Electronic Supplementary Material (ESI) for Chemical Communications


# Supporting Information

## Construction of Supramolecular Helical Nanofibers Using Renewable Biomaterials: Self-Assembly of Cytidylic Acid-Appended Bolaamphiphile in Lemon Juice

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## Materials

Cytidilic acid-appended bolaamphiphile was synthesized in a manner similar to that described in a previous report (R. Iwaura et al, *Small*, **2010**, *6*, 1131.). Oxalic, malonic, succinic, gulutaric, adipic, pimelic, and citric acids were purchased from Tokyo Chemical Industry Co. (Tokyo, Japan) and used without further purification. $^{1}$H NMR was recorded on a Bruker Avance model 400 spectrometer (Bruker BioSpin; Billerica, MA).

## Preparation of self-assemblies

The pH of the aqueous solutions containing each di-carboxylic acid or citric acid were adjusted with aqueous solutions of 0.1 N NaOH. The final concentrations of the di-carboxylic acids and citric acid were $2\times10^{-2}$ M to ~$3\times10^{-2}$ M. One mg of C18C was added to aqueous solutions of the di-carboxylic acid or citric acid (100 μl), heated at 90 °C, sonicated for 60 min (Branson ultrasonicator model 1200), and gradually allowed to cool to room temperature. The final concentration of C18C was $1\times10^{-2}$ M. The self-assemblies were kept at room temperature overnight and subjected to microscopic observations and spectroscopic measurements.

## ATR-FTIR spectroscopy

For the ATR-FTIR spectroscopic measurements, a Spectrum 100 (Perkin-Elmer Corp.) instrument with a 4-cm$^{-1}$ resolution at 20 °C was used. The binary self-assembly of C18C and CA was prepared as described above at pH 4.7. For comparison, we prepared

the single-component self-assembly of C18C in aqueous HCl at pH 4.7. All the samples were freeze-dried prior to the ATR-FTIR measurements.

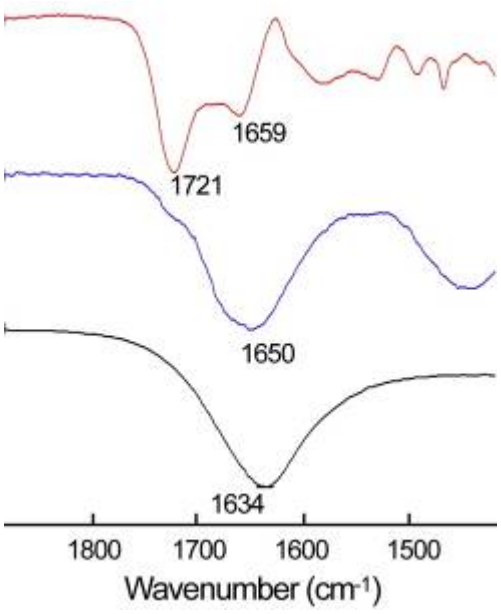


Figure S1 ATR-FTIR spectra for the freeze-dried binary self-assembly of C18C and CA (red), single-component of C18C (blue), and single-component CA (black).

**CD and UV-Vis spectroscopies**

For CD spectroscopy, self-assemblies were diluted by a factor of 10 with Milli-Q water. CD spectra were measured using a Jasco J-810 spectropolarimeter operating between 200 and 400 nm (scan rate 1 nm/s, sensitivity 0.01°, cell length = 0.01 cm). The UV-Vis spectrum for the aqueous solution of C18C ($1\times10^{-3}$ M) was recorded on a Shimazu TMSPC-8 spectrometer (cell length = 0.1 cm).

**AFM observations**

One microliter of each aqueous solution was placed on highly oriented pyrolytic

graphite (HOPG) and dried at room temperature for 30 minutes. The specimen was washed with a little water, dried again overnight, and then subjected to AFM observation on an S-image (SII Nanotechnology Inc.) with a silicon-microcantilever (spring constant 2 N $m^{-1}$, Olympus) in a tapping mode.

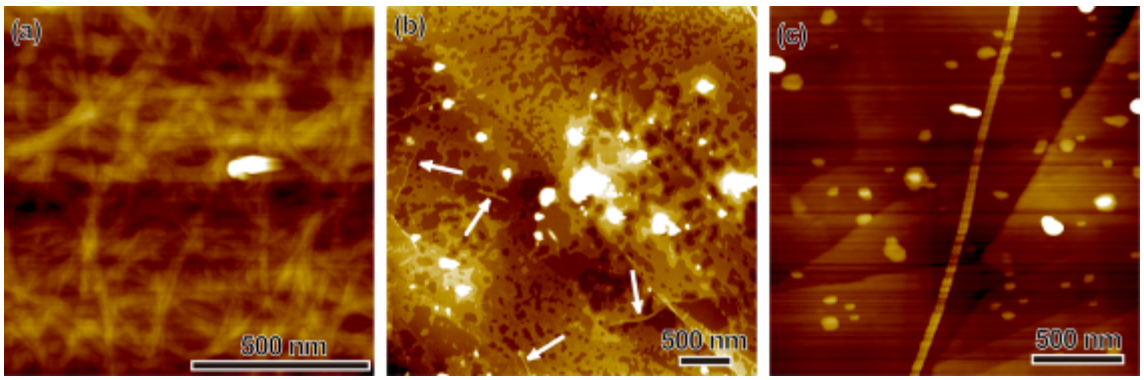


Figure S2 AFM images for the binary self-assembly of C18C and (a) malonic acid, (b) succinic acid, and (c) glutaric acid. The arrows in (b) indicate fiber structures.

**pH Titration**

For the pH titration of C18C, aqueous solution (2 ml) was prepared by addition of degassed distilled water to C18C and subsequent sonication at 25 °C. The resultant aqueous solution (10 mM) was then titrated with 0.1 N NaOH. The pH titration was carried out using an MP225 pH meter (Mettler Toledo).