Supporting Information

Control loading Au nanoparticles on the surface of hydroxyl pillar[5]arene functionalized single-walled carbon nanotube and its application for catalysis and sensing

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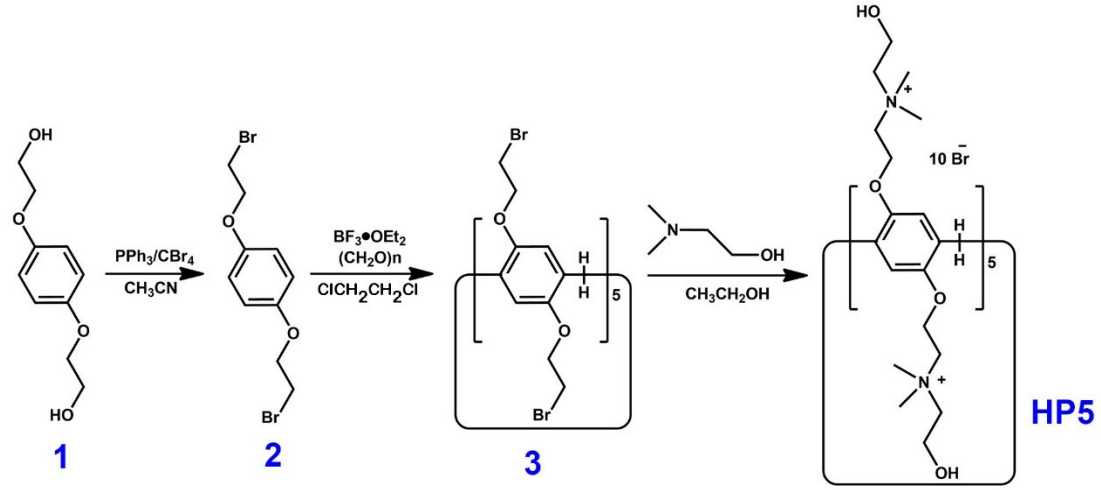
S1. Reagents and methods: 1,4-Bis(2-hydroxyethoxy)benzene, dichloroethane, boron trifluoride diethyl etherate, carbon tetrabromide, triphenylphosphine, acetonitrile, paraformaldehyde, were reagent grade and used as received. Solvents were either employed as purchased or driedaccording to procedures described in the literature. ^{1}H NMR and ^{13}C NMR spectra were recorded on a Bruker Avance DMX-400 spectrometer at 400 MHz and 600 MHz. HP5[S1,2] was synthesized according to the previous papers procedures.

S2. Synthesis of hydroxyl functionalized pillar[5]arene (HP5)[S1,2]



Scheme S1. Synthetic route of **HP5**.

The ^{1}H NMR spectrum of **2** is shown in Figure S1. ^{1}H NMR (400 MHz, $CDCl_3$, rt) δ (ppm): 6.857 (s, 4H), 4.239 (t, J = 4.0 Hz, 4H), 3.608 (t, J = 4 Hz, 4H). The ^{13}C NMR spectrum of **2** is shown in Figure S2. ^{13}C NMR (100 MHz, $CDCl_3$, rt) δ (ppm): 151.93, 114.79, 67.61, 28.21. The ^{1}H NMR spectrum of **3** is shown in Figure S3. ^{1}H NMR (600 MHz, $CDCl_3$, rt) δ (ppm): 6.914 (s, 10H), 4.226 (t, J = 5.4 Hz, 20H), 3.844 (s, 10H), 3.632 (t, J = 5.4 Hz, 20H). The ^{13}C NMR spectrum of **3** is shown in Figure S4. ^{13}C NMR (125 MHz, $CDCl_3$, rt) δ (ppm): 149.71, 129.21, 116.26, 69.13, 30.70, 29.64. The ^{1}H NMR spectrum of **HP5** is shown in Figure S5. ^{1}H NMR (600 MHz, D_2O, rt) δ (ppm): 6.948 (s, 10H), 4.494 (s, 20H), 3.982-3.894 (m, 50H), 3.584 (s, 20H), 3.246 (s, 60H). The ^{13}C NMR spectrum of **HP5** is shown in Figure S6. ^{13}C NMR (100 MHz, $CDCl_3$, rt) δ (ppm): 149.65, 128.79 115.96, 66.48, 63.66, 62.99, 55.32, 52.26, 29.83.

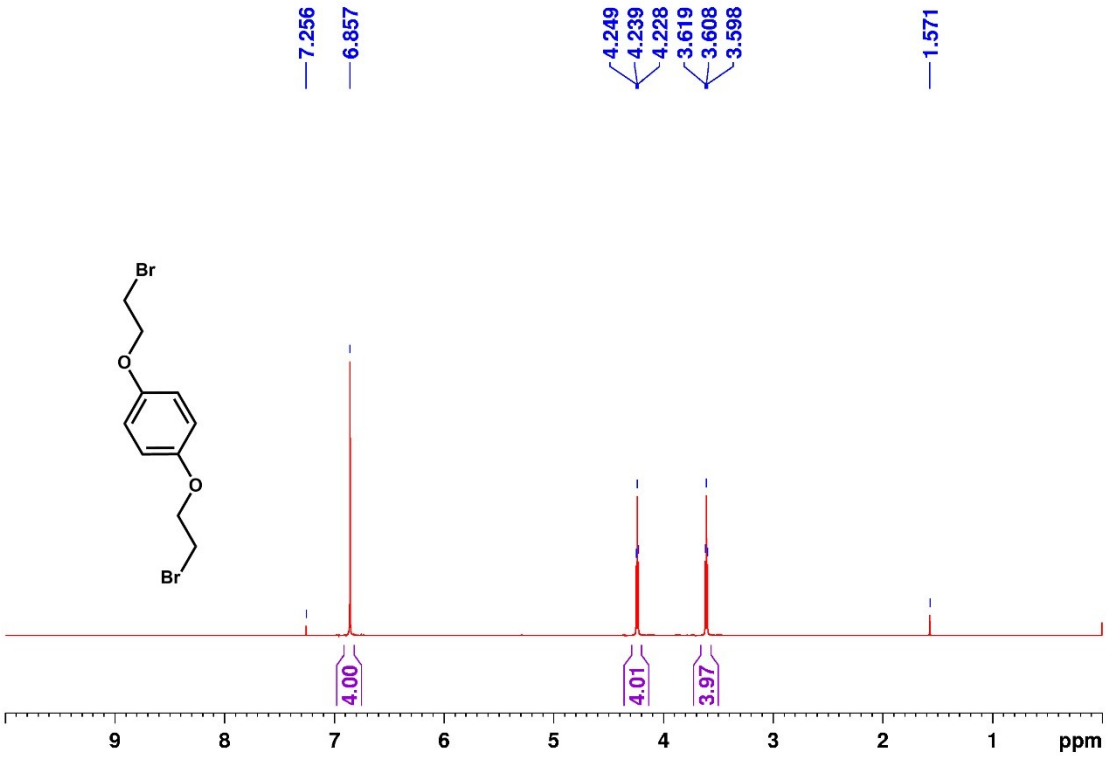


Figure S1. ^{1}H NMR spectrum (400 MHz, D_2O, 298 K) of **2**.

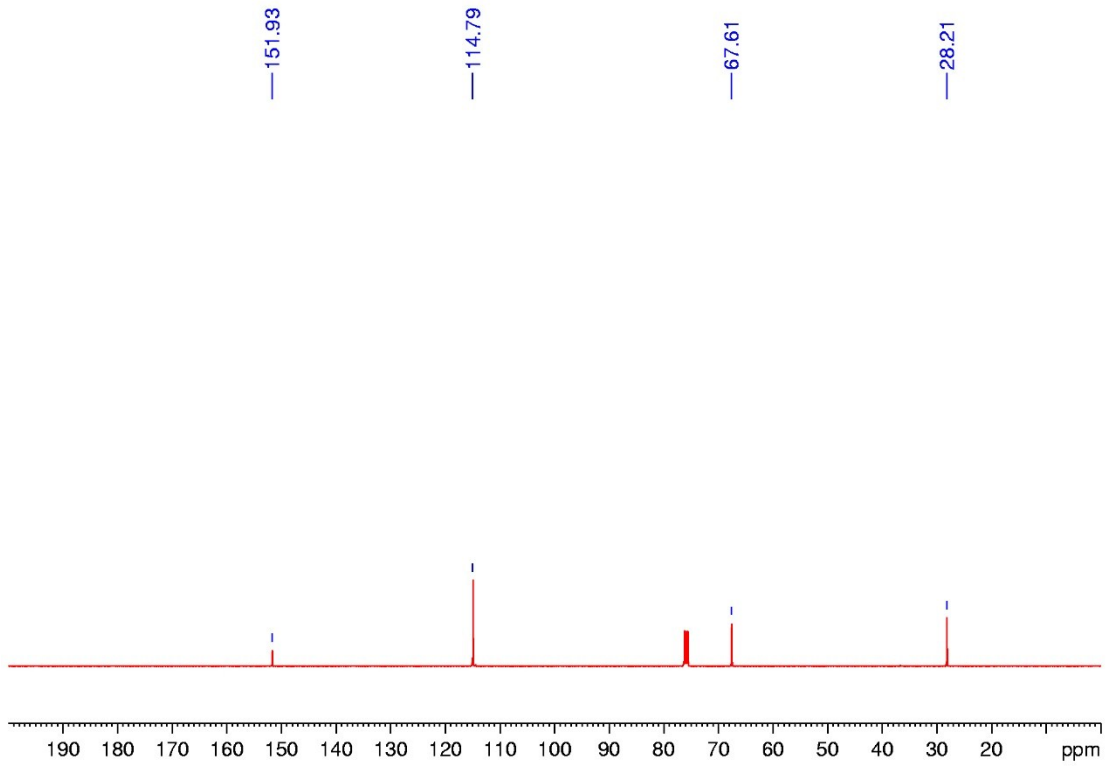


Figure S2. ^{13}C NMR spectrum (100 MHz, $CDCl_3$, 298 K) of **2**.

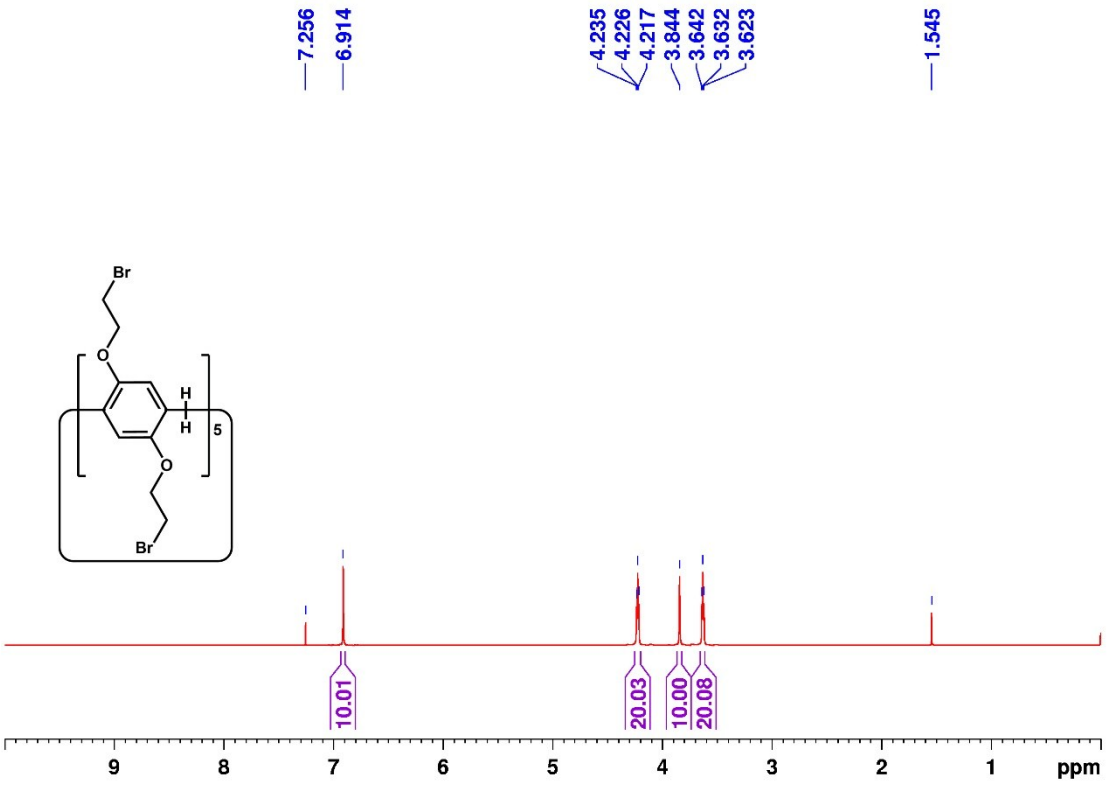


Figure S3. ^{1}H NMR spectrum (500 MHz, $CDCl_3$, 298 K) of **3**.

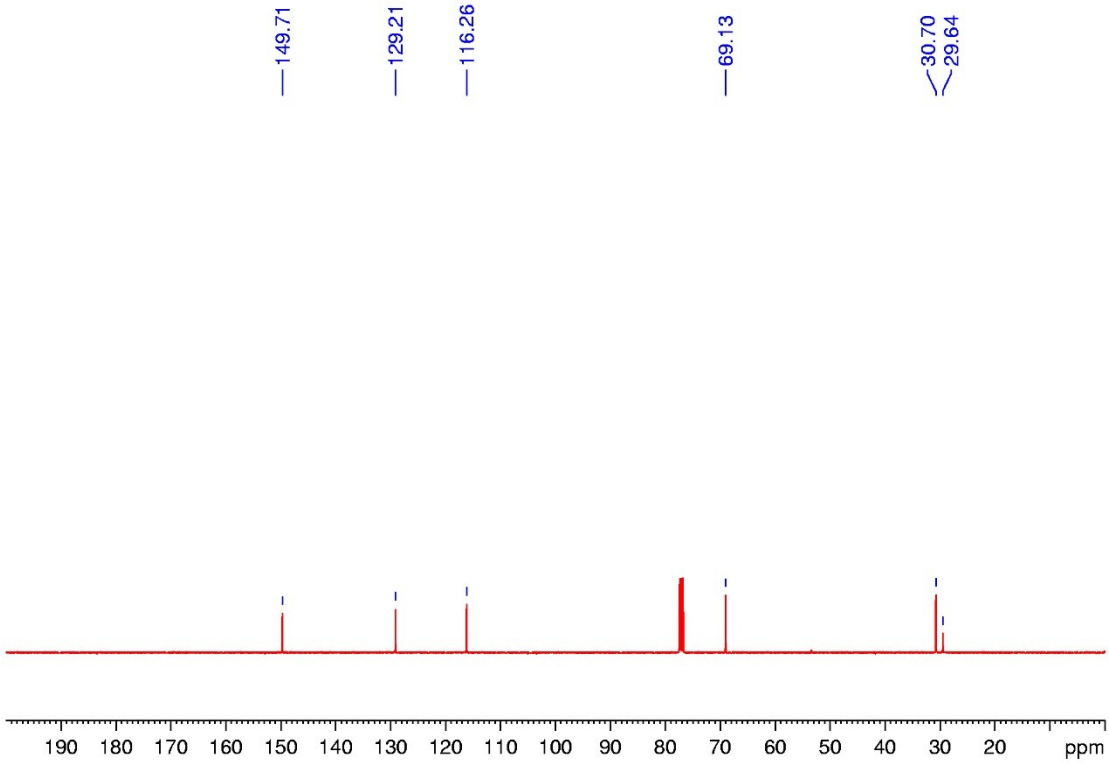


Figure S4. ^{13}C NMR spectrum (125 MHz, $CDCl_3$, 298 K) of **3**.

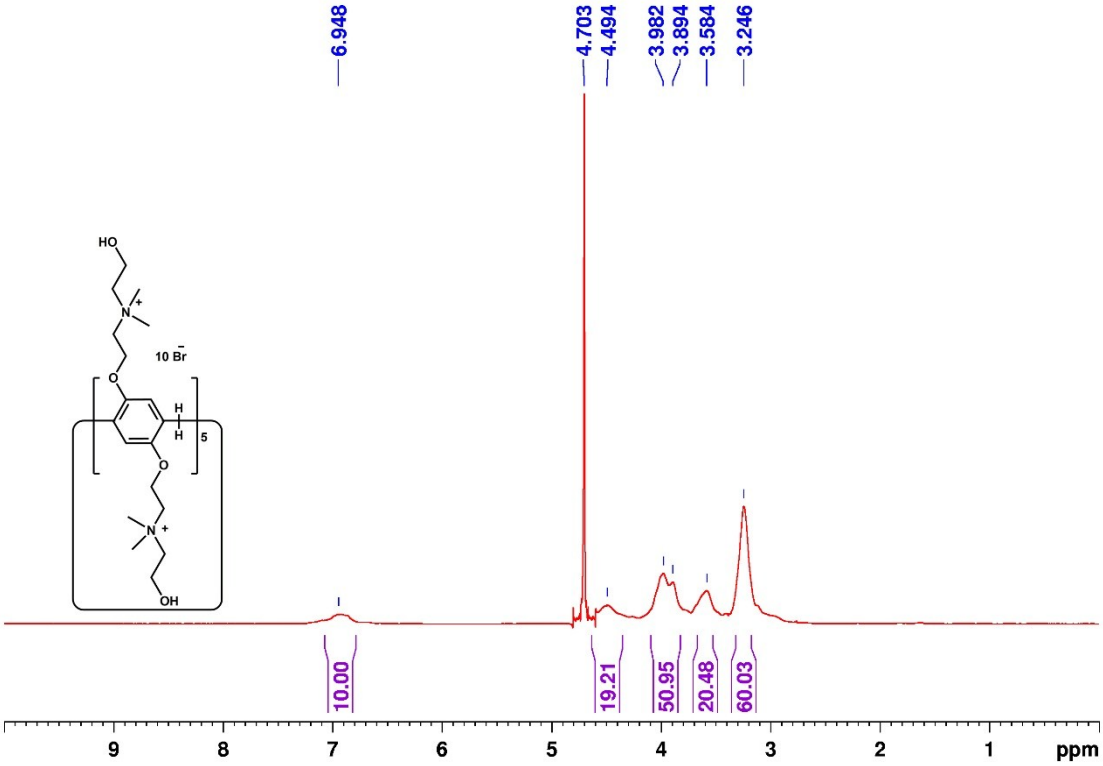


Figure S5. ^{1}H NMR spectrum (500 MHz, D_2O, 298 K) of **HP5**.

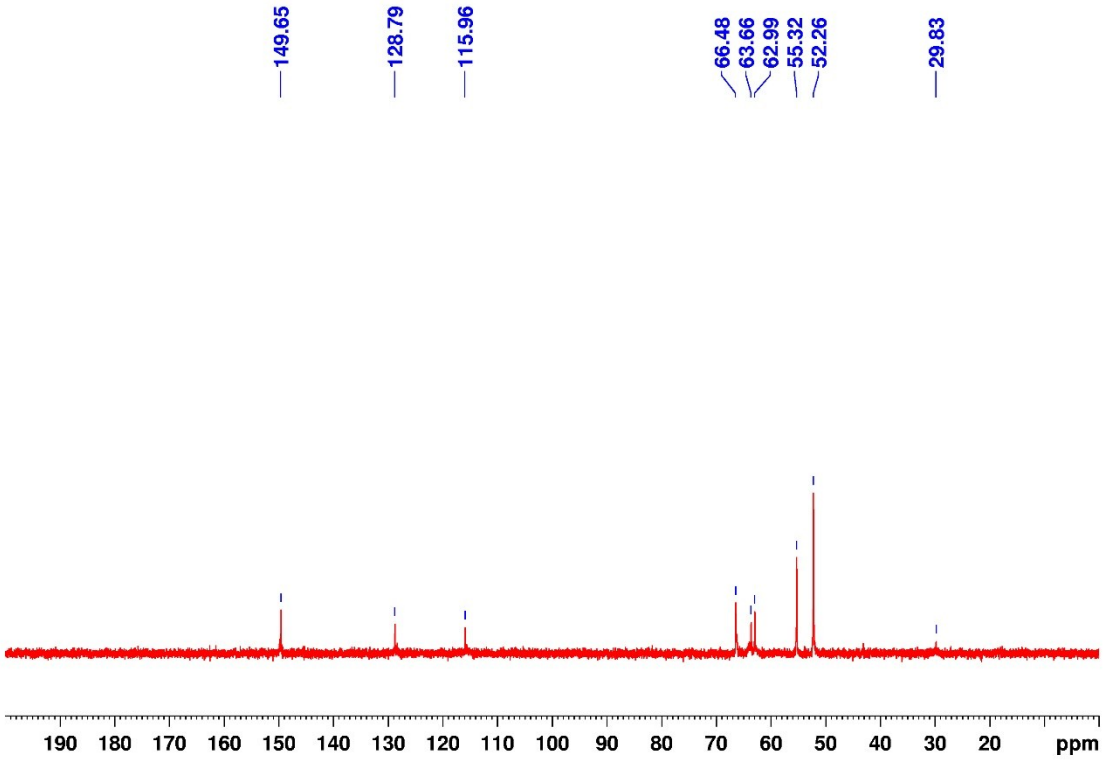


Figure S6. ^{13}C NMR spectrum (125 MHz, D_2O, 298 K) of **HP5**.

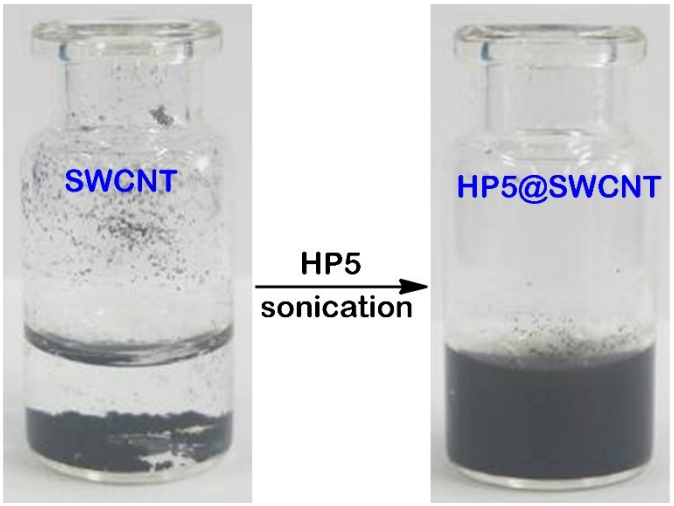


Figure S7. The photographs of SWCNT and HP5@SWCNT complexes in water.

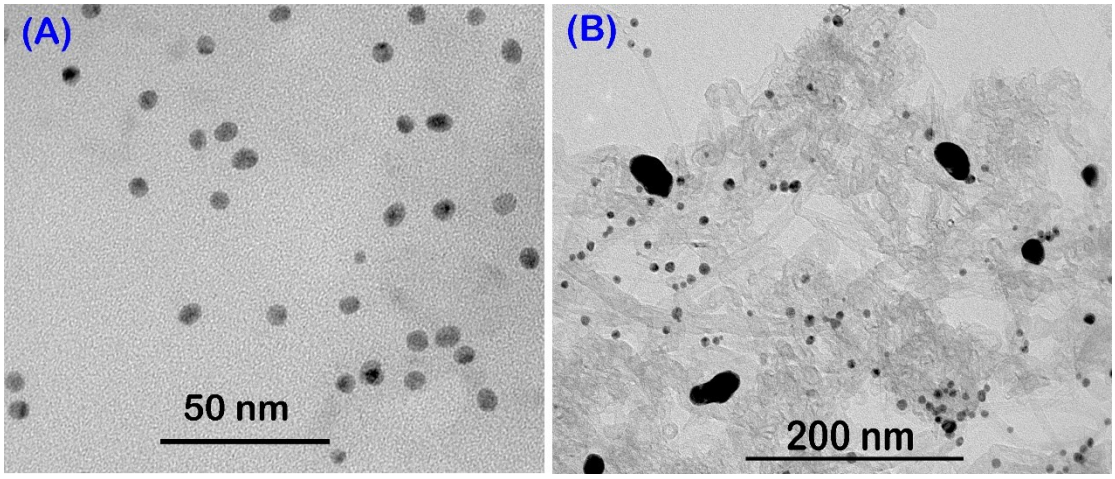


Figure S8. The TEM of Au@HP5 (A) and Au@SWCNT (B), respectively.

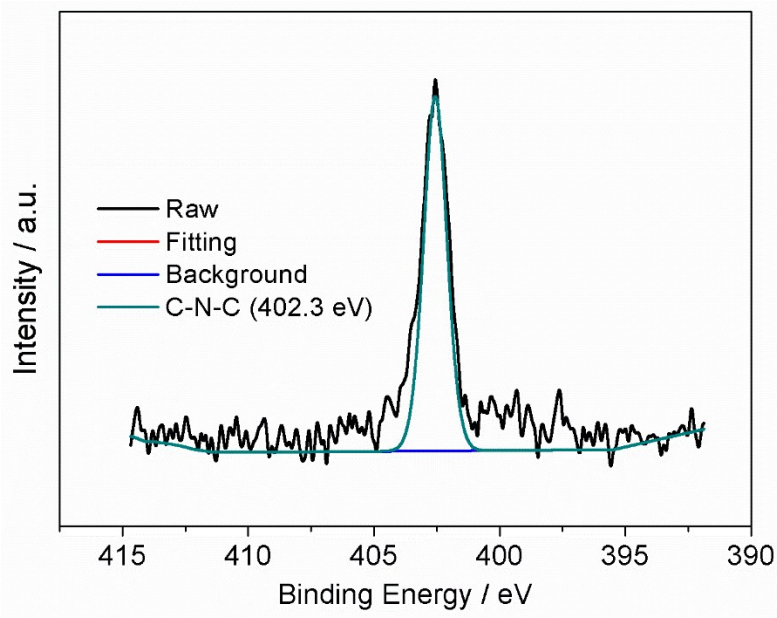


Figure S9. High resolution XPS spectra of N 1s for Au@HP5@SWCNT.

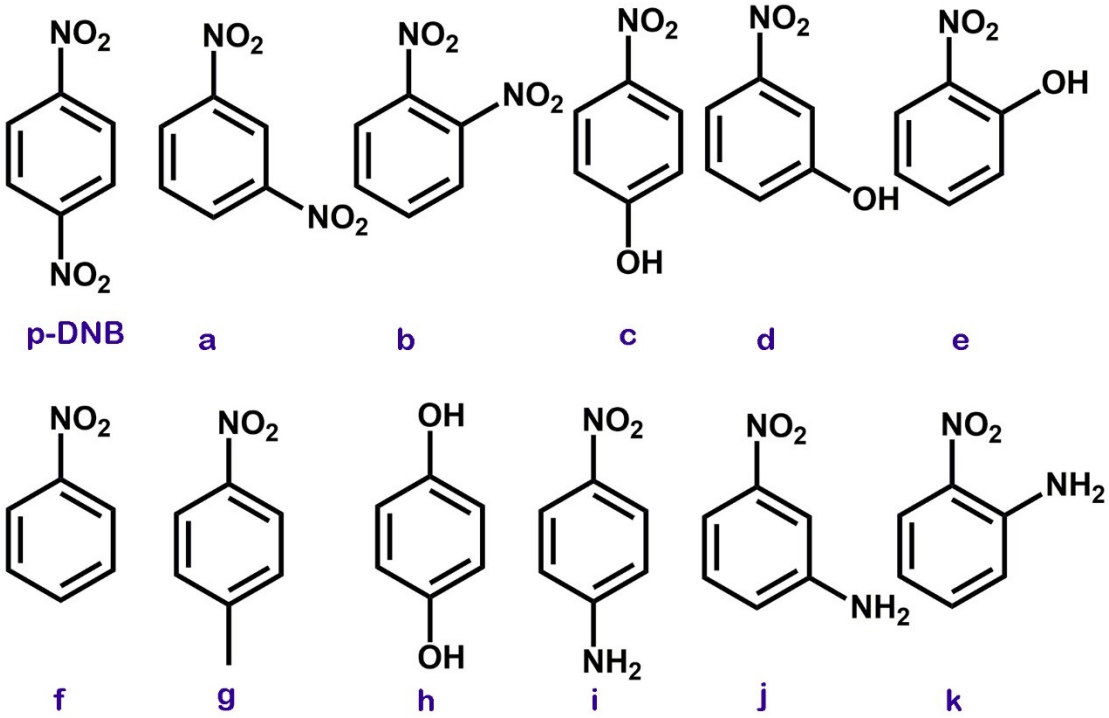


Figure S10. Chemical structures of *p*-DNB, *m*-DNB (a), *o*-DNB (b), *p*-nitrophenol (c), *m*-nitrophenol (d), *o*-nitrophenol (e), nitrobenzene (f), *p*-nitrotoluene (g), hydroquinone (h), *p*-nitroaniline (i), *m*-nitroaniline (j), *o*-nitroaniline (k), respectively.

Table S1

Determination of *p*-DNB in tap water and waste water samples.

Sample	Added (μM)	Found (μM)	RSD (%)	Recovery (%)
	0	-	-	-
Tap water	1	0.98 ± 0.01	1.0	98
	2	1.97 ± 0.11	5.5	98.5
	4	4.01 ± 0.21	5.2	100.2
	0	-	-	-
Waste water	1	1.01 ± 0.04	3.9	101
	2	2.12 ± 0.12	5.6	106
	10	9.78 ± 0.26	2.6	97.8

References

S1. R. Joseph, A. Naugolny, M. Feldman, I. M. Herzog, M. Fridman and Y. Cohen, *J. Am. Chem. Soc*., 2016, **138**, 754–757.

S2. Y. J. Ma, X. F. Ji, F. Xiang, X. D. Chi, C. Y. Han, J. M. He, Z. Abliz, W. X. Chen and F. H. Huang, *Chem. Commun*., 2011, **47**, 12340–12342.