Supporting Information

Dissymmetry Factor Spectral Analysis Can Provide Useful Diastereomer Discrimination: Chiral Molecular Structure of an Analogue of (-)-Crispine A

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| **Table S1. Crystal data and structure refinement for 5** |
|----------------------------------------------------------|
| **Empirical formula** | C\textsubscript{16}H\textsubscript{23}NO\textsubscript{7} |
| **Formula weight** | 341.35 |
| **Temperature** | 296(2) K |
| **Wavelength** | 0.71073 Å |
| **Crystal system** | Orthorhombic |
| **Space group** | P 21 21 21 |
| **Unit cell dimensions** | a = 5.674(3) Å; α = 90°. |
| | b = 10.990(7) Å; β = 90°. |
| | c = 26.414(16) Å; γ = 90°. |
| **Volume** | 1647.2(17) Å\textsuperscript{3} |
| **Z** | 4 |
| **Density (calculated)** | 1.376 Mg/m\textsuperscript{3} |
| **Absorption coefficient** | 0.108 mm\textsuperscript{-1} |
| **F(000)** | 728 |
| **Crystal size** | 0.800 x 0.600 x 0.400 mm\textsuperscript{3} |
| **Theta range for data collection** | 3.085 to 19.732°. |
| **Index ranges** | -5 <= h <= 5, -10 <= k <= 10, -24 <= l <= 24 |
| **Reflections collected** | 7946 |
| **Independent reflections** | 1466 [R(int) = 0.2462] |
| **Completeness to theta = 19.732°** | 98.60% |
| **Refinement method** | Full-matrix least-squares on F\textsuperscript{2} |
| **Data / restraints / parameters** | 1466 / 0 / 226 |
| **Goodness-of-fit on F2** | 1.027 |
| **Final R indices [I>2\sigma(I)]** | R1 = 0.0832, wR2 = 0.1605 |
| **R indices (all data)** | R1 = 0.1702, wR2 = 0.1998 |
| **Absolute structure parameter** | -5.8(10) |
| **Extinction coefficient** | 0.033(8) |
| **Largest diff. peak and hole** | 0.266 and -0.257 e.Å\textsuperscript{-3} |
Table S2. Bond lengths [Å] and angles [°] in crystal structure of 5

| Bond                      | Length  | Bond                      | Length  |
|---------------------------|---------|---------------------------|---------|
| O(3)-C(12)                | 1.256   | C(6)-C(7)-C(8)            | 120.6   |
| O(4)-C(14)                | 1.403   | C(6)-C(7)-C(11)           | 121.9   |
| O(5)-C(15)                | 1.422   | C(8)-C(7)-C(11)           | 117.2   |
| O(1)-C(4)                 | 1.374   | C(14)-C(13)-C(12)         | 103.2   |
| O(1)-C(1)                 | 1.397   | N(1)-C(11)-C(7)           | 110.5   |
| N(1)-C(12)                | 1.31    | N(1)-C(11)-C(14)          | 102.4   |
| N(1)-C(11)                | 1.452   | C(7)-C(11)-C(14)          | 118.0   |
| N(1)-C(10)                | 1.457   | C(5)-C(4)-C(3)            | 121.0   |
| O(2)-C(3)                 | 1.34    | C(5)-C(4)-O(1)            | 123.0   |
| O(2)-C(2)                 | 1.42    | C(3)-C(4)-O(1)            | 115.8   |
| C(7)-C(6)                 | 1.381   | O(4)-C(14)-C(13)          | 111.5   |
| C(7)-C(8)                 | 1.39    | O(4)-C(14)-C(15)          | 108.6   |
| C(7)-C(11)                | 1.53    | C(13)-C(14)-C(15)         | 114.7   |
| C(13)-C(14)               | 1.5     | O(4)-C(14)-C(11)          | 105.7   |
| O(6)-C(16)                | 1.422   | C(13)-C(14)-C(11)         | 99.4    |
| C(13)-C(12)               | 1.52    | C(15)-C(14)-C(11)         | 116.4   |
| C(11)-C(14)               | 1.559   | O(5)-C(15)-C(16)          | 109.0   |
| C(4)-C(5)                 | 1.36    | O(5)-C(15)-C(14)          | 106.3   |
| C(4)-C(3)                 | 1.36    | C(16)-C(15)-C(14)         | 116.5   |
| C(14)-C(15)               | 1.5     | C(7)-C(6)-C(5)            | 116.7   |
| C(15)-C(16)               | 1.46    | C(7)-C(6)-C(9)            | 119.6   |
| C(6)-C(5)                 | 1.42    | C(5)-C(6)-C(9)            | 123.7   |
| C(6)-C(9)                 | 1.5     | C(9)-C(10)-N(1)           | 107.1   |
| C(10)-C(9)                | 1.46    | O(3)-C(12)-N(1)           | 126.3   |
| C(3)-C(8)                 | 1.38    | O(3)-C(12)-C(13)          | 125.2   |
| C(4)-O(1)-C(1)            | 117.2   | N(1)-C(12)-C(13)          | 108.5   |
| C(12)-N(1)-C(11)          | 111.9   | O(2)-C(3)-C(4)            | 116.0   |
| C(12)-N(1)-C(10)          | 125.0   | O(2)-C(3)-C(8)            | 125.0   |
| C(11)-N(1)-C(10)          | 123.0   | C(4)-C(3)-C(8)            | 118.8   |
| C(3)-O(2)-C(2)            | 115.7   | C(3)-C(8)-C(7)            | 121.1   |
### Table S3: VCD Band assignments for (1R,10bR,1’R) diastereomer

In the B3PW91/6-311++G(2d,2p)/PCM(methanol) predicted VCD spectrum, the VCD band positions and the associated vibrational modes are as follows:

- **1713 cm⁻¹** negative band: carbonyl stretching
- **1548 cm⁻¹** negative band: in-plane C-H bending of the benzene ring
- **1491 cm⁻¹** positive band: CH₂ bending at C5
- **1472 cm⁻¹** negative band: CH₂ bending at C5 and C6; and CH₃ bending of methoxy groups
- **1429 cm⁻¹** negative band: CH₃ bending of both methoxy groups, CH₂ bending at C2 and C-C stretching of the benzene ring
- **1323 cm⁻¹** negative band: CH₂ bend at C5, C6 and CH bend at C1’
- **1287 cm⁻¹** negative band: in-plane C-H bending of benzene ring and C-H bending at C10b
- **1247 cm⁻¹** positive band: predominantly from CH₂ bend at C6.
- **1231 cm⁻¹** negative band: CH₂ bending at C6 and C-H bend of benzene
Table S4: Energies, Populations\(^a\), and Ring Puckering Angles for Conformers of Three Diastereomers with Deuterated OH Groups at B3PW91/6-311++G(2d,2p)/PCM (Methanol)

| Conformer | Gibbs Energy (kcal/mol) | Population | N4-C5-C6-C6a | C1-C2-C3-N4 |
|-----------|------------------------|------------|---------------|-------------|
| (1\(R\),10\(b\)S,1\(R\)) |
| 20        | -1128.07 0.00          | 0.42       | 48.3          | 15.1        |
| 140       | -1128.07 0.15          | 0.33       | 51.8          | 21.0        |
| 150       | -1128.07 0.44          | 0.20       | 51.9          | 19.6        |
| 483       | -1128.07 1.51          | 0.03       | 47.9          | 20.9        |
| 119       | -1128.07 2.49          | 0.01       | 51.9          | 19.7        |
| (1\(S\),10\(b\)R,1\(R\)) |
| 113       | -1128.07 0.00          | 0.52       | -49.2         | -14.7       |
| 28        | -1128.07 1.19          | 0.07       | -52.5         | -20.7       |
| 85        | -1128.07 1.23          | 0.06       | -49.5         | -16.8       |
| 10        | -1128.07 1.30          | 0.06       | -52.1         | -20.0       |
| 142       | -1128.07 1.32          | 0.05       | -52.4         | -21.1       |
| 178       | -1128.07 1.32          | 0.05       | -52.4         | -21.0       |
| 561       | -1128.07 1.50          | 0.04       | -50.8         | -17.0       |
| 383       | -1128.07 1.55          | 0.04       | -50.7         | -16.9       |
| 185       | -1128.07 1.69          | 0.03       | -49.1         | -14.3       |
| 81        | -1128.07 1.77          | 0.03       | -52.7         | -20.7       |
| 77        | -1128.07 1.89          | 0.02       | -49.2         | -15.2       |
| 74        | -1128.07 1.96          | 0.02       | -49.3         | -14.9       |
| 12        | -1128.06 2.63          | 0.01       | -52.7         | -20.6       |
| (1\(S\),10\(b\)S,1\(R\)) |
| 33        | -1128.07 0.00          | 0.74       | 52.5          | 20.5        |
| 86        | -1128.07 1.19          | 0.10       | 53.0          | 21.4        |
| 50        | -1128.07 1.50          | 0.06       | 51.4          | 18.4        |
| 11        | -1128.07 1.73          | 0.04       | 52.6          | 20.3        |
| 44        | -1128.07 1.80          | 0.03       | 52.6          | 20.3        |
| 60        | -1128.07 1.93          | 0.03       | 49.6          | 15.6        |
| 177       | -1128.07 2.91          | 0.01       | 52.8          | 19.5        |

\(^a\)Only conformers with population of at least 1% are listed
Table S5: SSO values\(^a\) of VDF spectra with maximum magnitudes for OH deuterated diastereomers as a function of experimental reliability criterion

| Diastereomer                | SimVDF |         |         |         |
|-----------------------------|--------|---------|---------|---------|
|                             | 0 ppm  | 10 ppm  | 40 ppm  |         |
| \((1R,10bR,1'R)\)           | 0.65   | 0.66    | 0.61    |         |
| \((1R,10bS,1'R)\)           | -0.37  | -0.35   | -0.23   |         |
| \((1S,10bR,1'R)\)           | 0.35   | 0.36    | 0.16    |         |
| \((1S,10bS,1'R)\)           | -0.45  | -0.46   | -0.44   |         |

\(^a\)1160-1800 cm\(^{-1}\) region used for VCD and VDF similarity overlap analyses
Figure S1: EA and ECD spectra for individual conformers of (1R,10bR,1'R) diastereomer and population weighted spectra.
Figure S2. MOs responsible for the 252 nm transition.
Figure S3. MOs responsible for the 226 nm transition.
Figure S4. MOs responsible for the 200 nm transition.
Figure S5. Comparison of experimental EA, ECD and EDF spectra of 5 with those predicted for (1S,10bR,1’S) diastereomer. The ECD spectra for (1S,10bR,1’S) diastereomer were obtained by multiplying the ECD of (1R,10bS,1’R) diastereomer with -1. In the left vertical panel, the predicted wavelengths are scaled with 1.055 (which corresponds to maximum SimECD value) and overlaid on experimental spectra. In the right vertical panel, QC predicted spectra obtained with unscaled band positions are presented.
Figure S6. Comparison of experimental EA, ECD and EDF spectra of 5 with those predicted for (1S,10bR,1'R) diastereomer. In the left vertical panel, the predicted wavelengths are scaled with 1.05 (which corresponds to maximum SimECD value) and overlaid on experimental spectra. In the right vertical panel, QC predicted spectra obtained with unscaled band positions are presented.
Figure S7. Comparison of experimental EA, ECD and EDF spectra of 5 with those predicted for (1R,10bR,1’S) diastereomer. The ECD spectra for (1R,10bR,1’S) diastereomer were obtained by multiplying the ECD of (1S,10bS,1’R) diastereomer with -1. In the left vertical panel, the predicted wavelengths are scaled with 1.04 (which corresponds to maximum SimECD value) and overlaid on experimental spectra. In the right vertical panel, QC predicted spectra obtained with unscaled band positions are presented.
Figure S8. Comparison of experimental VA, VCD and VDF spectra of 5 with those predicted for (1S,10bR,1’S) diastereomer. The VCD spectra for (1S,10bR,1’S) diastereomer were obtained by multiplying the VCD of (1R,10bS,1’R) diastereomer with -1. In the left vertical panel, the predicted wavenumbers are scaled with 0.9795 (which corresponds to maximum SimVCD value) and overlaid on experimental spectra. In the right vertical panel, QC predicted spectra with unscaled wavenumbers are stacked over experimental spectra and band positions labeled.
Figure S9. Comparison of experimental VA, VCD and VDF spectra of 5 with those predicted for (1S,10bR,1’R) diastereomer. In the left vertical panel, the predicted wavenumbers are scaled with 0.9805 (which corresponds to maximum $Sim_{VCD}$ value) and overlaid on experimental spectra. In the right vertical panel, QC predicted spectra with unscaled wavenumbers are stacked over experimental spectra and band positions labeled.
**Figure S10.** Comparison of experimental VA, VCD and VDF spectra of 5 with those predicted for (1R,10bR,1'S) diastereomer. The VCD spectra for (1R,10bR,1'S) diastereomer were obtained by multiplying the VCD of (1S,10bS,1'R) diastereomer with -1. In the left vertical panel, the predicted wavenumbers are scaled with 0.9795 (which corresponds to maximum $Sim_{VCD}$ value) and overlaid on experimental spectra. In the right vertical panel, QC predicted spectra with unscaled wavenumbers are stacked over experimental spectra and band positions labeled.