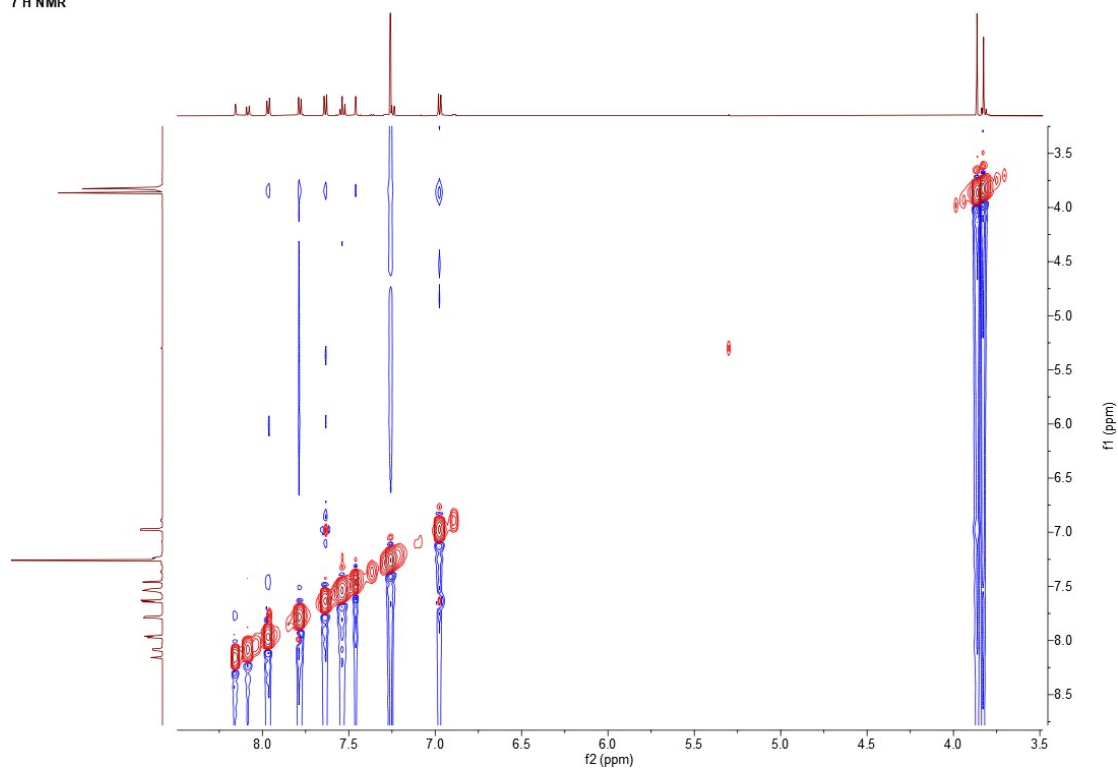


Figure S76. NOESY spectrum of compound **RB-CS** in CDCl_3 at 298 K.

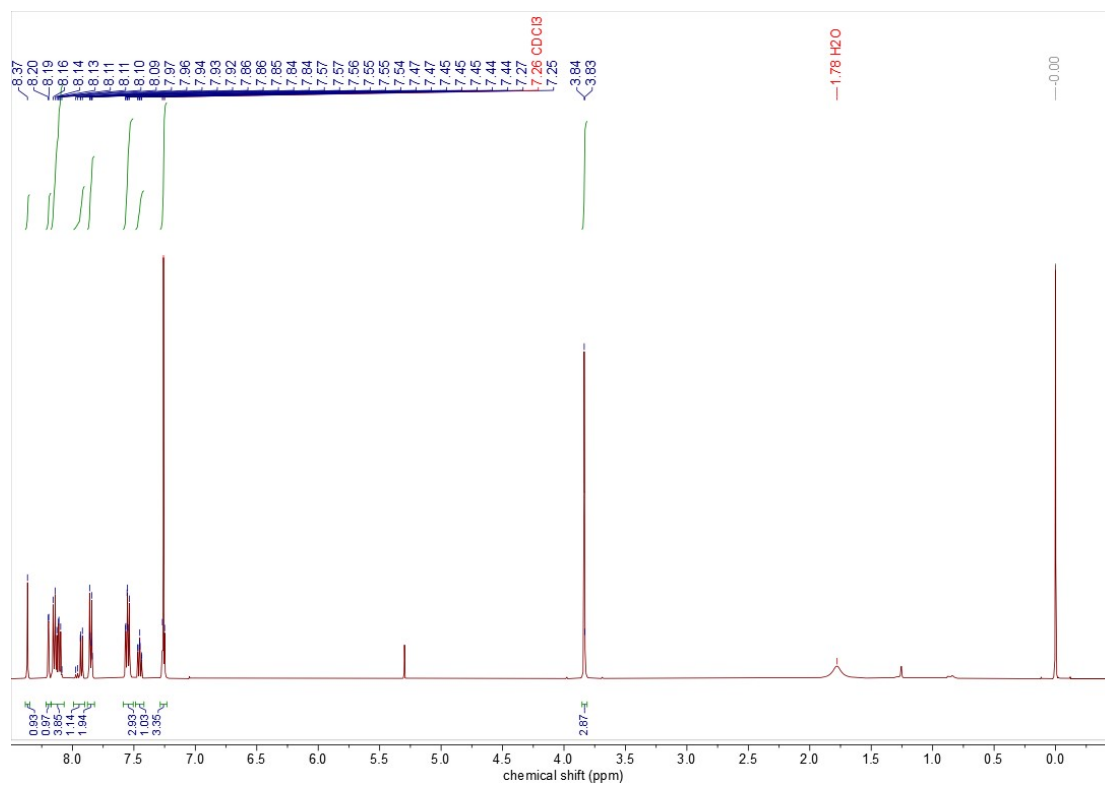


Figure S77. ¹H NMR spectrum of compound **SB-BT** in CDCl₃ at 298 K.

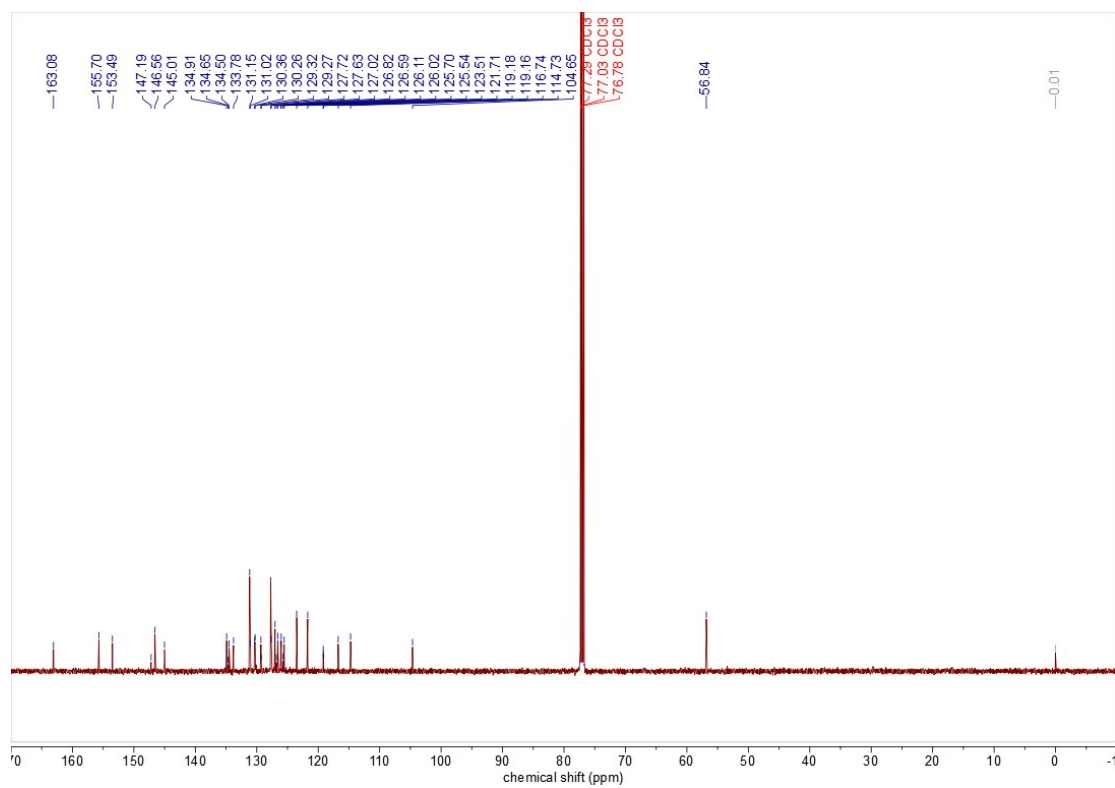


Figure S78. ¹³C NMR spectrum of compound **SB-BT** in CDCl₃ at 298 K.

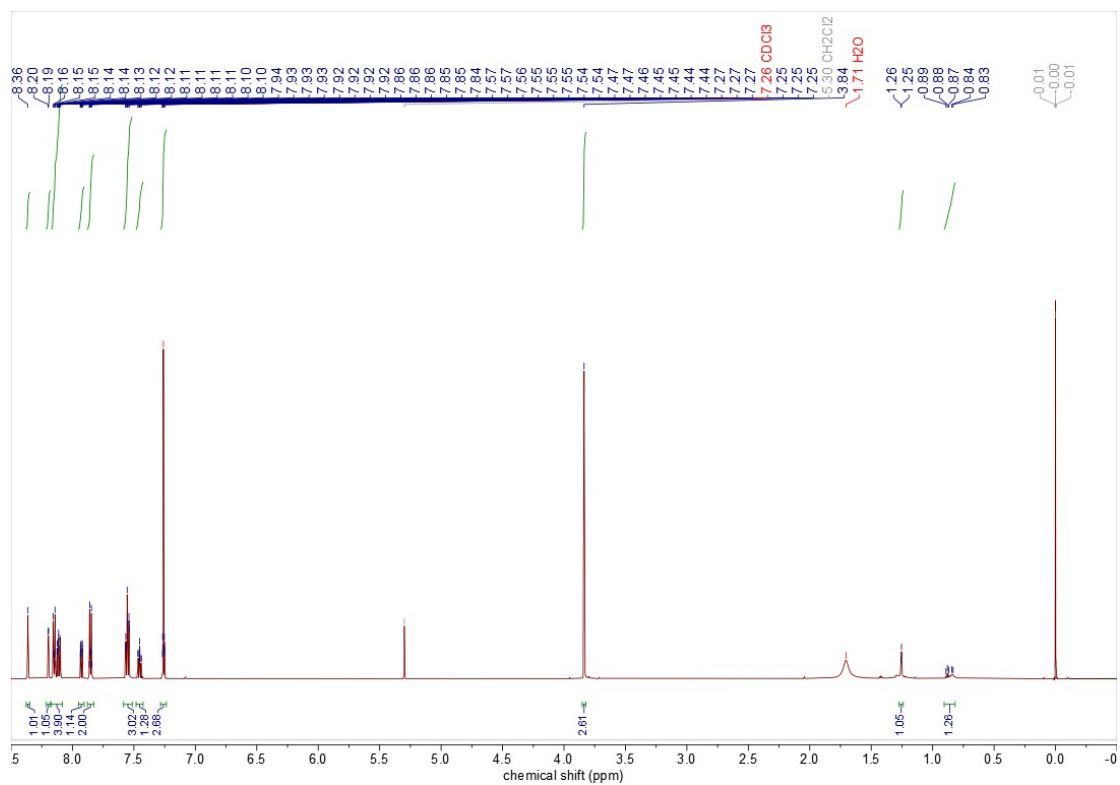


Figure S79. ^1H NMR spectrum of compound **RB-BT** in CDCl_3 at 298 K.

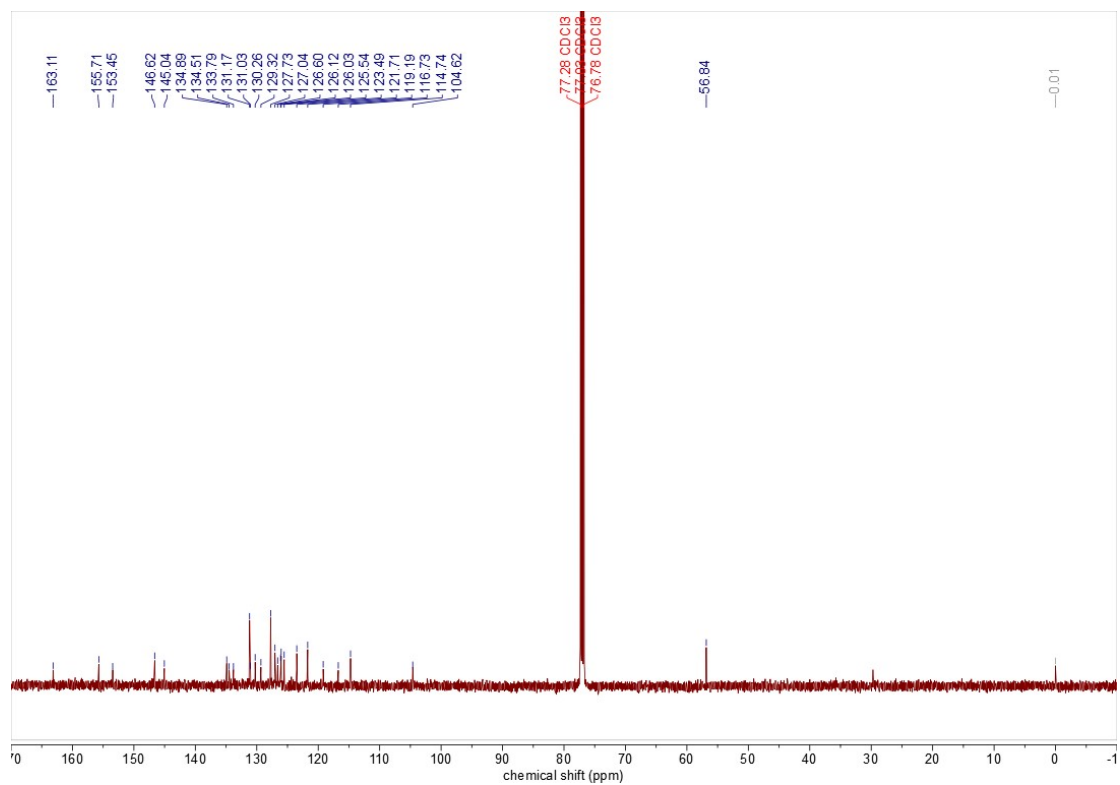


Figure S80. ^{13}C NMR spectrum of compound **RB-BT** in CDCl_3 at 298 K.

7 H NMR

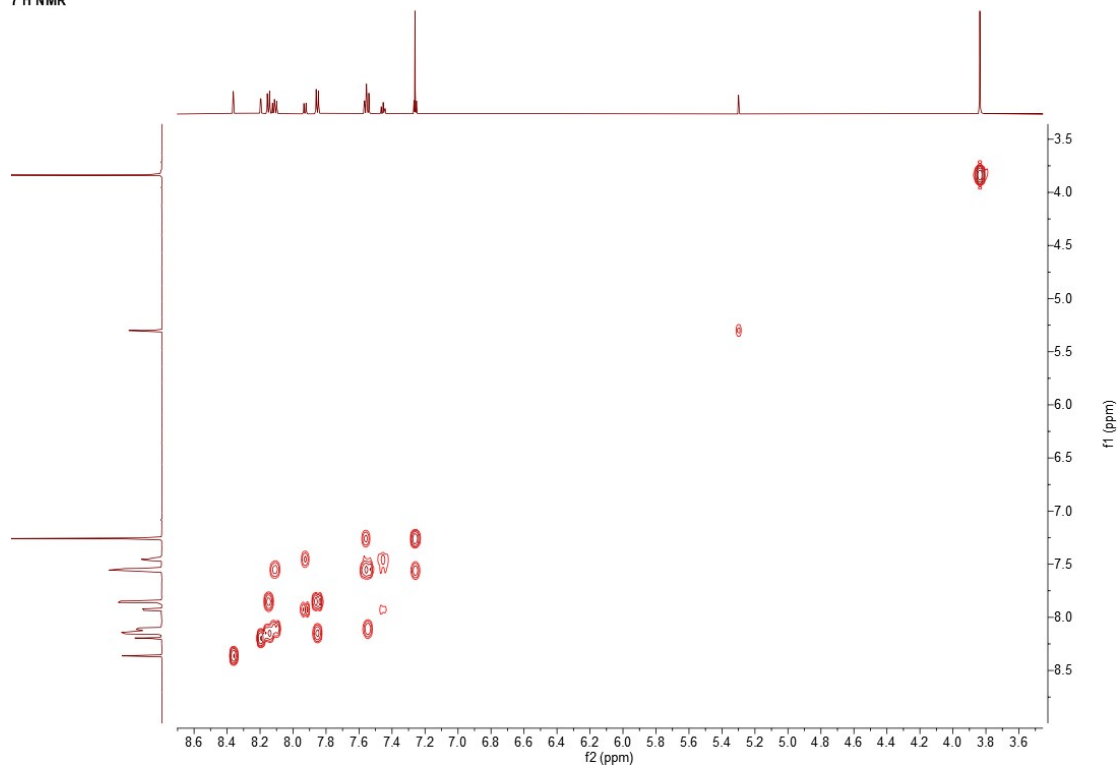


Figure S81. COSY spectrum of compound **RB-BT** in CDCl_3 at 298 K.

7 H NMR

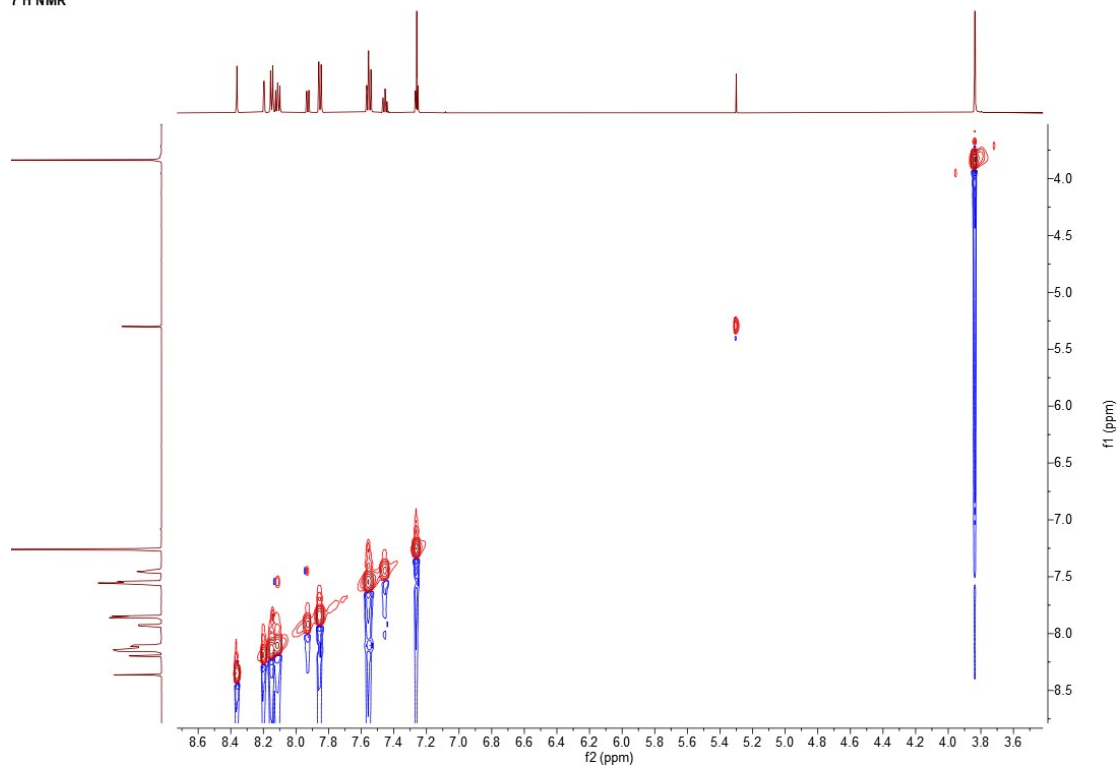


Figure S82. NOESY spectrum of compound **RB-BT** in CDCl_3 at 298 K.

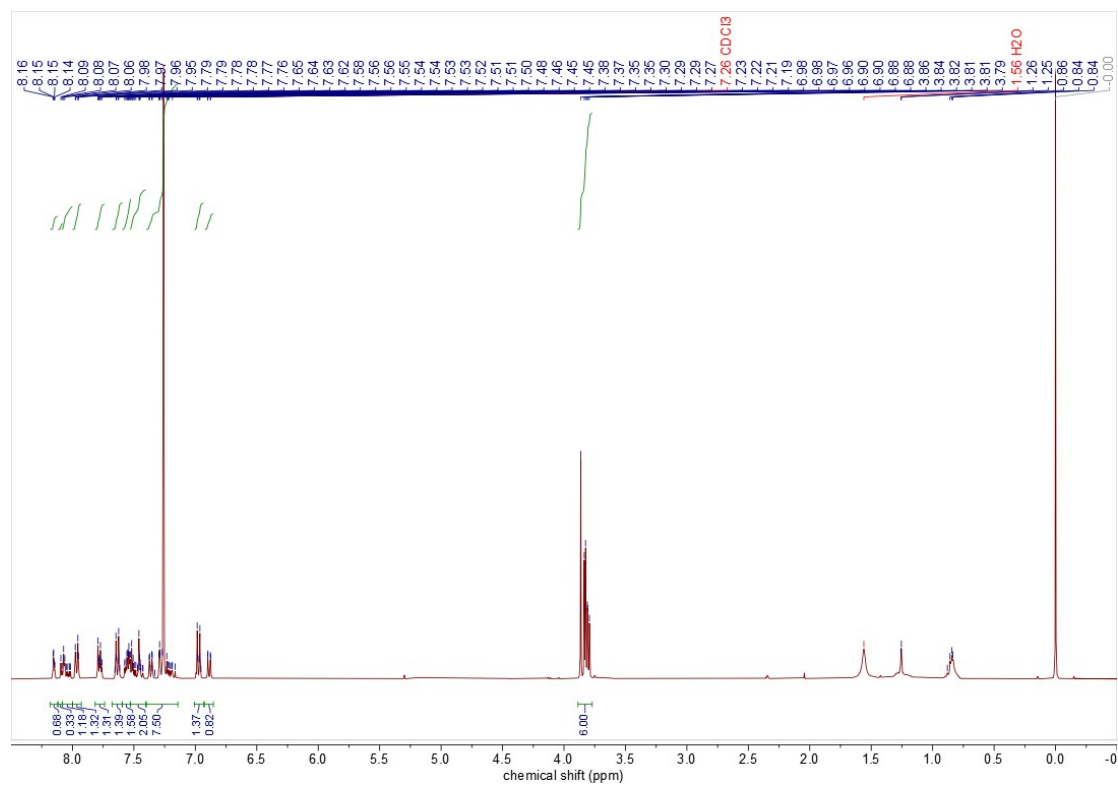


Figure S83. ¹H NMR spectrum of compound **SB-CS** after UV light irradiation for 5 minutes in CDCl₃ at 298 K.

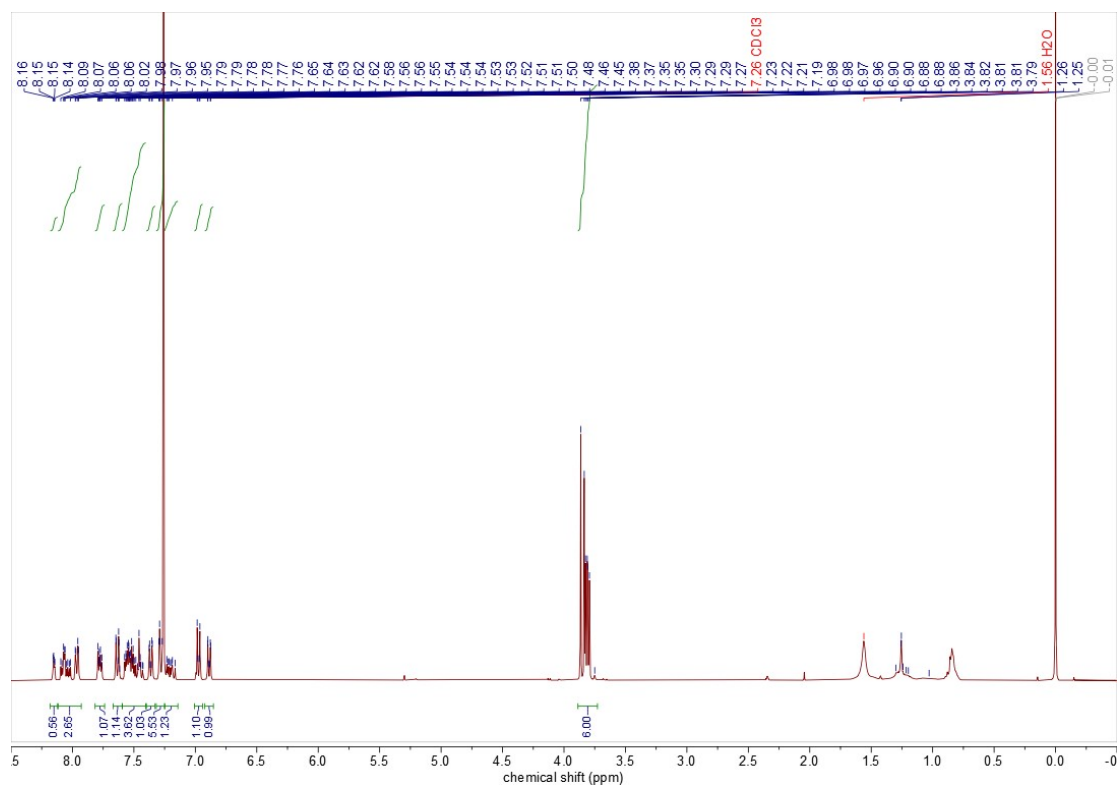


Figure S84. ¹H NMR spectrum of compound **SB-CS** after UV light irradiation for 10 minutes in CDCl₃ at 298 K.

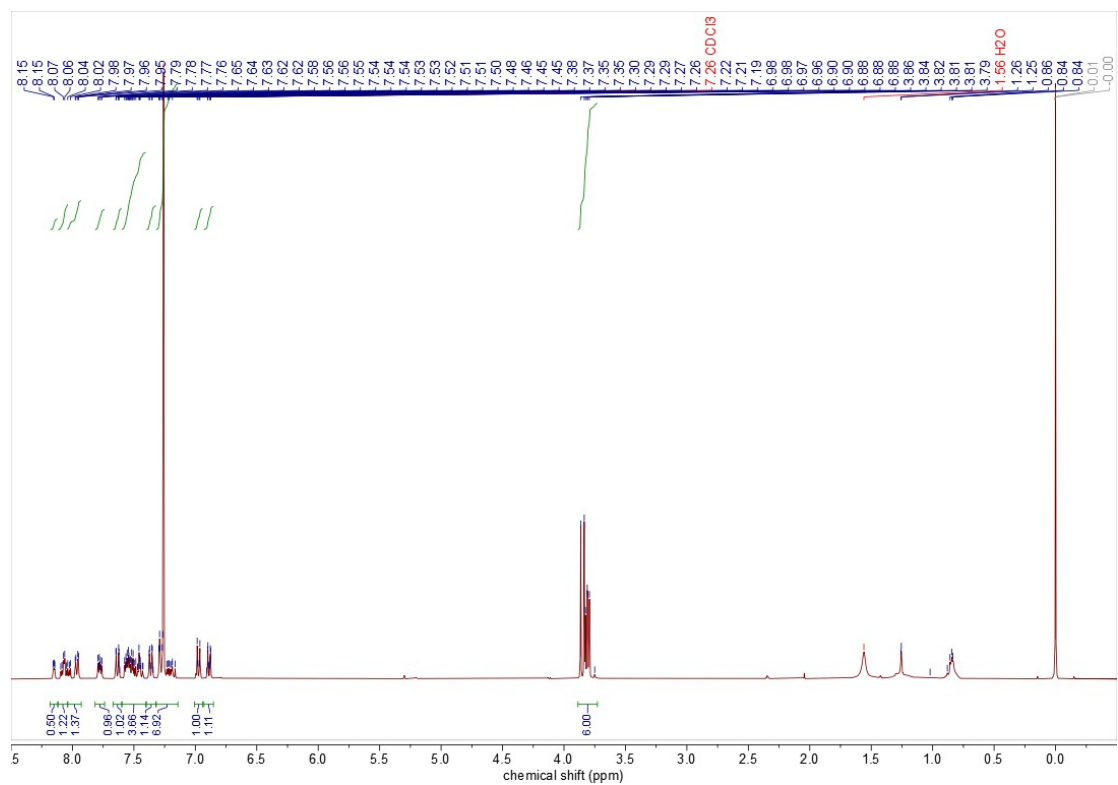


Figure S85. ^1H NMR spectrum of compound **SB-CS** after UV light irradiation for 15 minutes in CDCl_3 at 298 K.

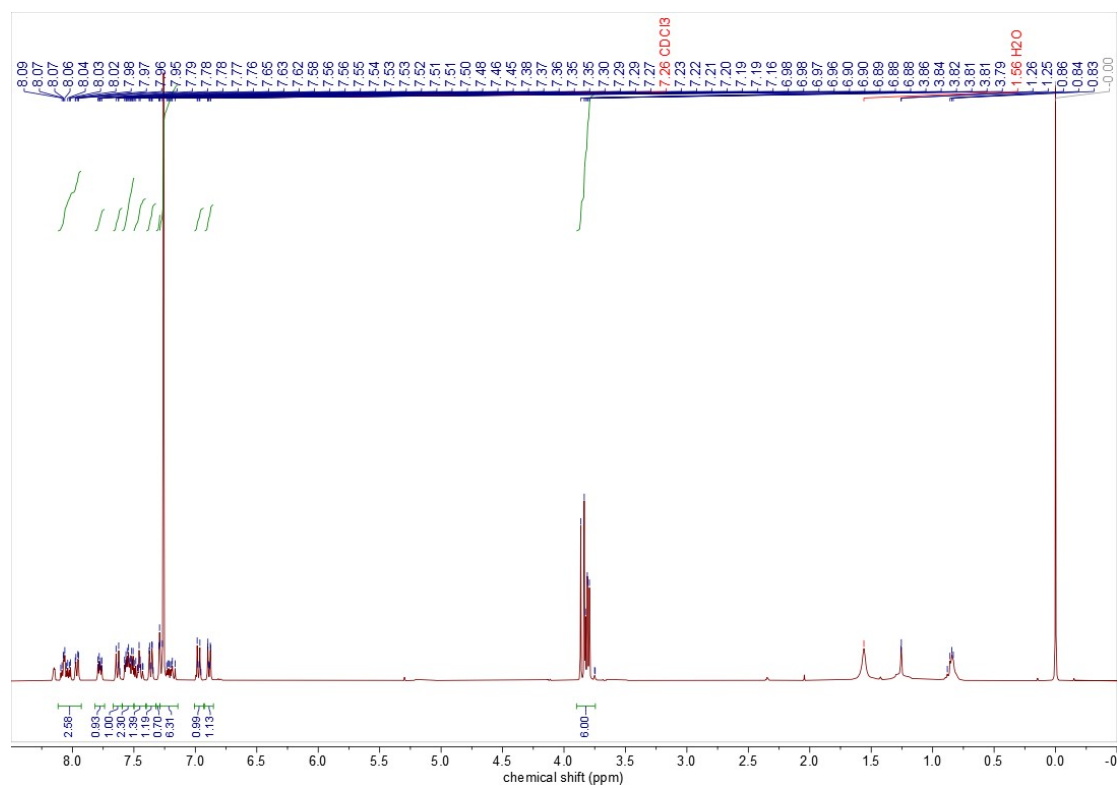


Figure S86. ^1H NMR spectrum of compound **SB-CS** after UV light irradiation for 20 minutes in CDCl_3 at 298 K.

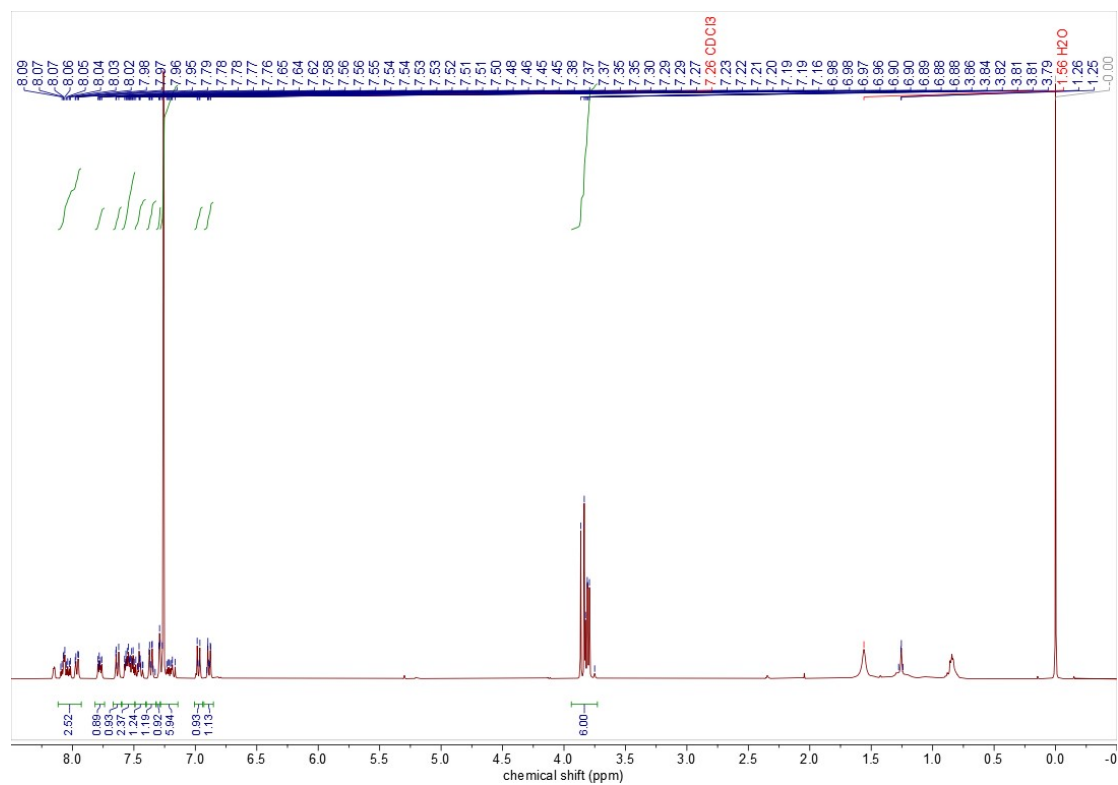


Figure S87. ^1H NMR spectrum of compound **SB-CS** after UV light irradiation for 25 minutes in CDCl_3 at 298 K.

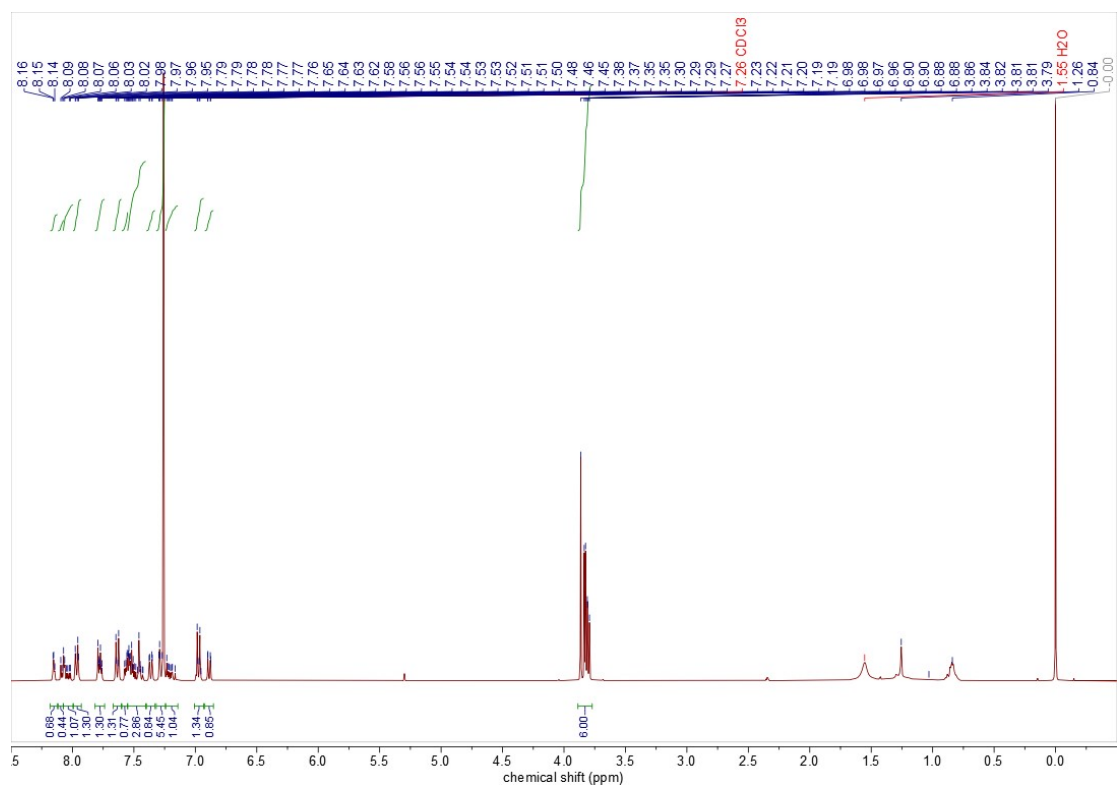


Figure S88. ^1H NMR spectrum of compound **RB-CS** after UV light irradiation for 5 minutes in CDCl_3 at 298 K.

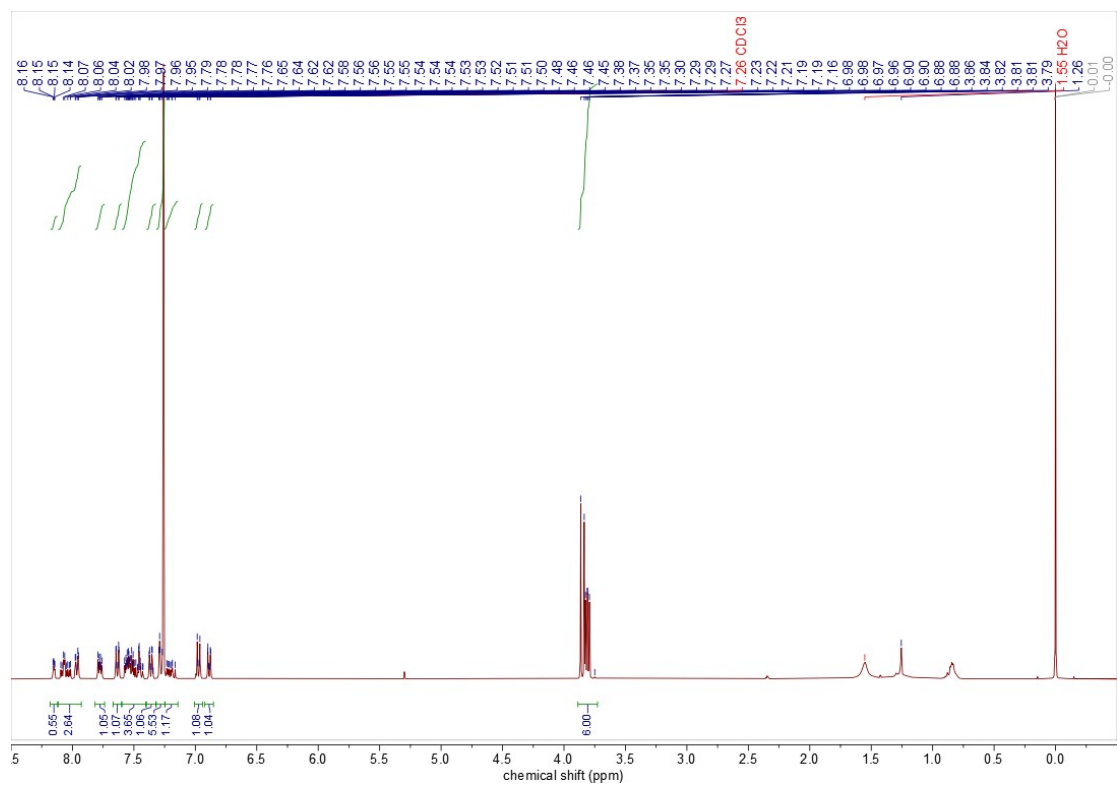


Figure S89. ¹H NMR spectrum of compound **RB-CS** after UV light irradiation for 10 minutes in CDCl₃ at 298 K.

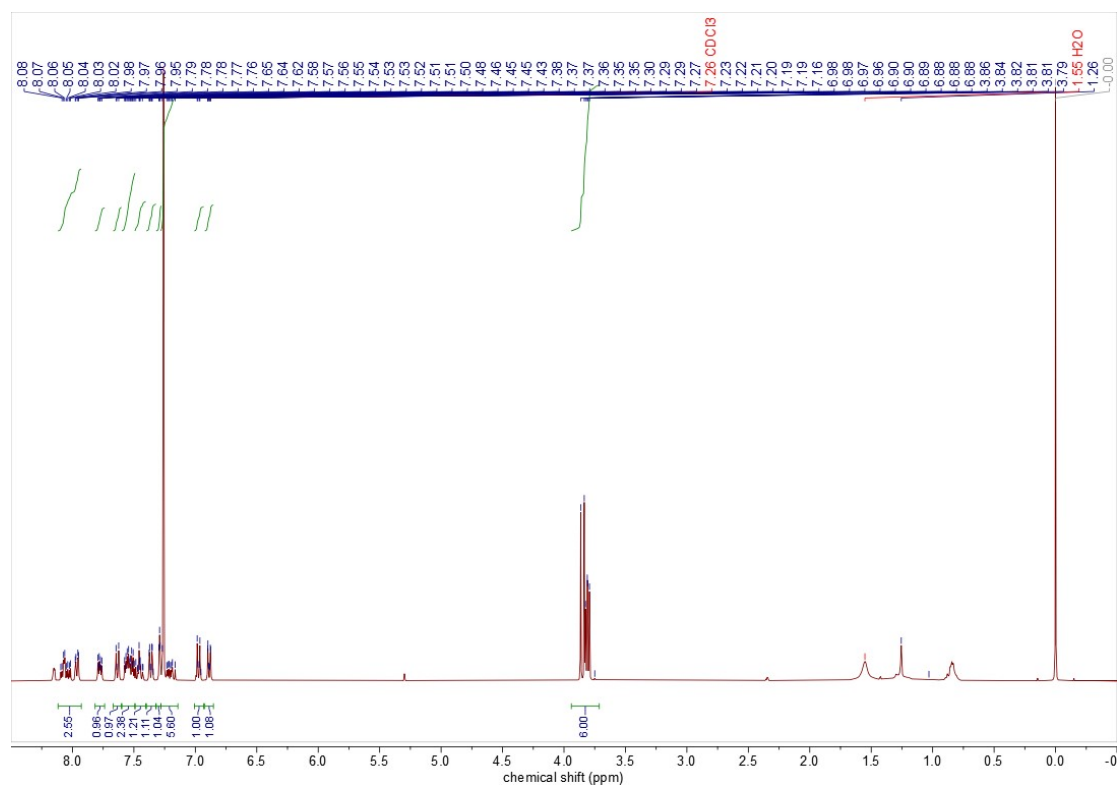


Figure S90. ¹H NMR spectrum of compound **RB-CS** after UV light irradiation for 15 minutes in CDCl₃ at 298 K.

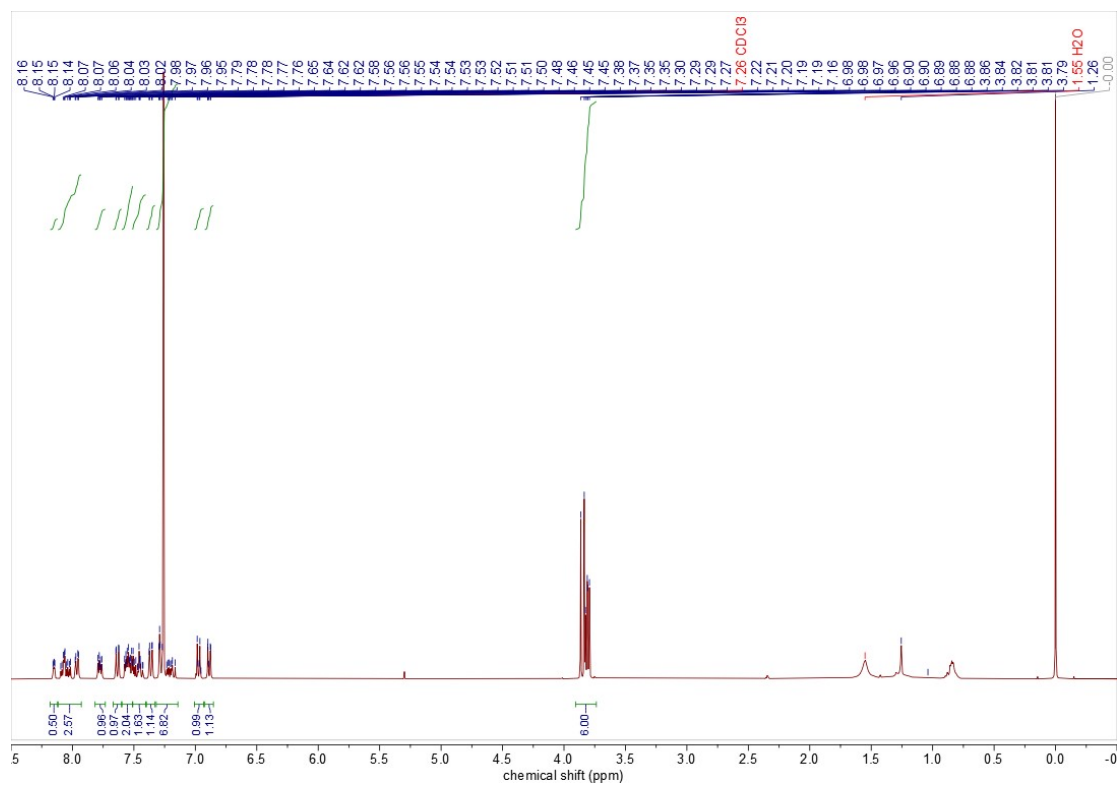


Figure S91. ¹H NMR spectrum of compound **RB-CS** after UV light irradiation for 20 minutes in CDCl₃ at 298 K.

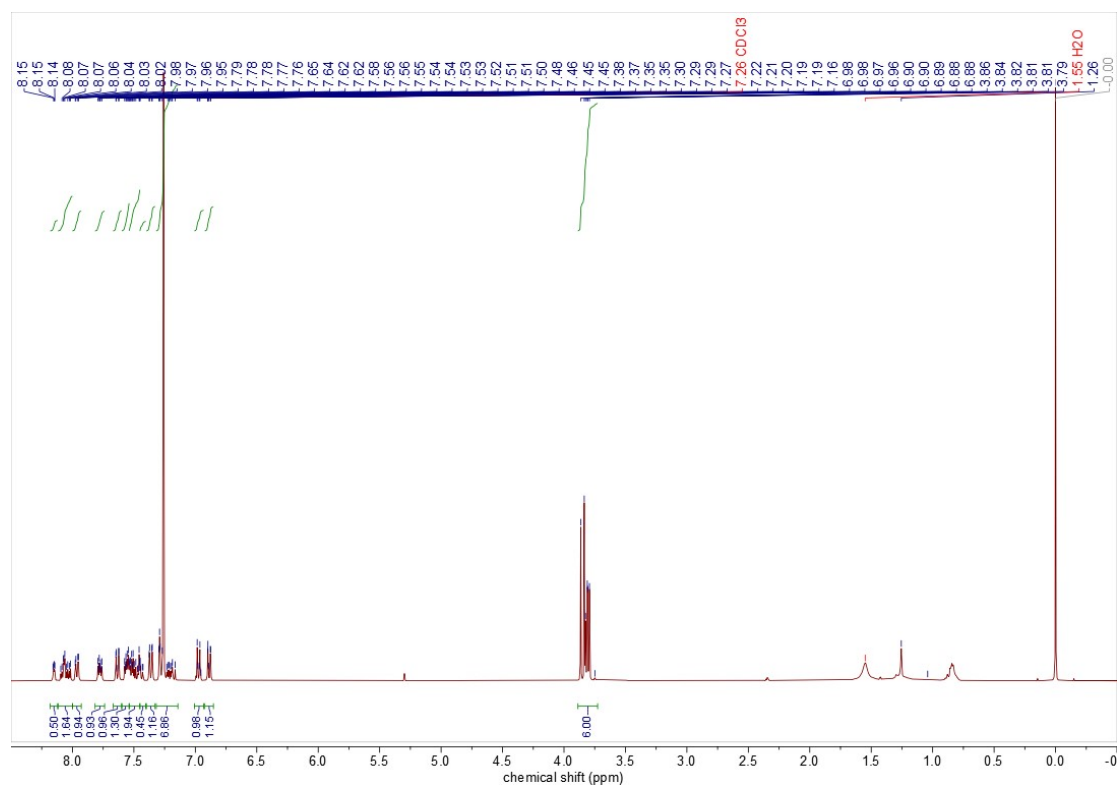


Figure S92. ¹H NMR spectrum of compound **RB-CS** after UV light irradiation for 25 minutes in CDCl₃ at 298 K.