

Electronic Supplementary Information

One-dimensional periodic mesoporous organosilica helical nanotube with amphiphilic property for removal of contaminants in water

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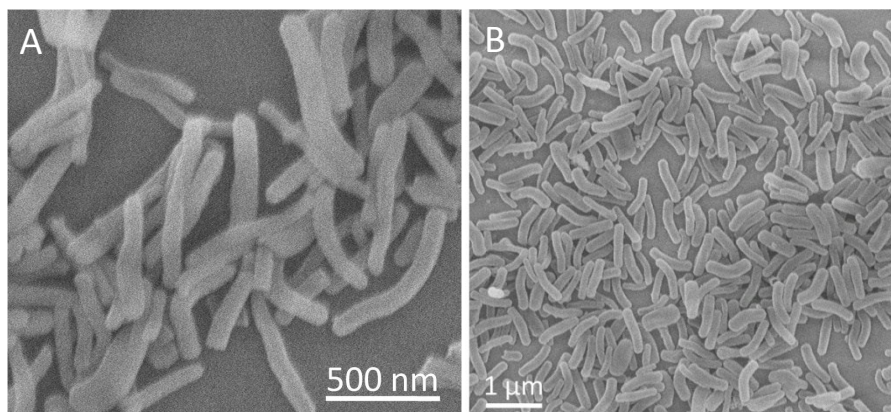


Figure S1. (A), SEM image of chiral mesoporous silica (CMS) helical nanorod with the length of 700~800 nm and the diameter of 80~100 nm. (B), Low-magnification SEM image of Et-PMO helical nanotube with the length of 700~800 nm and the diameter of approximately 120 nm.

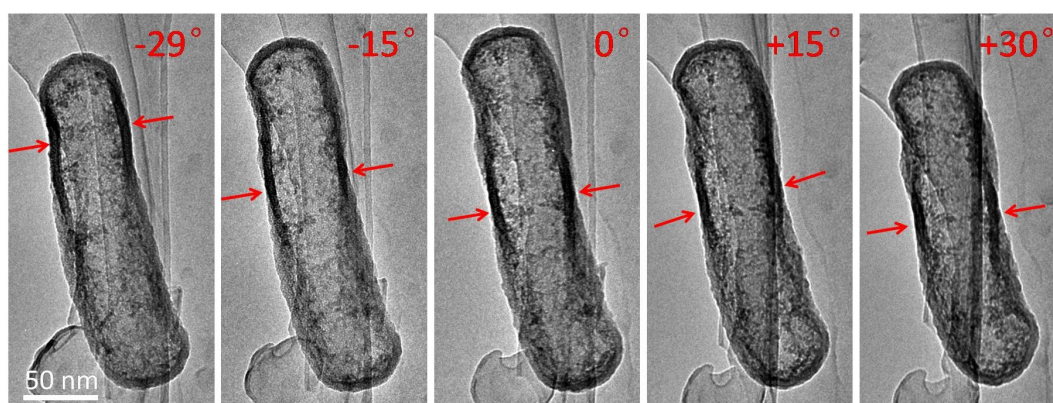


Figure S2. TEM images of a single Et-PMO helical nanotube taken at the tilt angles indicated. The tilt axis is not completely parallel to the central axis of nanotube.

Sample tilting is an efficient tool for studying the chirality of nanomaterials according to previous reports.^{1,2} The (10) fringes of CMS helical nanorod will move downward or upward as sample tilting, while the tilt axis is completely parallel to the axis of CMS nanorod which means the nanorod is perpendicular to the beam. Moreover, when the TEM specimen is tilted to make the nanorod not perpendicular to the beam, the (10) fringes become longer and curved. Therefore, we also used this efficient tool to characterize the chirality of Et-PMO helical nanotube, and the relevant TEM images taken at various tilt angles are shown in the Fig.3. Because a set of complete electron diffraction spots cannot be given, which is caused by the polycrystalline structure and the only partly ordered mesostructure, it is very difficult for us to make the tilt axis completely parallel to the central axis of nanotube. But it is sufficient to obtain some important information about the helicity of Et-PMO helical nanotube. With the sample tilting from 0° to -29°, the dark regions (directed by red arrows) not only move upward but also become longer, similar with that of CMS helical nanorod. Likewise, the dark regions become longer as the sample tilting from 0° to +29°. These results strongly reveal the spiral nature of the tubal wall and cavity.

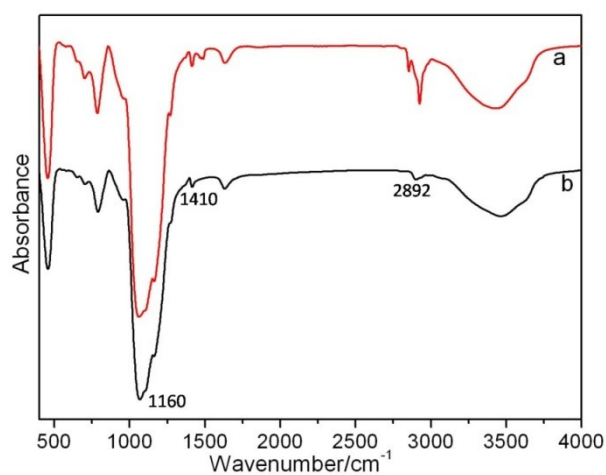


Figure S3. FT-IR spectra of as-made (a) and extracted (b) Et-PMO helical nanotube.

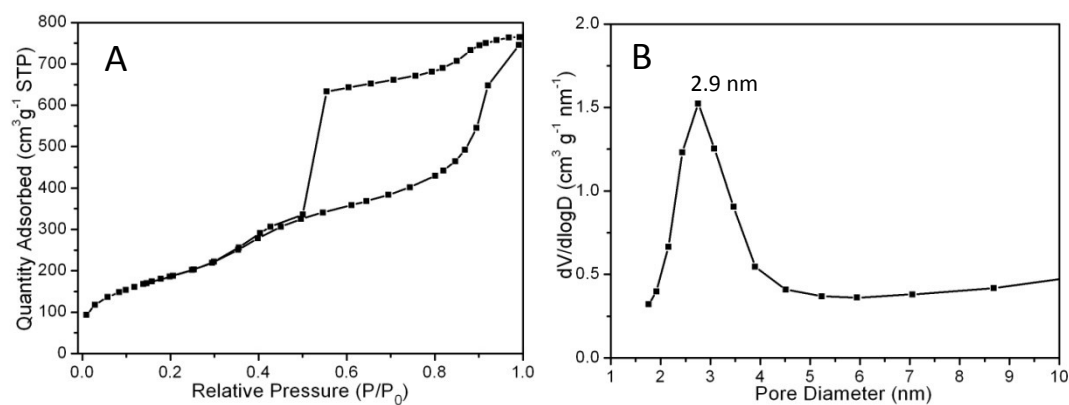


Figure S4. N₂ sorption isotherm (A) and relevant BJH pore size distribution (B) of Me-PMO helical nanotube.

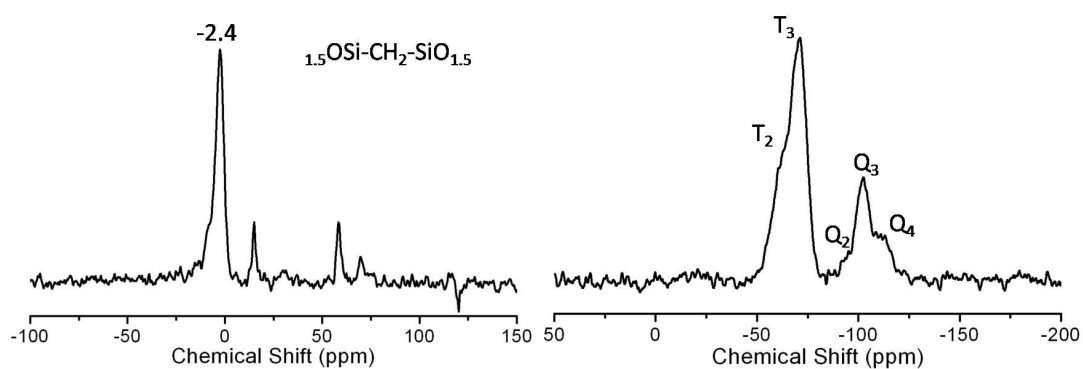


Figure S5. ¹³C NMR spectrum (left) and ²⁹Si NMR spectrum (right) of Me-PMO helical nanotube.

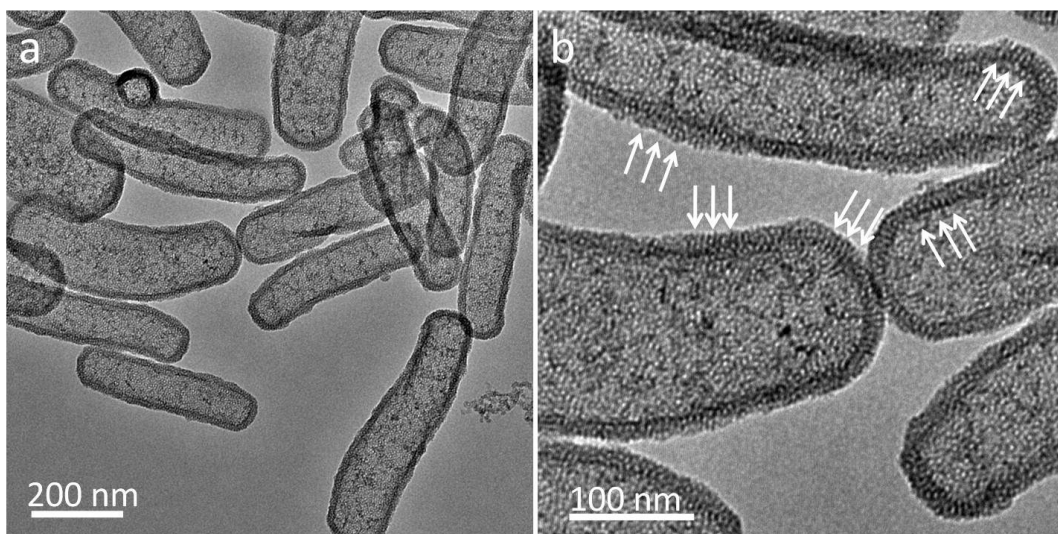


Figure S6. TEM images of fully hydrophilic mesosilica nanotube with perpendicular mesochannels in wall. The oriented mesochannels (directed by white arrows) can be clearly observed in the wall and end of mesosilica nanotube. This mesosilica nanotube was prepared via calcining the Et-PMO helical nanutubes at 550°C for 6 h.

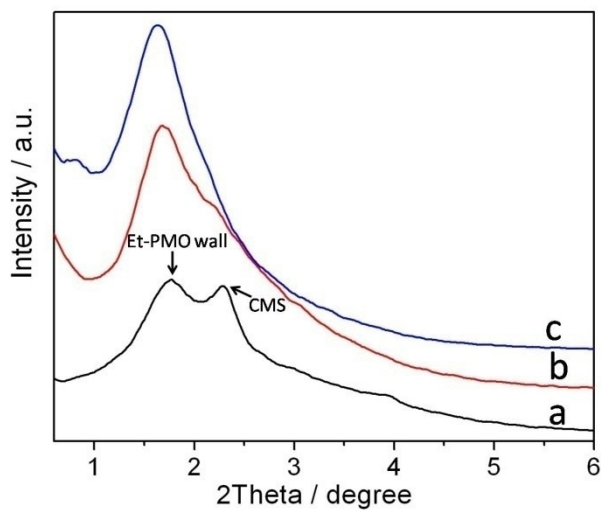


Figure S7. Small-angle XRD patterns of the samples under various reaction times at 100°C: (a) 0 h, (b) 1 h, (c) 4 h.

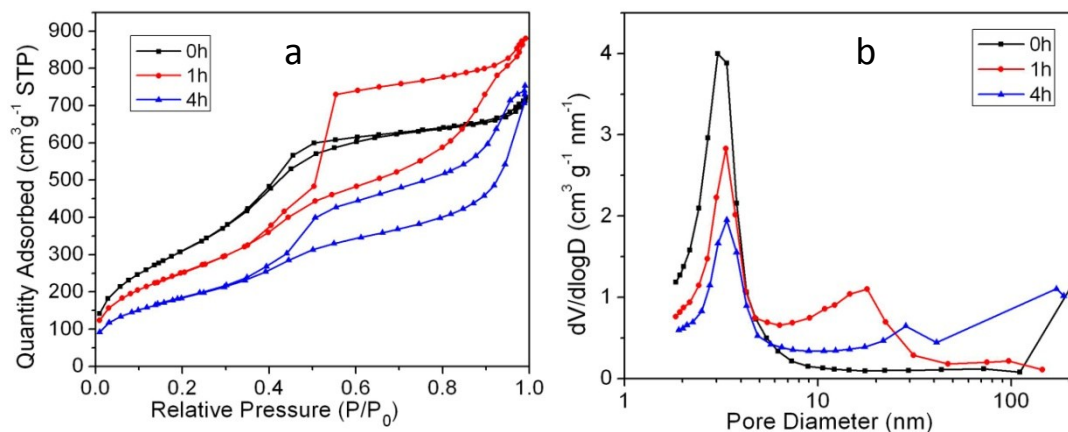


Figure S8. Nitrogen sorption isotherms (a) and the pore size distribution (b) of the samples under various reaction times at 100 °C.

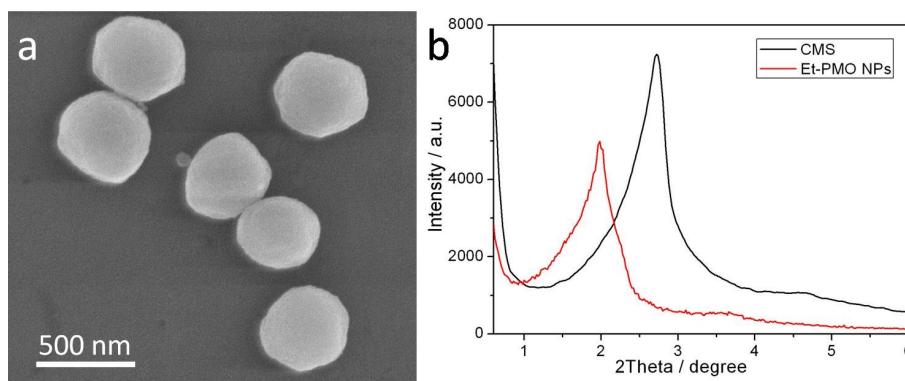


Figure S9. SEM image (a) and small-angle XRD pattern (b) of Et-PMO nanoparticles prepared under the same condition for CMS.

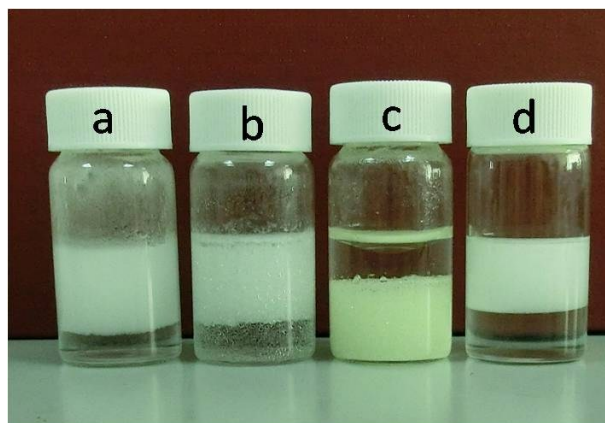


Figure S10. Digital photographs of W/O emulsions after standing for one month without disturbance in various systems of (a) octane-water, (b) toluene-water, (c) nitrobenzene-water and (d) octane-water; the Et-PMO helical nanotube was used as particle emulsifier in (a, b, c) and the surfactant CTAB was used as emulsifier in (d).

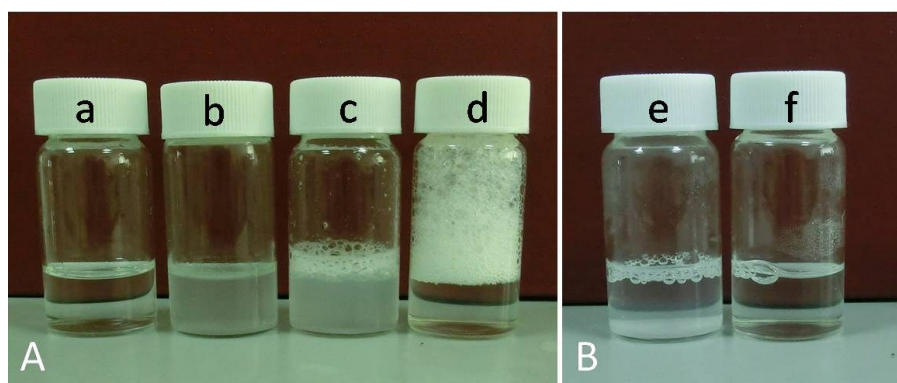


Figure S11. (A) Digital photographs of air/water emulsion using different emulsifiers: (a) blank, (b) MCM-41 nanoparticle, (c) Et-PMO helical nanotube, (d) surfactant CTAB. (B) Digital photographs of air/water emulsion using different emulsifiers (e) Et-PMO helical nanotube and (f) surfactant CTAB after standing for 4 days without disturbance.

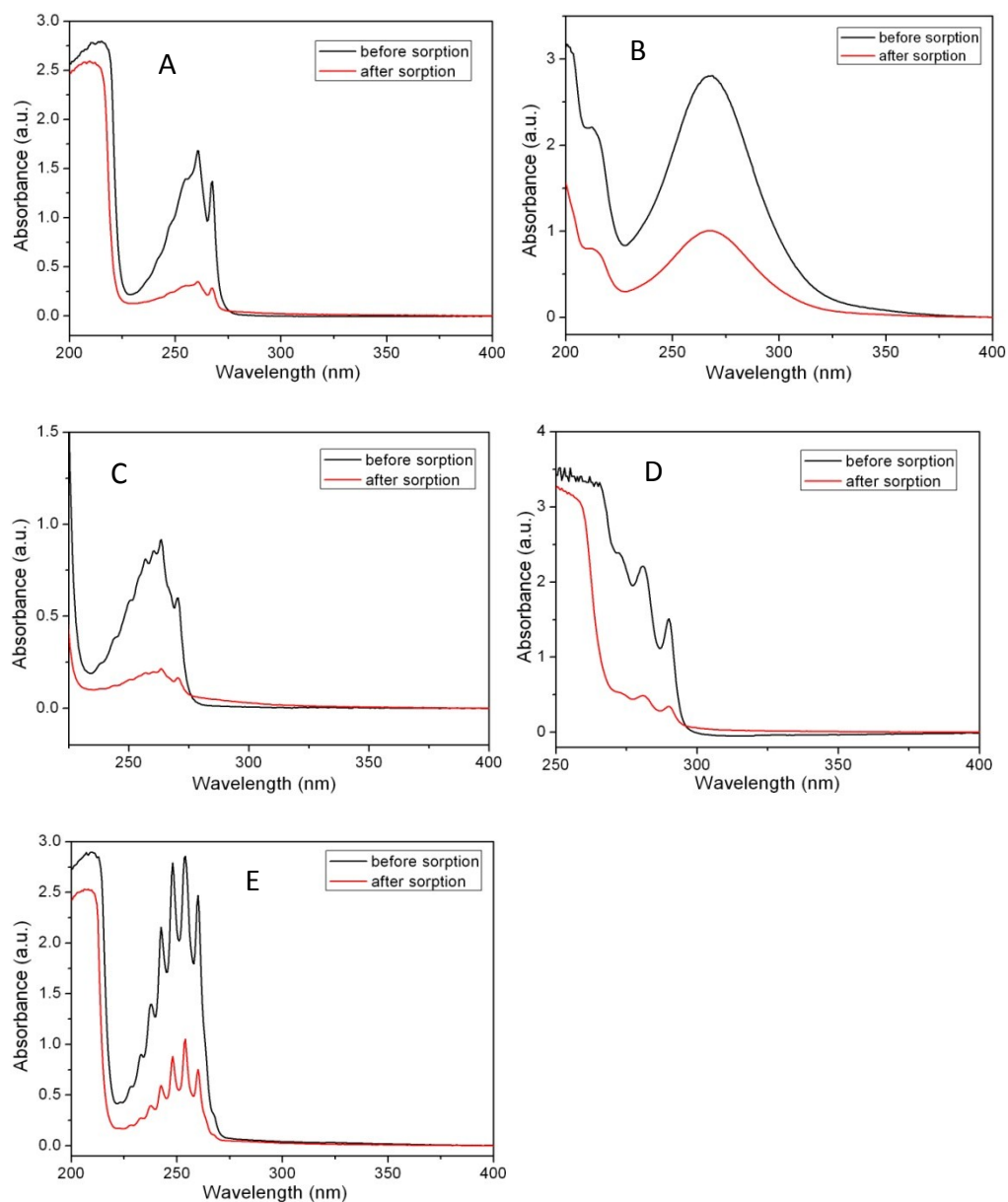


Figure S12. UV spectra of different hydrophobic organics aqueous solutions before and after sorption by Et-PMO helical nanotube: (A) toluene, (B) nitrobenzene, (C) chlorobenzene, (D) styrene, (E) benzene.

References

- [1] Zhu, Y.; He, J.; Shang, C.; Miao, X.; Huang, J.; Liu, Z.; Chen, H.; Han, Y. Chiral Gold Nanowires with Boerdijk–Coxeter–Bernal Structure. *J. Am. Chem. Soc.* **2014**, *136*, 12746-12752.
- [2] Han, Y.; Zhao, L.; Ying, J. Y. Entropy-Driven Helical Mesostructure Formation with Achiral Cationic Surfactant Templates. *Adv. Mater.* **2007**, *19*, 2454-2459.