Directed Covalent Assembly of Rigid Organic Nanodisks Using Self-Assembled Temporary Scaffolds

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Supporting Information

Materials and Methods

DMPC and DHPC were purchased from Avanti Lipids Inc. Styrene and divinylbenzene were purchased from Sigma-Aldrich. Lucirin TPO was purchased from BASF Aktiengesellschaft (Germany).

UV spectra of styrene and divinylbenzene. Styrene or divinylbenzene were added to water and allowed to diffuse at ambient temperature for 30 minutes. Solubility of styrene in water was previously reported to be 0.031-0.033 %,[1] which is sufficient to obtain a UV spectrum. UV measurements were performed on an Agilent 8453 UV-vis spectrophotometer. Spectra of divinylbenzene in bicelles and in water are shown on Figure S1. Divinylbenzene exhibits similar spectral behavior to styrene (Figure 2 of main manuscript) when transferred from polar to non-polar environment.

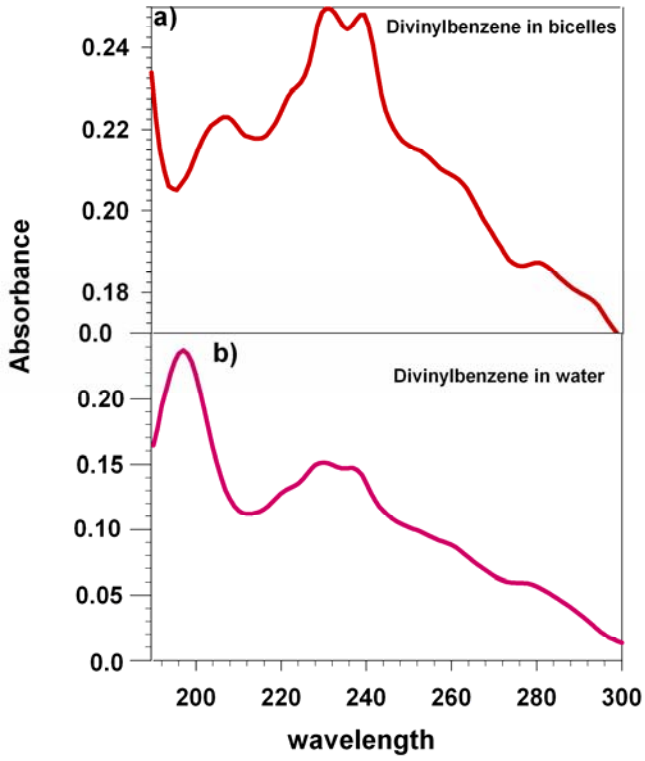
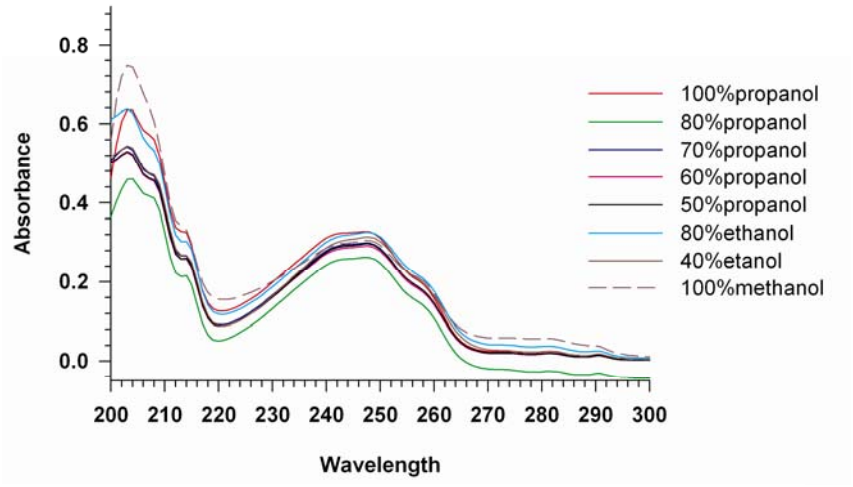
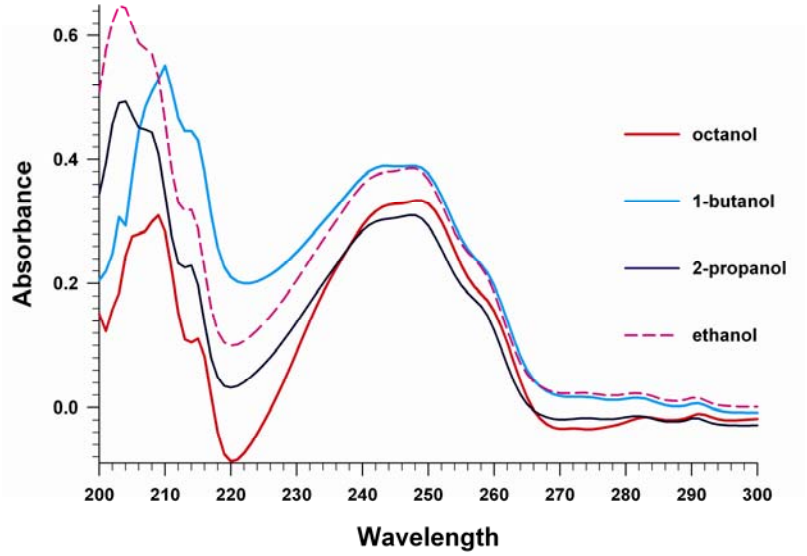


Figure S1. UV spectra of divinylbenzene in: a) bicelle solution and b) water.

[1] W.H. Lane, *Ind. Eng. Chem. Anal. Ed.*, 1946, **18**, 295-296





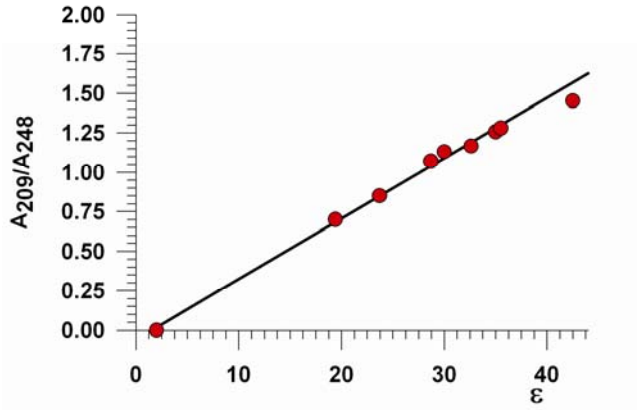


Figure S2. UV spectra of styrene in solvents with different polarity and a calibration curve used to calculate the dielectric constant for styrene in bicelle solution. Data points on the curve are taken from the spectra above and literature values for dielectric constants.

Measurements of monomers by gas chromatography (GC). After incubation of bicelles with styrene/divinylbenzene mixture, entrapped monomers were extracted with hexane and analyzed by GC as described previously.[2] For monomer/lipid ratios below 0.47, all monomers (within experimental error) used for the incubation with bicelles were found in the extract.

Transmission electron microscopy (TEM): TEM images were obtained with a JEOL JEM-1200EXII. The working voltage was 100kV. Samples were negatively stained with 2% phosphotungstic acid (pH 6.2). Before staining, the samples were adsorbed into 200-mesh carbon grid by carefully placing the grid on one drop of sample. A paper filter was then used to wipe away the excess of sample from the grid, which was subsequently placed on a drop of 2% phosphotungstic acid. After two minutes the grid was removed and the excess of liquid was carefully wiped with a filter paper.

Scanning electron microscopy (SEM): SEM images were obtained with a Philips XL 30ESEM instrument. Nanodiks samples were coated with 2nm Au-Pd layer using EMS 590 X sputter.

Liquid Chromatography/Mass Spectrometry (LC-MS): LC-MS measurements were carried out using LCQ Advantage system. The flow rate was set at 0.5mL/min, temperature was 300 ºC, mobile phase was 2% glacial acetic acid in methanol, the ion source was electrospray ionization (ESI), the MS was set for positive ion identification. A sample containing polymerized nanodisks in the interior of DMPC/DHPC bicelles was placed in a culture tube, and thoroughly mixed with 10ml of methanol to dissolve the lipid shell and precipitate the nanodisks. After centrifugation at 4000 g for 5 min, the polymerized material precipitated and the upper methanol layer was collected for phospholipids analysis by LC-MS. The operation was repeated ten times. No lipids were found in methanol after the 5th washing step. The results of the LC-MS measurements are shown on Figure S3.

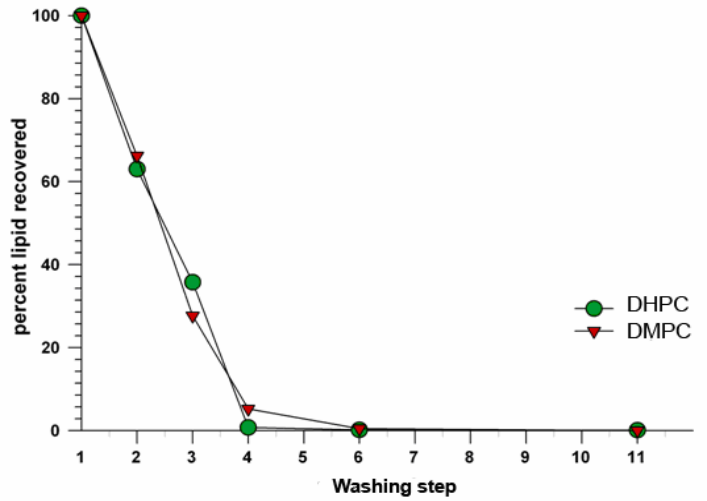


Figure S3. Lipids found in methanol by LC-MS after washing nanodisks. Lipid content in methanol after the first washing step is taken as 100%.

[2] L.T. Banner, D.C. Danila, K. Sharpe, M. Durkin, B. Clayton, B. Anderson, A. Richter, E. Pinkhassik, *Langmuir*, 2008, **24**, 11464-11473.

Dynamic light scattering (DLS). The disk sizes were measured using Dynapro^{TM} Titan stand alone Dynamic Light Scattering instrument. Samples were prepared by dispersing a small amount (~1 mg) of nanodisk powder in 10 mL of toluene and sonicating the suspension for 0.5 - 1 min. This stock suspension was diluted 10-100 fold prior to measurements.

To study the stability of nanodisks suspension in toluene, DLS measurements were performed after storing a suspension for two weeks at ambient conditions. DLS data, shown on Figure S4, support long-term stability of a monodisperse suspension of nanodisks in toluene.

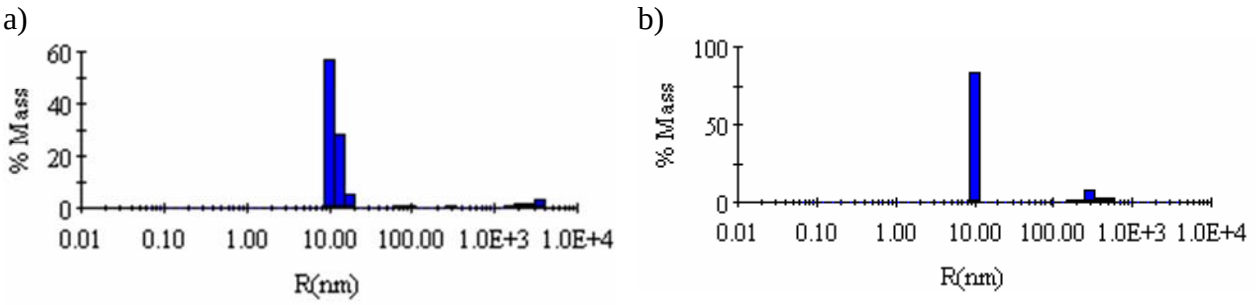


Figure S4. DLS data for nanodisks suspension in toluene: a) immediately after preparation and b) after two-week storage at ambient conditions.