Supplementary Information

Non-Hydrogen-Bonding-Based, Solvent-Dependent Helix Inversion Between Pure P-Helix and Pure M-Helix in Poly(quinoxaline-2,3-diyl)s Bearing Chiral Side Chains

Tetsuya Yamada,\textsuperscript{a} Yuuya Nagata,\textsuperscript{a} and Michinori Suginome \textsuperscript{a,b}* 

\textsuperscript{a}Department of Synthetic Chemistry and Biological Chemistry, Graduate School of Engineering, Kyoto University, Katsura, Nishikyo-ku, Kyoto 615-8510, Japan 
\textsuperscript{b}JST, CREST (Creation of Next-Generation Nanosystems through Process Integration), Sanbancho, Chiyodaku, Tokyo, 102-0075, Japan

Contents

1. General
2. Experimental Procedures
3. Analytical and NMR Data for New Compounds
4. Determination of the Screw-Sense Excess 
5. CD and UV Spectra of the Polymers
1. General

All reactions were carried out under an atmosphere of nitrogen with magnetic stirring. $^1$H and $^{13}$C NMR spectra were recorded on a Varian Mercury vx400 or a JEOL JNM-A500 spectrometer at ambient temperature. $^1$H NMR data are reported as follows: chemical shift in ppm downfield from tetramethylsilane ($\delta$ scale), multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, quint = quintet, sex = sextet, m = multiplet, and br = broad), coupling constant (Hz), and integration. $^{13}$C NMR chemical shifts are reported in ppm downfield from tetramethylsilane ($\delta$ scale). All $^{13}$C NMR spectra were obtained with complete proton decoupling. CD spectra were recorded on a JASCO J-750 spectrometer. UV spectra were recorded on a JASCO V-500 spectrometer. The GPC analysis was carried out with TSKgel G4000HHR (CHCl$_3$, polystyrene standard). Preparative GPC was performed on JAI LC-908 equipped with JAIGEL-1H and -2H columns in a series (CHCl$_3$).

THF was dried and deoxygenized using an alumina/catalyst column system (GlassContour Co.). Trimethylphenylphosphine (Aldrich) and sodium borohydride (Aldrich) were used as received from the commercial sources. Achiral monomer 1 and chiral monomers ($R$)- and ($S$)-2 and achiral nickel initiator were prepared according to the reported procedures.
2. Experimental Procedures

Synthesis of Monomer (R)-2

\[ \text{O} \text{H}_2 \text{N} \text{H}_2 \text{O} \text{H}_2 \text{N} \text{H}_2 \quad 1) \text{AcOCHO, CH}_2\text{Cl}_2 \quad 2) \text{POCl}_3, \text{Et}_3\text{N, CH}_2\text{Cl}_2 \quad \text{NC} \text{NC} \quad \text{O} \text{O} \quad \text{O} \text{O} \]

To a CH\(_2\text{Cl}_2\) (25 mL) solution of 1,2-amino-3,6-dimethyl-4,5-bis((R)-2-butoxy-methyl)benzene ((R)-S1, 1.64 g, 5.32 mmol) was added acetylformate (1.5 mL, 21 mmol) at 0°C. The mixture was stirred for 15 h with gradual warming up to rt. The mixture containing 1,2-diformamido-3,6-dimethyl-4,5-bis((R)-2-butoxy)methyl)benzene was subjected to evaporation of volatile materials in vacuo and used for the next step without further purification. To a CH\(_2\text{Cl}_2\) (50 mL) suspension of the diformamide and Et\(_3\)N (7.8 mL, 55 mmol) cooled to 0°C, POCl\(_3\) (1.6 mL, 17 mmol) was added. After stirring for 1 h at 0°C, saturated NaHCO\(_3\) aq. was added to the reaction mixture. Extraction with CH\(_2\text{Cl}_2\) followed by column chromatography on silica gel (hexane:ether = 5:1) gave (R)-2 as white solid (1.00 g, 57% yield).

Typical Procedures for the Synthesis of Poly(quinoline-2,3-diyl)s

Synthesis of copolymer poly-1/(R)-2(20/20): A THF solution of o-TolNiCl(PMe\(_3\))\(_2\) (0.050 M, 50 μL, 2.5 μmol) was diluted with THF (3.85 mL). To the solution was added a solution of PMe\(_3\) in THF (1.0 M, 2.5 μL, 2.5 μmol). After stirring for 15 minutes, a solution of monomer 1 (15.0 mg, 50 μmol) and (R)-2 (16.4 mg, 50 μmol) in THF (1.25 mL) was added at room temperature. After 3 h, a THF solution of o-TolMgBr (1.0M, 50 μL, 50 μmol) was added to the reaction mixture at room temperature. After stirring for 15 min. at room temperature, water was added. Extraction with CHCl\(_3\) followed by preparative GPC gave poly-1/(R)-2(20/20) as orange solid (29 mg, 92% yield).

Synthesis of homopolymer poly-(R)-2: A THF solution of o-TolNiCl(PMe\(_3\))\(_2\) (0.050 M, 50 μL, 2.5 μmol) was diluted with THF (3.85 mL). To the solution was added a solution of
PMe₃ in THF (1.0 M, 2.5 µL, 2.5 µmol). After stirring for 15 minutes, a solution of (R)-2 (32.8 mg, 100 µmol) in THF (1.25 mL) was added at room temperature. After 3 h, a THF solution of o-TolMgBr (1.0M, 50 µL, 50 µmol) was added to the reaction mixture at room temperature. After stirring for 15 min. at room temperature, water was added. Extraction with CHCl₃ followed by preparative GPC gave poly-(R)-2 as orange solid (31 mg, 95% yield).

**Synthesis of homopolymer poly-(R)-2(100):** A THF solution of o-TolNiCl(PMe₃)₂ (0.050 M, 20 µL, 1.0 µmol) was diluted with THF (3.85 mL). To the solution was added a solution of PMe₃ in THF (1.0 M, 2.5 µL, 2.5 µmol). After stirring for 15 minutes, a solution of (R)-2 (32.8 mg, 100 µmol) in THF (1.25 mL) was added at room temperature. After 3 h, a THF solution of o-TolMgBr (1.0M, 50 µL, 50 µmol) was added to the reaction mixture at room temperature. After stirring for 15 minutes at room temperature, water was added. Extraction with CHCl₃ followed by preparative GPC gave poly-(R)-2(100) as orange solid (29 mg, 95% yield).

**Synthesis of homopolymer poly-(R)-2(200):** A THF solution of o-TolNiCl(PMe₃)₂ (0.050 M, 10 µL, 0.50 µmol) was diluted with THF (3.85 mL). To the solution was added a solution of PMe₃ in THF (1.0 M, 2.5 µL, 2.5 µmol). After stirring for 15 min., a solution of (R)-2 (32.8 mg, 100 µmol) in THF (1.25 mL) was added at room temperature. After 3 h, a THF solution of o-TolMgBr (1.0 M, 50 µL, 50 µmol) was added to the reaction mixture at room temperature. After stirring for 15 min. at room temperature, water was added. Extraction with CHCl₃ followed by preparative GPC gave poly-(R)-2 as orange solid (27 mg, 95% yield).

**Procedure for the CD measurements in 1,1,2-TCE/CHCl₃ Solution (Figure 2)**

Mixed solvents for the CD measurements were prepared by mixing CHCl₃ and 1,1,2-TCE by volume. The volume was measured with measuring cylinder.

poly-(R)-2 (1.98 mg) was dissolved in CHCl₃ in 10 mL measuring flask. A 1 mL portion of
the solution was transferred into other 10 mL measuring flasks by use of measuring pipette (1 mL). Chloroform in these flasks were evaporated in vacuo 3 h at room temperature. Each flask containing dried poly-(R)-2 (0.198 mg) was filled with the mixed solvent. After leaving the solution at room temperature for 3 h, the solutions were subjected to CD and UV/Vis measurements.
3. Analytical and NMR Data for New Compounds

Monomer (\(R\))- and (\(S\))-2

(\(R\))-2: \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 0.93 (t, 7.6Hz, 6H), 1.24 (d, 6.4Hz, 6H), 1.45-1.65 (m, 4H), 2.49 (s, 6H), 3.49 (sex, 6.0 Hz, 2H), 4.44 (d, 10.4 Hz, 2H), 4.59 (d, 10.4 Hz, 2H); \(^{13}\)C NMR (125 MHz, CDCl\(_3\)) \(\delta\) 9.9, 15.5, 19.1, 29.2, 64.0, 77.7, 123.9, 134.1, 138.3, 172.8; IR (KBr) 2122 cm\(^{-1}\); Anal. Calcd. for C\(_{20}\)H\(_{28}\)N\(_2\)O\(_2\): C, 73.14; H, 8.59; N, 8.53. Found: C, 73.29; H, 8.75; N, 8.57; [\(\alpha\)]\(D\) -29.6 (CHCl\(_3\), c = 0.49).

(S)-2; [\(\alpha\)]\(D\) +29.0 (CHCl\(_3\), c = 0.49).

Monomer (\(S\))-3

(\(S\))-3: \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 0.91 (t, 7.2Hz, 6H), 0.99 (d, 6.4Hz, 6H), 1.18-1.50 (m, 10H), 2.39 (s, 6H), 2.55 (dt, 4.8Hz, 12.8Hz, 2H), 2.65 (dt, 4.8Hz, 12.8Hz, 2H); \(^{13}\)C NMR (125 MHz, CDCl\(_3\)) \(\delta\) 11.4, 15.7, 19.0, 27.9, 29.2, 35.3, 36.6, 122.0, 131.6, 142.0, 171.4; IR (neat) 2116 cm\(^{-1}\); HRMS Calcd. For C\(_{22}\)H\(_{32}\)N\(_2\): 324.2565. Found 324.2566.; [\(\alpha\)]\(D\) +11.6 (CHCl\(_3\), c = 0.50).
$^1$H NMR of (S)-3

$^{13}$C NMR of (S)-3
Properties of Homopolymers (poly-1, poly-(R)-2 and poly-(S)-2) and Random Copolymers (poly-1/(R)-2 and poly-1/(S)-2)

Table S1. Properties of Homopolymers (poly-1 and poly-(R)-2) and Random Copolymers poly-1/(R)-2

<table>
<thead>
<tr>
<th>polymer</th>
<th>yield (%)</th>
<th>$M_n/10^4$</th>
<th>$M_w/M_n$</th>
<th>$g_{abs}^{366}/10^{-3}$ (CHCl$_3$)</th>
<th>$g_{abs}^{366}/10^{-3}$ (1,1,2-TCE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>poly-1</td>
<td>86</td>
<td>6.8</td>
<td>1.08</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>poly-1/2(95/5)</td>
<td>88</td>
<td>7.5</td>
<td>1.07</td>
<td>0.56</td>
<td>-0.39</td>
</tr>
<tr>
<td>poly-1/2(90/10)</td>
<td>91</td>
<td>7.7</td>
<td>1.07</td>
<td>1.07</td>
<td>-0.67</td>
</tr>
<tr>
<td>poly-1/2(80/20)</td>
<td>87</td>
<td>7.7</td>
<td>1.08</td>
<td>1.76</td>
<td>-1.49</td>
</tr>
<tr>
<td>poly-1/2(70/30)</td>
<td>93</td>
<td>8.2</td>
<td>1.08</td>
<td>2.13</td>
<td>-1.81</td>
</tr>
<tr>
<td>poly-1/2(50/50)</td>
<td>92</td>
<td>7.9</td>
<td>1.08</td>
<td>2.38</td>
<td>-2.49</td>
</tr>
<tr>
<td>poly-1/2(30/70)</td>
<td>88</td>
<td>7.9</td>
<td>1.09</td>
<td>2.34</td>
<td>-2.78</td>
</tr>
<tr>
<td>poly-2</td>
<td>95</td>
<td>7.9</td>
<td>1.07</td>
<td>2.36</td>
<td>-2.81</td>
</tr>
<tr>
<td>poly-2(100)</td>
<td>87</td>
<td>28</td>
<td>1.06</td>
<td>2.47</td>
<td>$^{\mathrm{a}}$</td>
</tr>
<tr>
<td>poly-2(200)</td>
<td>83</td>
<td>58</td>
<td>1.04</td>
<td>2.51</td>
<td>$^{\mathrm{a}}$</td>
</tr>
</tbody>
</table>

a) not determined due to the poor solubility.

Table S2. Properties of Homopolymer poly-(S)-2 and Random Copolymers poly-1/(S)-2

<table>
<thead>
<tr>
<th>polymer</th>
<th>yield (%)</th>
<th>$M_n/10^4$</th>
<th>$M_w/M_n$</th>
<th>$g_{abs}^{366}/10^{-3}$ (CHCl$_3$)</th>
<th>$g_{abs}^{366}/10^{-3}$ (1,1,2-TCE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>poly-1/2(90/10)</td>
<td>94</td>
<td>6.8</td>
<td>1.08</td>
<td>-1.03</td>
<td>0.71</td>
</tr>
<tr>
<td>poly-1/2(80/20)</td>
<td>91</td>
<td>7.5</td>
<td>1.07</td>
<td>-1.82</td>
<td>1.59</td>
</tr>
<tr>
<td>poly-1/2(70/30)</td>
<td>89</td>
<td>7.7</td>
<td>1.07</td>
<td>-2.14</td>
<td>2.13</td>
</tr>
<tr>
<td>poly-1/2(50/50)</td>
<td>86</td>
<td>7.7</td>
<td>1.08</td>
<td>-2.34</td>
<td>2.50</td>
</tr>
<tr>
<td>poly-2</td>
<td>91</td>
<td>8.2</td>
<td>1.08</td>
<td>-2.45</td>
<td>2.83</td>
</tr>
</tbody>
</table>

Table S3. Properties of Homopolymer poly-(S)-3

<table>
<thead>
<tr>
<th>polymer</th>
<th>yield (%)</th>
<th>$M_n/10^4$</th>
<th>$M_w/M_n$</th>
<th>$g_{abs}^{366}/10^{-3}$ (CHCl$_3$)</th>
<th>$g_{abs}^{366}/10^{-3}$ (1,1,2-TCE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>poly-(S)-3</td>
<td>88</td>
<td>5.6</td>
<td>1.17</td>
<td>-0.32</td>
<td>1.06</td>
</tr>
</tbody>
</table>

Homopolymer poly-1: $^1$H NMR (400MHz, CDCl$_3$) $\delta$ 0.88 (brs, 6nH), 1.59 (brs, 4nH), 2.34 (brs, 6nH), 3.46 (brs, 4nH), 4.58 (brs, 2nH), 4.63 (brs, 2nH), 7.1-7.4 (brm, 6H), 7.85 (brs, 2H).

Homopolymer poly-2: $^1$H NMR (400MHz, CDCl$_3$) $\delta$ 0.88 (brs, 6nH), 1.21 (brs, 6nH), 1.44
(bss, 2nH), 1.53 (bss, 2nH), 1.59 (bss, 4nH), 2.31 (bss, 6nH), 3.40 (bss, 2nH), 4.53 (bss, 2nH), 4.62 (bss, 2nH), 7.1-7.4 (brm, 6H), 7.85 (bss, 2H).

Random Copolymers **poly-1/(R)-2(x/y)** and **poly-1/(S)-2(x/y)** (x + y = 40): $^1$H NMR (400MHz, CDCl$_3$) δ 0.88 (bss, (6x+6y)H), 1.21 (bss, 6yH), 1.44 (bss, 2yH), 1.53 (bss, (4x+2y)H), 2.30 (bss, (6x+6y)H), 3.41 (bss, (4x+2y)H), 4.54 (bss, (2x+2y)H), 4.62 (bss, (2x+2y)H), 7.1-7.4 (brm, 6H), 7.85 (bss, 2H).

Homopolymer **poly-3**: $^1$H NMR (400MHz, CDCl$_3$) δ 0.86 (bss, 12nH), 1.18 (bss, 4nH), 1.26 (bss, 6nH), 1.36 (bss, 6nH), 2.22 (bss, 2nH), 2.61 (bss, 2nH).

Molar ratios of the achiral and chiral monomer units (x:y) can be estimated from the integral ratio of the signals at δ 2.30 (= 240H) and δ 1.21 as shown below. The integral ratio of the two signals (δ 1.21 and δ 2.30) directly reflects the ratio of the two monomers.

The following graphs demonstrate a linear relationship of the feeding ratio and the NMR integral ratio for **poly-1/(R)-2(x/y)** (top) and **poly-1/(S)-2(x/y)** (bottom).
Table S3. Ratio of the integral value of δ 2.30 and δ 1.21 in random copolymers using (R)-2

<table>
<thead>
<tr>
<th>content of (R)-2</th>
<th>ratio of integral value (H^c/H^a+H^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.05</td>
<td>0.09</td>
</tr>
<tr>
<td>0.1</td>
<td>0.16</td>
</tr>
<tr>
<td>0.2</td>
<td>0.25</td>
</tr>
<tr>
<td>0.3</td>
<td>0.34</td>
</tr>
<tr>
<td>0.5</td>
<td>0.57</td>
</tr>
<tr>
<td>0.7</td>
<td>0.72</td>
</tr>
<tr>
<td>1</td>
<td>1.08</td>
</tr>
</tbody>
</table>

Figure S1. Relationship of the content of (R)-2 and the ratio of the integral value

y = 1.086x
R_2 = 0.991

Table S4. Ratio of the integral value of δ 2.30 and δ 1.21 in random copolymers using (S)-2

<table>
<thead>
<tr>
<th>content of (S)-2</th>
<th>ratio of integral value (H^c/H^a+H^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>0.15</td>
</tr>
<tr>
<td>0.2</td>
<td>0.30</td>
</tr>
<tr>
<td>0.3</td>
<td>0.37</td>
</tr>
<tr>
<td>0.5</td>
<td>0.55</td>
</tr>
<tr>
<td>1</td>
<td>1.02</td>
</tr>
</tbody>
</table>

Figure S2. Relationship of the content of (S)-2 and the ratio of the integral value

y = 1.063x
R_2 = 0.978
4. Determination of the screw-sense excess

The screw-sense excesses of the polymers were determined by CD spectra and UV/vis absorption spectra. Here we used the dissymmetry factor $g_{abs} \left( \Delta \varepsilon / \varepsilon \right)$\(^1\) to avoid the effects of the concentration errors of the polymer solutions. Firstly, the percent screw-sense excess $se$ was defined as

$$se = \frac{[P]-[M]}{[P]+[M]} \times 100$$  \hspace{1cm} (1)

where $[P]$ and $[M]$ are molar concentrations of $P$ and $M$ helical polymers. In other words, positive $se$ means a $P$-enriched state and negative $se$ represents $M$-enriched state for practical convenience. The screw-sense excess is directly proportional to $g_{abs}$: the screw-sense excess could therefore be obtained as a product of $g_{abs}$ and the proportionality factor $F$.

$$se = F \times g_{abs}$$  \hspace{1cm} (2)

On the other hand, the ratio of the molar concentrations of purely $M$ and $P$ helical polymers is given by the Boltzmann distribution using the energy difference per monomer unit $E_h$ between the $P$- and $M$-helices, the number of chiral unit $N$ (40 to -40, positive number means the number of $(R)$ monomer units and negative number represents the number of $(S)$ monomer units), the gas constant $R$ (8.31447 J·K\(^{-1}\)·mol\(^{-1}\)), and temperature $T$ (298 K) as previously reported.

$$\frac{[P]}{[M]} = \exp\left(\frac{E_h N}{RT}\right)$$  \hspace{1cm} (3)

Therefore, the screw-sense excess is expressed as follows.

$$se = \tanh\left(\frac{E_h N}{2RT}\right)$$  \hspace{1cm} (4)

Nonlinear least-squares fitting of the screw-sense excess $se$ against the number of the chiral unit $N$ was performed by using the Solver Function in Microsoft Office Excel 2007. Sums of the squares of the deviation were minimized by varying the proportionality factor $F$ and the energy difference per monomer unit $E_h$. These parameters were successfully converged.

---


and the final values were as follows.

\[ F = 4.1785 \times 10^4, \quad E_h -0.5909 \text{ kJ mol}^{-1} \quad (5) \]

To evaluate the validity of the obtained value of \( F \), the difference of the energy between \( P \) and \( M \) helices \( \Delta G \), which was obtained from \( F \) and \( g_{abs} \), were plotted against the number of chiral unit \( N \). Ideally, \( \Delta G \) is proportional to the number of chiral unit \( N \), and the gradient represents the energy difference per monomer unit \( E_h \).

\[ \Delta G = G^P - G^M = E_h N = \text{arctanh}(F \times g_{abs})/2RT \quad (6) \]

The relationships between \( \Delta G \) and \( N \) (12 - -12) with varied \( F \) (4.1785\( \times 10^4 \) - 4.1785\( \times 10^4 \times 0.80 \)) are shown in Figure S3. Only the region where \( N \) is between 12 and -12 is shown, because the values of \( g_{abs} \) for \(|N| > 12\) are too large to evaluate \( \Delta G \) accurately. In this region, the effect of the measurement error is not negligible due to the nature of arc hyperbolic tangent function. Goodness of fit, as measured by Pearson R\(^2\), is greater than 0.999 when \( F \) is 4.1785\( \times 10^4 \). Smaller \( F \) makes the line sigmoidal, and the linearity was not obtained.

**Figure S3.** The relationships between \( \Delta G \) and \( N \) with varied \( F \).
5. CD and UV Spectra of the Polymers

**Figure S4.** UV/vis absorption spectrum and CD spectrum of poly-1 in CHCl$_3$ (1.82 × 10$^{-2}$ g/L).

**Figure S5.** UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(38/2) in CHCl$_3$ (2.46 × 10$^{-2}$ g/L).
Figure S6. UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(36/4) in CHCl₃ (1.53 × 10⁻² g/L).

Figure S7. UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(32/8) in CHCl₃ (1.79 × 10⁻² g/L).
**Figure S8.** UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(28/12) in CHCl₃ (1.49 × 10⁻² g/L).

![Absorbance and Ellipticity Graph](image)

**Figure S9.** UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(20/20) in CHCl₃ (2.31 × 10⁻² g/L).

![Absorbance and Ellipticity Graph](image)
**Figure S10.** UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(12/28) in CHCl$_3$ (2.56 x 10$^{-2}$ g/L).

![Absorbance and Ellipticity](image)

**Figure S11.** UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in CHCl$_3$ (2.39 x 10$^{-2}$ g/L).

![Absorbance and Ellipticity](image)
**Figure S12.** UV/vis absorption spectrum and CD spectrum of poly-1/(S)-2(36/4) in CHCl$_3$ (2.19 × 10$^{-2}$ g/L).

**Figure S13.** UV/vis absorption spectrum and CD spectrum of poly-1/(S)-2(32/8) in CHCl$_3$ (1.85 × 10$^{-2}$ g/L).
**Figure S14.** UV/vis absorption spectrum and CD spectrum of poly-1/(S)-2(28/12) in CHCl₃ (2.72 × 10⁻² g/L).

**Figure S15.** UV/vis absorption spectrum and CD spectrum of poly-1/(S)-2(20/20) in CHCl₃ (2.91 × 10⁻² g/L).
**Figure S16.** UV/vis absorption spectrum and CD spectrum of poly-(S)-2 in CHCl₃ (2.54 × 10⁻² g/L).

![UV/vis absorption spectrum and CD spectrum of poly-(S)-2 in CHCl₃](image)

**Figure S17.** UV/vis absorption spectrum and CD spectrum of poly-(R)-2(100) in CHCl₃ (1.60 × 10⁻² g/L).

![UV/vis absorption spectrum and CD spectrum of poly-(R)-2(100) in CHCl₃](image)
**Figure S18.** UV/vis absorption spectrum and CD spectrum of poly-(R)-2(200) in CHCl$_3$ (2.32 \times 10^{-2}$ g/L).

![UV/vis absorption spectrum and CD spectrum of poly-(R)-2(200) in CHCl$_3$](image)

**Figure S19.** UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl$_3$ (20:80, v/v, 2.00 \times 10^{-2}$ g/L).

![UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl$_3$](image)
Figure S20. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl$_3$ (30:70, v/v, $1.98 \times 10^{-2}$ g/L).

Figure S21. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl$_3$ (40:60, v/v, $1.98 \times 10^{-2}$ g/L).
**Figure S22.** UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl₃ (50:50, v/v, 1.45 × 10⁻² g/L).

![UV/vis absorption spectrum and CD spectrum](image)

**Figure S23.** UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl₃ (55:45, v/v, 1.45 × 10⁻² g/L).

![UV/vis absorption spectrum and CD spectrum](image)
Figure S24. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl₃ (60:40, v/v, 1.45 × 10⁻² g/L).

Figure S25. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl₃ (70:30, v/v, 1.98 × 10⁻² g/L).
Figure S26. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl₃ (80:20, v/v, 1.98 × 10⁻² g/L).

![UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl₃ (80:20, v/v, 1.98 × 10⁻² g/L).](image)

Figure S27. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl₃ (90:10, v/v, 1.98 × 10⁻² g/L).

![UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane/CHCl₃ (90:10, v/v, 1.98 × 10⁻² g/L).](image)
**Figure S28.** UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,2-Trichloroethane (2.01 × 10^{-2} g/L).

![UV/vis absorption spectrum and CD spectrum of poly-(R)-2](image)

**Figure S29.** UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(12/28) in 1,1,2-Trichloroethane (1.47 × 10^{-2} g/L).

![UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(12/28)](image)
Figure S30. UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(20/20) in 1,1,2-Trichloroethane (2.32 × 10^{-2} g/L).

![Graph](image)

Figure S31. UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(28/12) in 1,1,2-Trichloroethane (1.84 × 10^{-2} g/L).

![Graph](image)
Figure S32. UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(32/8) in 1,1,2-Trichloroethane (2.17 × 10^{-2} g/L).

Figure S33. UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(36/4) in 1,1,2-Trichloroethane (1.60 × 10^{-2} g/L).
**Figure S34.** UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(38/2) in 1,1,2-Trichloroethane (1.31 × 10^{-2} g/L).

![UV/vis absorption spectrum and CD spectrum of poly-1/(R)-2(38/2)](image)

**Figure S35.** UV/vis absorption spectrum and CD spectrum of poly-1 in 1,1,2-Trichloroethane (1.82 × 10^{-2} g/L).

![UV/vis absorption spectrum and CD spectrum of poly-1](image)
**Figure S36.** UV/vis absorption spectrum and CD spectrum of poly-1/(S)-2(36/4) in 1,1,2-Trichloroethane (1.86 × 10⁻² g/L).

**Figure S37.** UV/vis absorption spectrum and CD spectrum of poly-1/(S)-2(32/8) in 1,1,2-Trichloroethane (2.10× 10⁻² g/L).
Figure S38. UV/vis absorption spectrum and CD spectrum of poly-1/(S)-2(28/12) in 1,1,2-Trichloroethane (2.36 × 10⁻² g/L).

Figure S39. UV/vis absorption spectrum and CD spectrum of poly-1/(S)-2(20/20) in 1,1,2-Trichloroethane (1.34 × 10⁻² g/L).
**Figure S40.** UV/vis absorption spectrum and CD spectrum of poly-(S)-2 in 1,1,2-Trichloroethane (1.86 × 10^{-2} g/L).

**Figure S41.** UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in dichloromethane (1.95 × 10^{-2} g/L).
Figure S42. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in tetrahydrofuran (2.41 × 10⁻² g/L).

Figure S43. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1-butanol (1.66 × 10⁻² g/L).
**Figure S44.** UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,1-trichloroethane (1.40 × 10^{-2} g/L).

![UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,1,1-trichloroethane](image)

**Figure S45.** UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1-chlorobutane (1.73 × 10^{-2} g/L).

![UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1-chlorobutane](image)
Figure S46. UV/vis absorption spectrum and CD spectrum of poly-(R)-2(100) in 1-chlorobutane (1.73 × 10^{-2} g/L).

Figure S47. UV/vis absorption spectrum and CD spectrum of poly-(R)-2(200) in 1-chlorobutane (0.99 × 10^{-2} g/L).
Figure S48. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1-bromobutane (1.77 × 10^{-2} g/L).

![Figure S48](image1)

Figure S49. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in valeronitrile (2.10 × 10^{-2} g/L).

![Figure S49](image2)
Figure S50. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,2-dichloroetane (2.33 × 10⁻² g/L).

Figure S51. UV/vis absorption spectrum and CD spectrum of poly-(R)-2 in 1,3-dichloropropane (1.81 × 10⁻² g/L).