

**Supramolecular chirality control by solvent changes. Solvodychroic effect on
chiral porphyrin aggregation**

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Supplementary Material

Experimental

General. UV-visible spectra were performed on a Perkin Elmer λ 18 Spectrophotometer. Solvents used were of highest degree of purity and used as received. Chemicals were of the highest grade available and were used without further purification. Silica gel 60 (70-230 mesh) was used for column chromatography. Solvents employed in the spectroscopic studies are of spectroscopic grade and used as received. Milli-Q, Millipore, previously doubly distilled water, was used for the preparation of porphyrin aqueous solutions.

Kinetic studies: Kinetic experiments were performed on a Perkin Elmer λ 18 Spectrophotometer equipped with a thermostating apparatus, by measuring the UV-Visible spectroscopic changes of **1H₂** with time. Porphyrin aqueous solutions, suited for kinetic studies, were prepared as follows. Proper aliquots, of a **1H₂** millimolar stock solution in ethanol (15÷150 μ L), were added to a 1.0 mL of ethanol in an 8 mL glass vial. To this solution 3.0 mL of water were then added and the resulting solution vigorously shaken. A 3 mL portion was then transferred in a quartz cuvette and the relative UV-Visible spectra acquired. This procedure ensures a 75:25 H₂O/EtOH (v:v) final solvent composition, with a final **1H₂** concentration spanning in the range of 1.5 to 9.0 x 10⁻⁵ M.

Values of k were obtained by analysing the absorbance (extinction) vs. time data points by a nonconventional kinetic treatment, earlier proposed by Pasternack, for related case of aggregation of porphyrin derivatives on (bio)polymers templates. The equation used is as follows:

$$E = E_{inf} + (E_0 - E_{inf})\exp[-(kt)^{n+1}/(n+1)]$$

where E , E_0 , E_{inf} are the extinction values at time t , initially, and at equilibrium, respectively. The kinetic parameters, k and n , were obtained by nonlinear least-squares regression fit (Kaleidagraph® program, Synergy Software, 2003) over hundreds of experimental data points. Values obtained at different wavelength (*e.g.* 450 nm) were similar, within experimental errors.

A different protocol, entailing the simple addition of **1H₂** stock solution to a preformed H₂O/EtOH mixture, gave less reproducible results. Attempts to perform kinetic runs in 90:10 H₂O/EtOH (v:v) by standard routine equipment failed, as the spectral pattern changes were too rapid to be conveniently followed. Studies by rapid-mixing methods are under way, and the results will be reported elsewhere. Kinetic experiments have been also carried out by CD spectroscopy, obtaining experimental data in fair agreement to those obtained by UV-Visible techniques. A typical plot, showing the relative spectral variation upon aggregation, is reported in Figure S1.

CD spectroscopic studies. CD spectra have been performed on a JASCO J-600, equipped with a thermostated cell holder, and purged with ultra-pure nitrogen gas.

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Resonance light scattering experiments: RLS experiments have been performed on a Spex Fluorolog Fluorimeter. Spectra have been acquired, at 25 ± 0.5 °C, in a “synchronous scan” mode, in which the emission and excitation monochromators are pre-set to identical wavelengths. Solutions have been prepared by following the protocol used in the kinetic experiments.

Preparation of porphyrin derivatives. All the reactions were carried out in an inert atmosphere. The protocol followed for the synthesis of **1H₂** is outlined in Scheme S1. *N*-[5-(4-Aminophenyl)-10,15,20-triphenylporphyrinyl]-L-prolin(*N*-methyl)amide, **2H₂**. To a stirred solution of 0.4 g of 5-(4-aminophenyl)-10,15,20-triphenylporphyrin (0.635 mmol) in 50 mL of anhydrous THF kept at 0 °C, 0.082 g of *N*-methyl-L-proline monohydrate (0.635 mmol), 0.1 g of *N*-methyl-morpholine (0.80 mmol), and 0.086 g of HOBT (0.635 mmol) were added. The reaction mixture was stirred under a nitrogen atmosphere for 1 hour at 0 °C. EDC-HCl (0.129 g, 0.667 mmol) was then added and the reaction mixture was stirred for additional 48 hours at room temperature. After that time a tlc run (CHCl₃-1% MeOH) showed no further progress of the reaction. The solvent was then removed under reduced pressure and the residue dissolved in 100 mL of chloroform and extracted with brine (3 x 100 mL). The organic layer was dried (Na₂SO₄) and the solvent evaporated to give a red solid that was applied to a short SiO₂ chromatographic column and eluted with a CHCl₃/CH₃OH 9:1 v/v solvent mixture. The unreacted aminophenylporphyrin derivative was separated. The L-proline-porphyrin conjugate was subsequently separated by eluting with a CHCl₃/CH₃OH 1:1 v/v solvent mixture. A 0.090 g crop (0.120 mmol; 18% yield) of the title porphyrin was recovered after solvent evaporation, and used without further purification in the subsequent reactions.

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UV-Vis (CHCl₃): λ_{\max} (log ϵ) 419 (5.1), 514 (3.8), 546 (3.6), 586 (3.5), 645 (3.2).

FAB-MS (NBA), m/e : 741 [M-H]⁺.

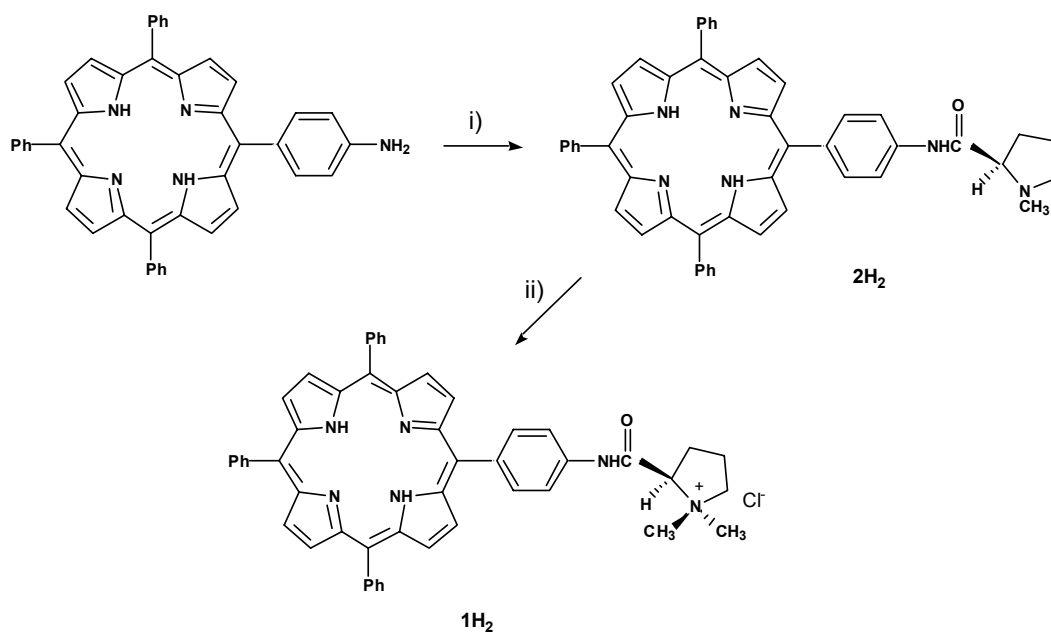
N-[5-(4-aminophenyl)-10,15,20-triphenylporphyrinyl]-*L*-(*N,N*-dimethyl)prolininium amide chloride, **1H₂**. In a 100 mL two-necked round bottomed flask, 0.06 g of porphyrin **2H₂** (0.08 mmol) were dissolved in 50 mL of dry DMF. To this solution, stirred under an inert atmosphere, 600 mg of CH₃I (4 mmol) were added. The reaction mixture was stirred at room temperature for 24 hours. After that time a tlc run (CHCl₃- 5% CH₃OH) showed no further progress of the reaction. Usual workup of the mixture gave, after column chromatography (SiO₂, CHCl₃-5% CH₃OH as eluant) gave a red microcrystalline solid. The product was subsequently dissolved in methanol (25 mL) and stirred overnight with a large excess of solid NaCl (1 g). The mixture was then filtered and evaporated under reduced pressure. The red solid was then dissolved in the minimum amount of CH₂Cl₂, filtered and crystallised by addition of *n*-pentane obtaining 0.05 g (0.065 mmol, 80% yield) of **1H₂**, as a bright purple crystalline solid.

UV-Vis (CHCl₃): λ_{\max} (log ϵ) 419 (5.0), 514 (3.7), 546 (3.6), 586 (3.5), 645 (3.1).

¹H-NMR (CD₃OD), δ : 9.1-8.5 (brs, 8H, pyrrole β -Hs), 8.2 (m, 10H, Aromatics), 7.8 (m, 9H, Aromatics), 3.9 (m, 1H, proline δ -H), 3.7 (m, 1H, proline δ -H), 3.45 (d, J = 12 Hz, 6H, proline NMe), 2.7 (m, 2H, proline β -H), 2.4 (m, 2H, proline γ -H), -2.81 (brs, 2H, pyrrole NH) ppm.

FAB-MS (NBA), m/e : 756 [M-Cl]⁺.

Schemes and Figures



Scheme 1. i) EDC, HOBT, *N*-methyl morpholine, L-(*N*-Me)proline, CHCl₃, 1 h at 0 °C, then 48 h at r.t. ii) CH₃I, DMF, r.t. 24 h. NaCl in MeOH, r.t. overnight.