Electronic Supplementary Information

Lyotropic meso-phase behavior of supra-molecular nanotubes with helical charge distribution

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Experiment Methods

All the samples were maintained in a constant temperature room at 25°C.Synchrotron radiation small angle X-ray scattering (SAXS) were performed at beamline 16B1 in Shanghai Synchrotron Radiation Facility when the samples aged for one and five month. TEM images were measured on a JET-2100F. All the TEM samples were stained by 2wt% neutral phosphotungstic acid for 5 minute. The structure factors are obtained by dividing the Form Factor of the nanotube from the experiment data.



Scheme S1 Chemical structure of $P_7(COONa)_3$ with diameter around 3.5nm.

Table S1 Statistics of diameter of nanotubes of $1.0wt\% P_7(COONa)_3$ after aging forone and five month respectively from TEM images.

	1	2	3	4	5	6	7	8	9	10	Average
One month	11.72	12.62	11.54	11.90	13.35	13.10	13.27	12.35	11.95	12.62	12.4nm
Five month	13.53	12.19	12.21	12.89	13.17	12.29	12.13	12.13	12.48	12.18	12.52nm



Figure S1.The form factor of the hollow nanotubes. The relevant parameters acquire from the TEM images the core-radius is 3.25nm, the radius is 6.25nm and the length with a polydispersity Gaussian distribution. The mean of the length is 2μ m.



Figure S2 The 1D-SAXS curves show the aggregation behaviors of the charged nanotubes with the increase of the mole ratios of NaCl to (a) 0.9 wt%,(b)1.1wt% P₇(COONa)₃ after aging for one month.



Figure.S3 TEM image of samples with mole ratio of (a)NaCl (b)Pr₄NCl to 1.0wt% P₇(COONa)₃ at 0.2:1 shows that the tubular structures are maintained in the presence of salts.



Figure-S4 Schematic representation of the manner $P_7(COONa)_3$ molecular selfassembled into helical column and azimuthal rotation around axis between helices at close separation.