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Supplementary Information for

Packaging vertically aligned carbon nanotubes into a heat-shrink tubing for efficient removal of phenolic pollutants

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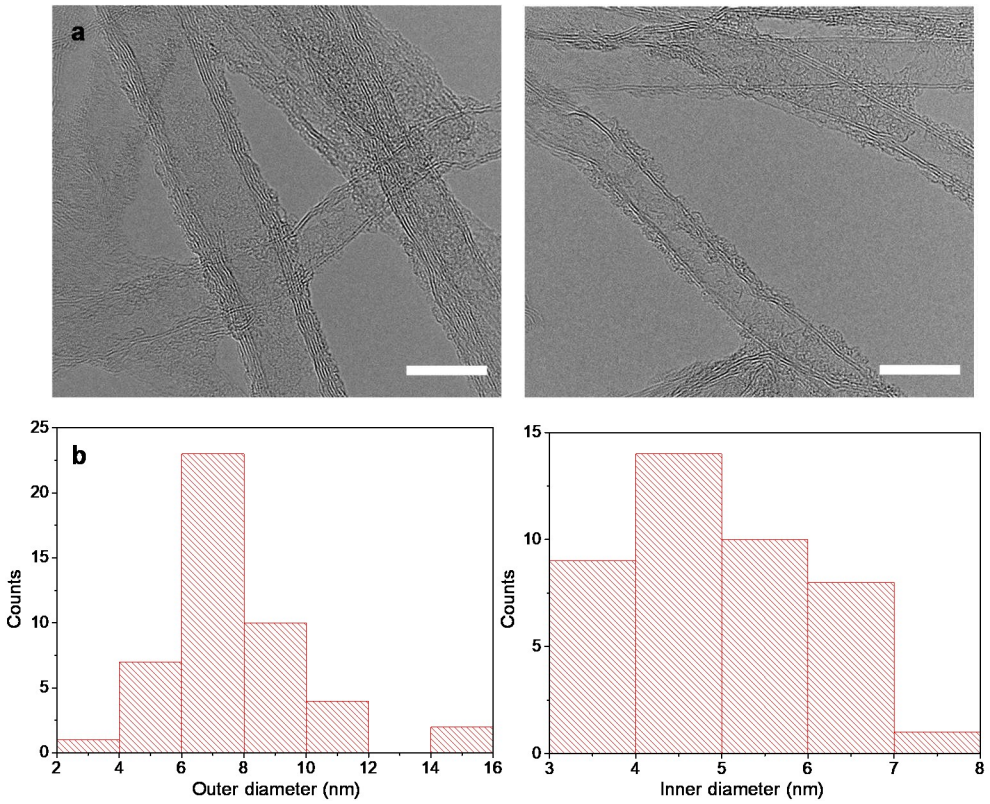

Fig. S1. Diameter distribution of pristine CNTs. (a) TEM images of pristine CNTs. (b) Distribution of outer (left) and inner (right) diameters of pristine CNTs. Scale bars: 10 nm

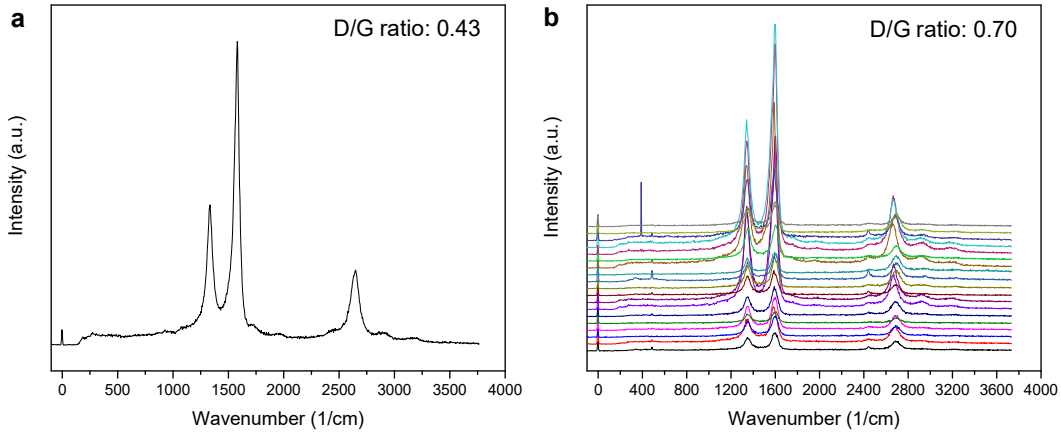

Fig. S2. Raman spectra of (a) pristine CNTs and (b) acid-treated CNTs. The ratio between disorder (D) and tangential (G) modes increased by the acid treatment, supporting covalent functionalization of the CNTs.

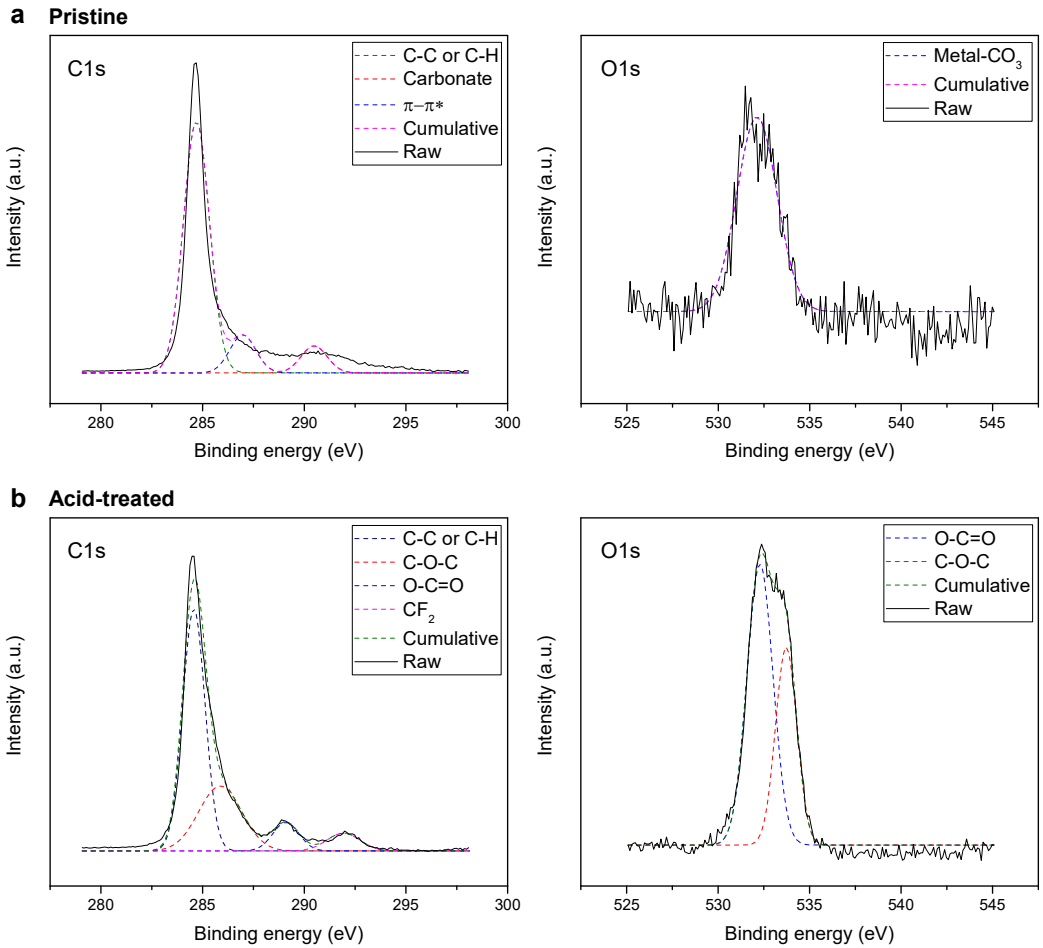

Fig. S3. X-ray photoelectron spectroscopy (XPS) analysis of VA-CNTs before and after acid treatment. (a) C1s (left) and O1s (right) signals of pristine CNTs, (b) C1s (left) and O1s (right) signals of acid-treated CNTs. Signals from C-O-C and O-C=O appeared after the treatment.

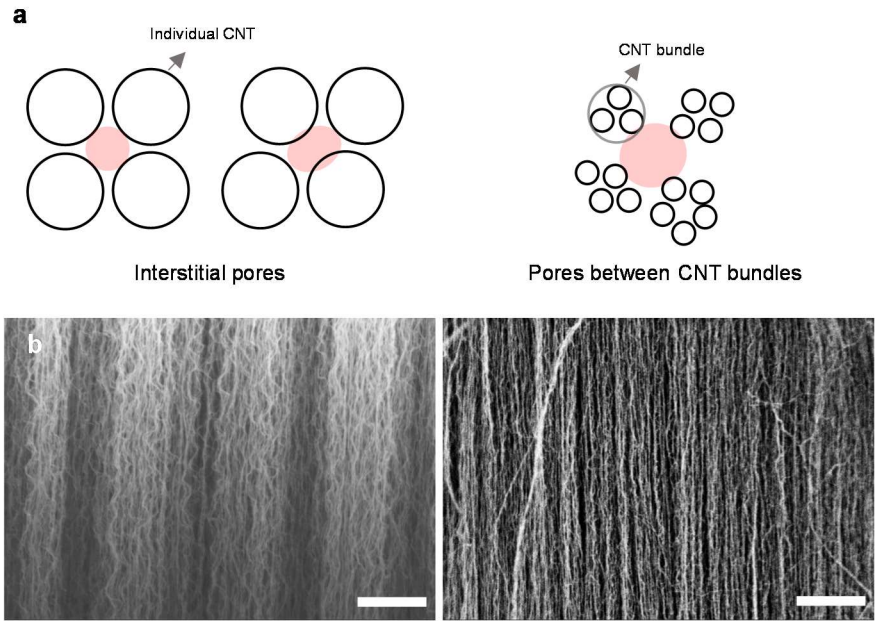

Fig. S4. Estimation of pore sizes in CNT-based adsorption tube. (a) Schematic showing two type of pores in CNTs. (b) SEM images of CNTs before (left) and after (right) the heat shrinkage. Scale bars: 2 μm

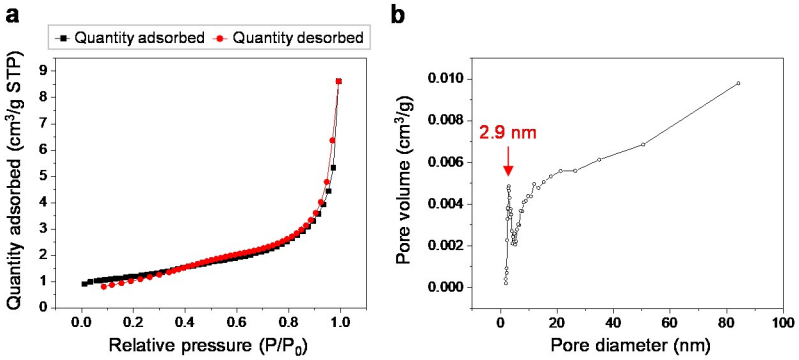

Fig. S5. Results of BET analysis. (a) BET surface area of CNT adsorption tubes. (b) Pore size distribution of CNT adsorption tubes.

Adsorbates	Octanol-water partition coefficient ($\log K_{OW}$)[1]	Adsorption capacity (mmol/g)
Phenol	1.46	0.76
m-cresol	1.96	0.79
2-chlorophenol	2.15	0.51

Table S1. Octanol-water partition coefficient and adsorption capacity of phenolic compounds

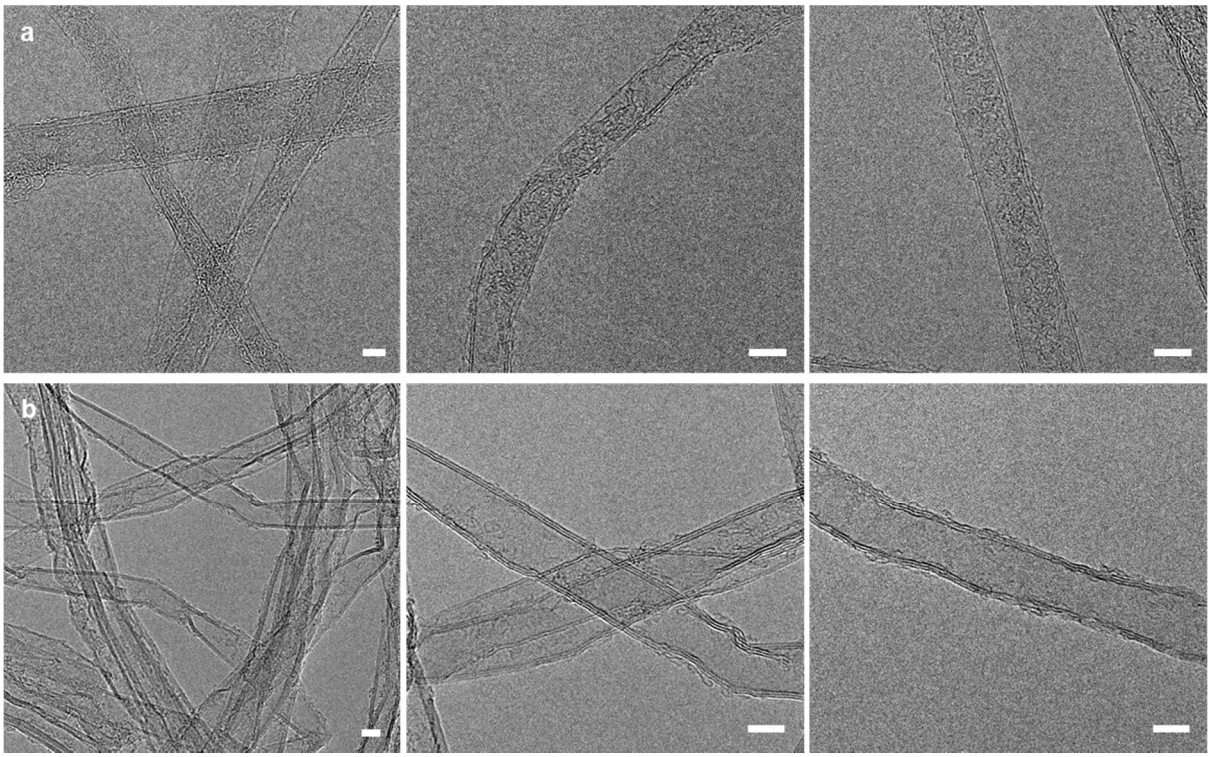

Fig. S6. Transmission electron microscopy (TEM) images of (a) pristine CNTs and (b) acid-treated CNTs. Here the acid treatment was performed by flowing nitric acid solution through VA-CNTs packaged by heat-shrink tubing. The amount of amorphous carbons was greatly reduced by the acid treatment. Scale bars: 5 nm.

Reference

1. C. Hansch, A. Leo, D. H. Hoekman and A. C. Society, *Exploring QSAR.: Hydrophobic, electronic, and steric constants*, American Chemical Society, 1995.