

Hyperbranched polyol decorated carbon nanotube by click chemistry for functional polyurethane urea hybrid composites

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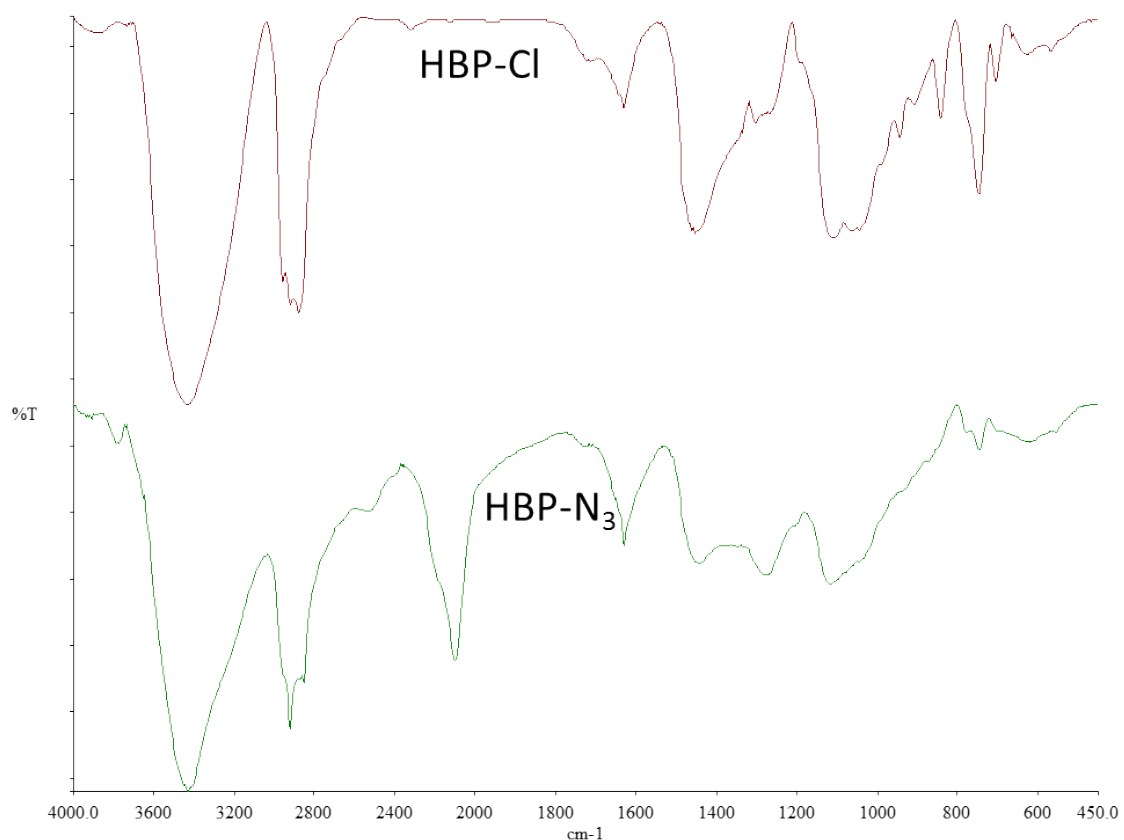


Figure S1. FT-IR spectra of (a) HBP-Cl and (b) HBP-N₃

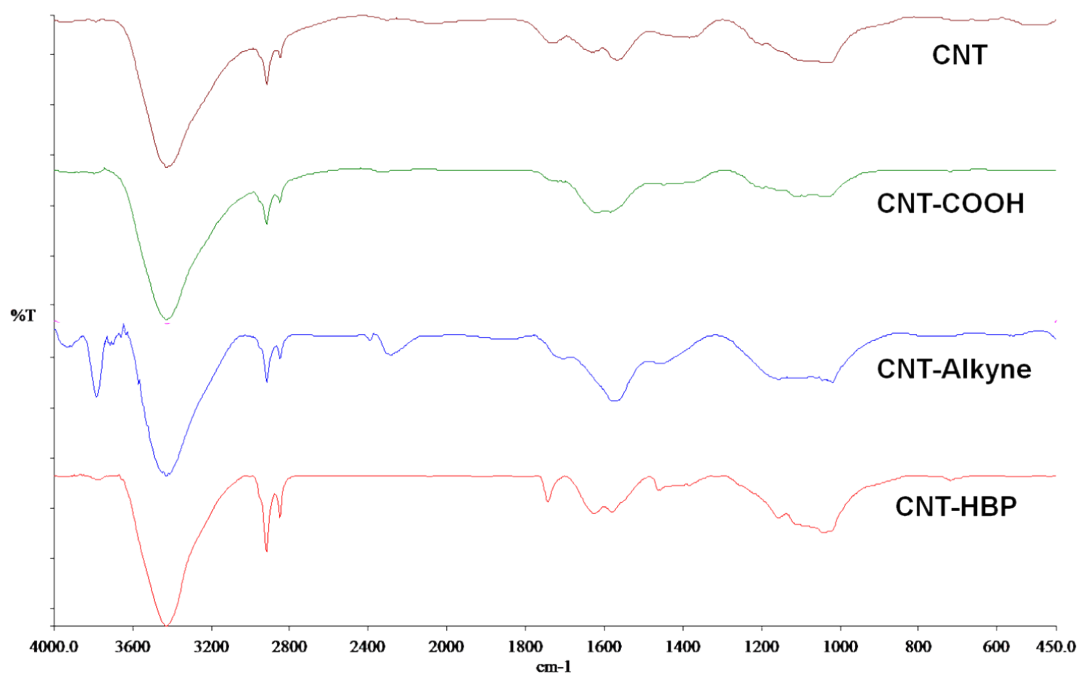


Figure S2. FT-IR spectra of pristine CNT, CNT-COOH, CNT-Alkyne and CNT-HBP

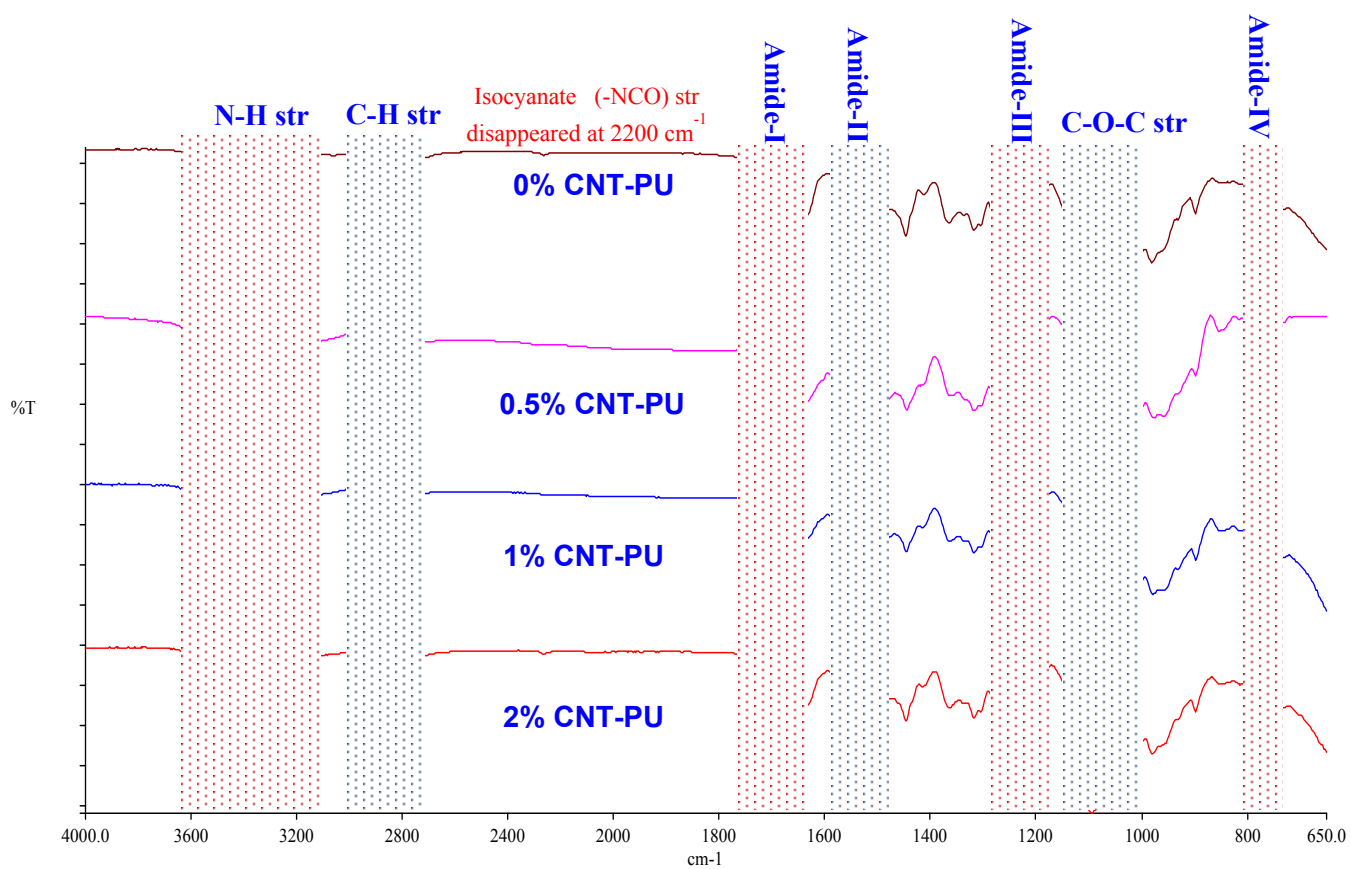


Figure S3. FT-IR spectra of 0%,0.5%, 1% and 2% CNT-PU

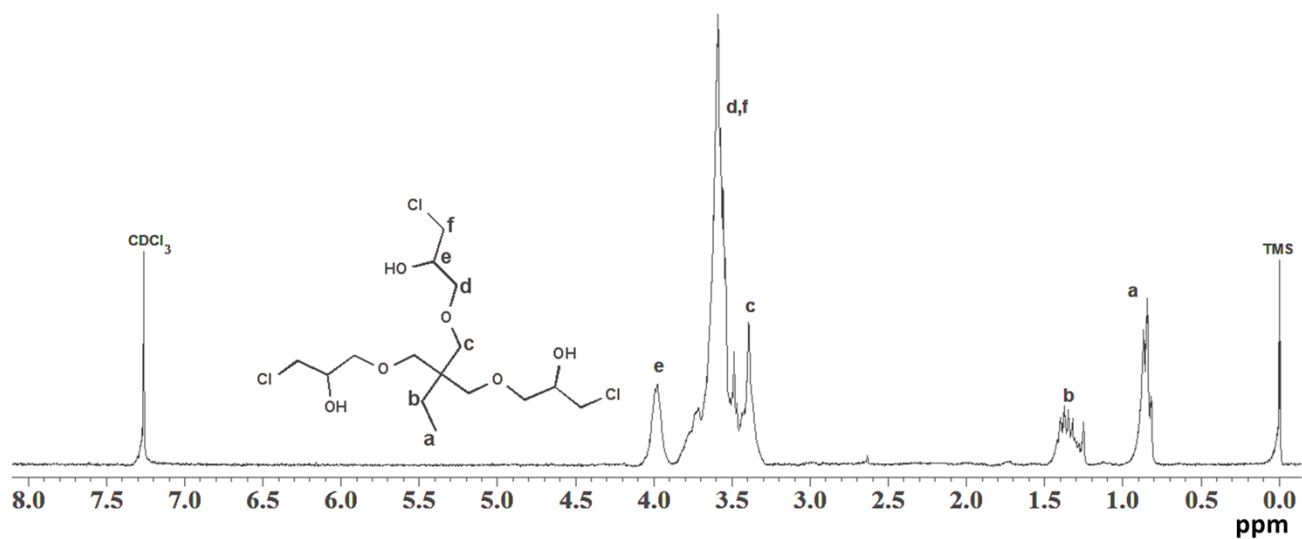


Figure S4. ¹H-NMR spectra of HBP-Cl

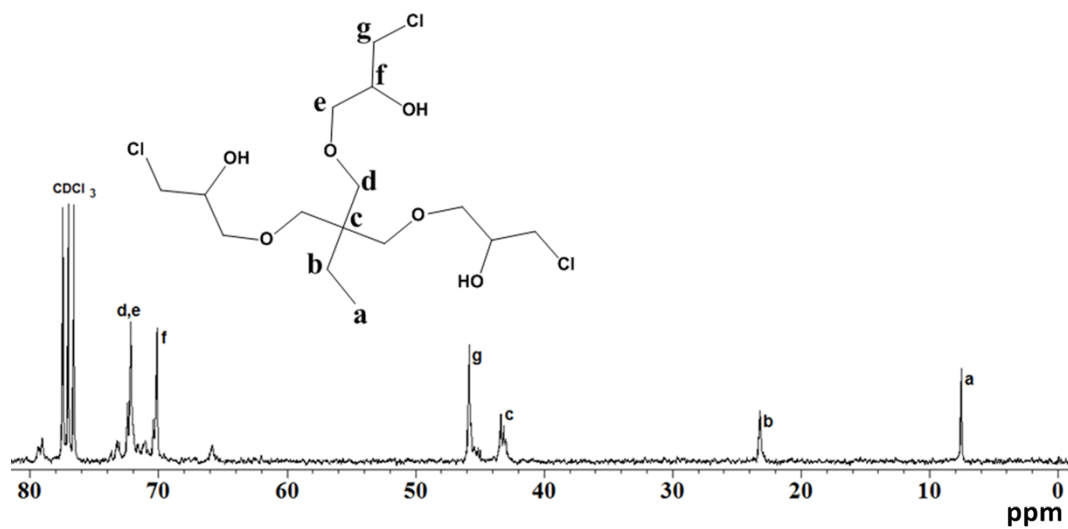


Figure S5. ¹³C-NMR spectra of HBP-Cl

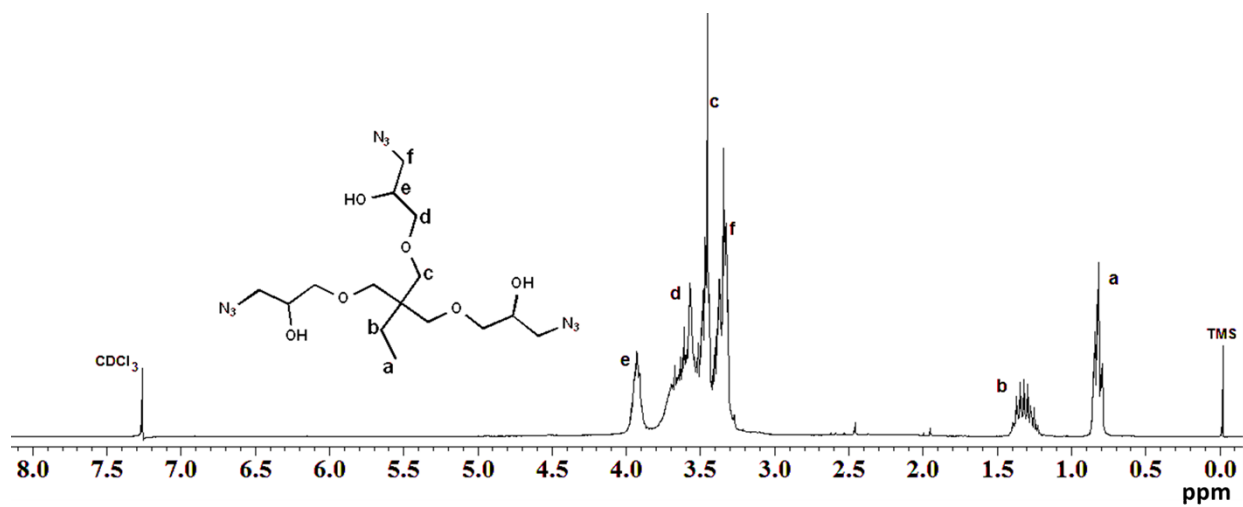


Figure S6. ¹H-NMR spectra of HBP-N₃

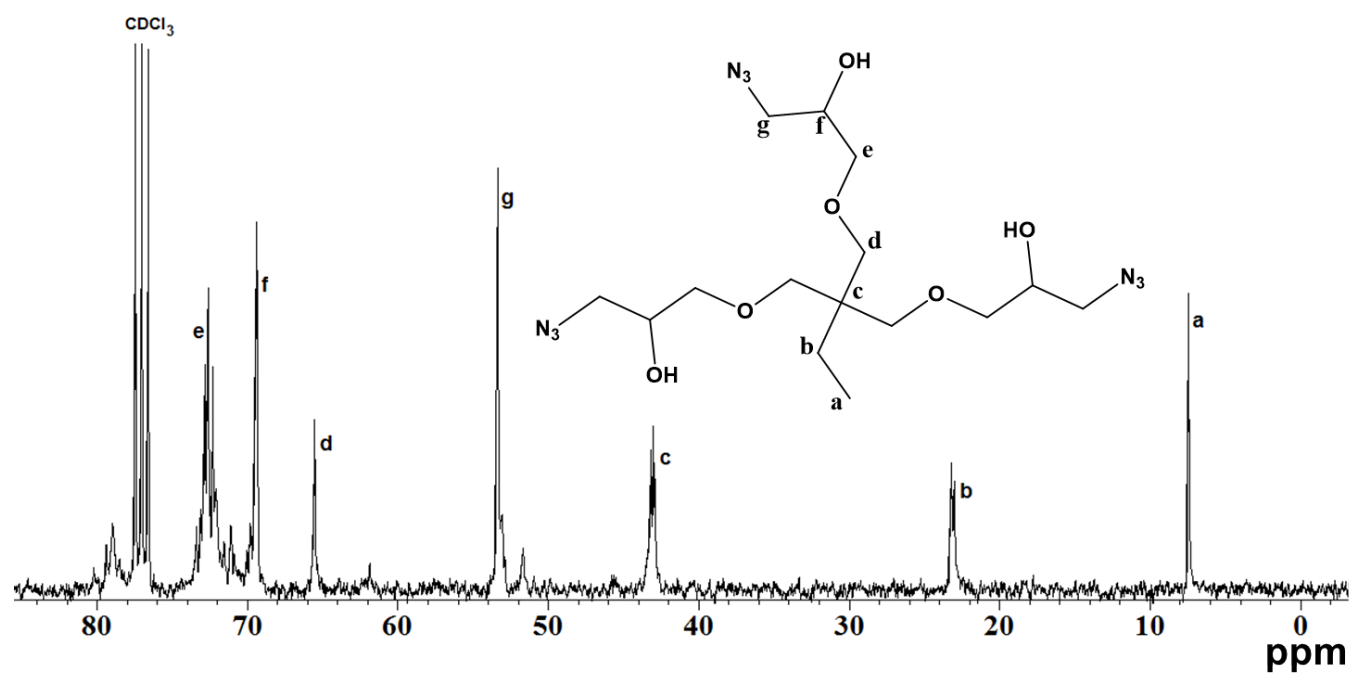


Figure S7. ¹³C-NMR spectra of HBP-N₃

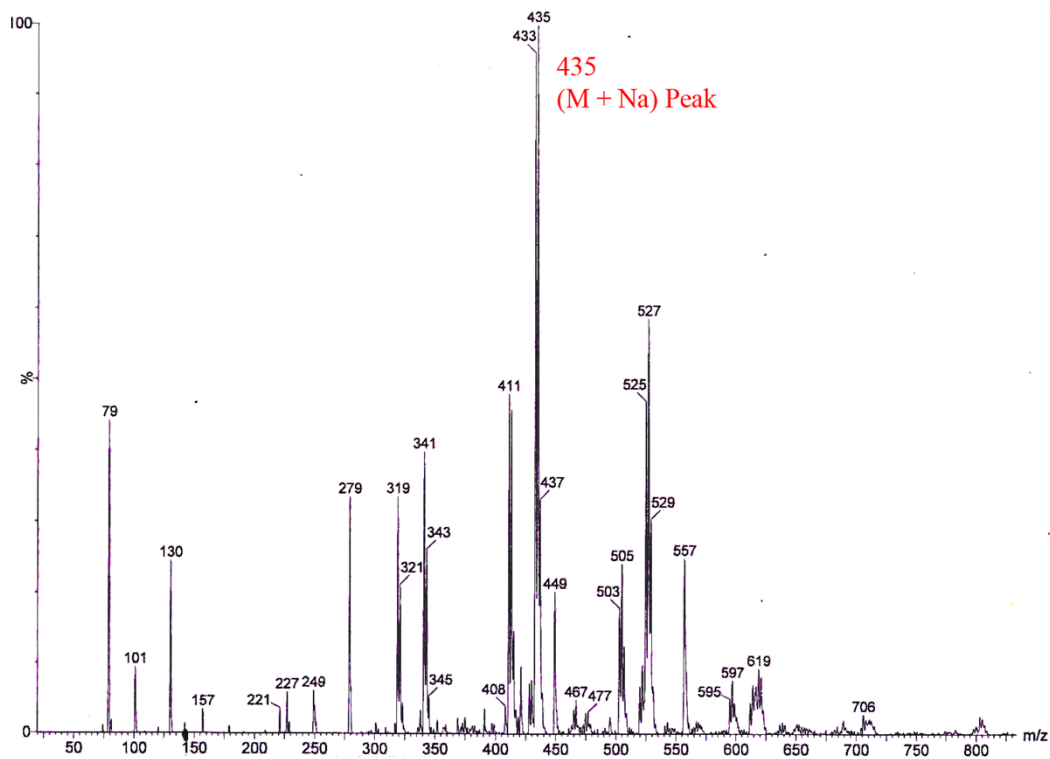


Figure S8. ESI-MS spectra of HBP-Cl

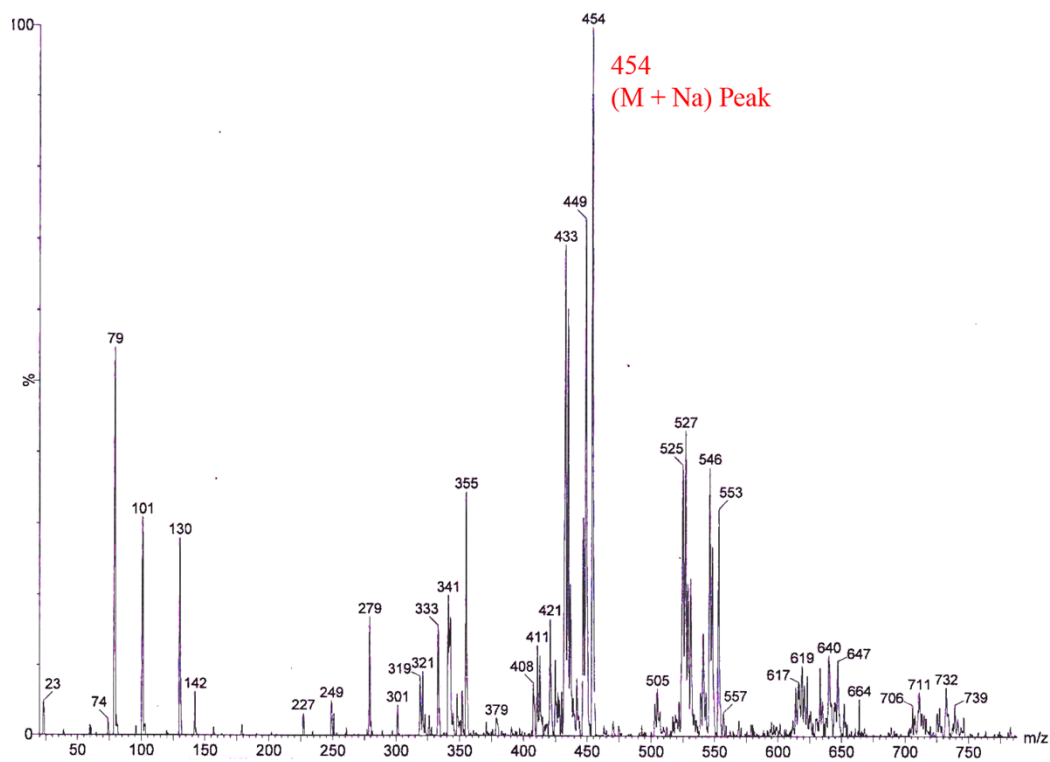


Figure S9. ESI-MS spectra of HBP-N₃

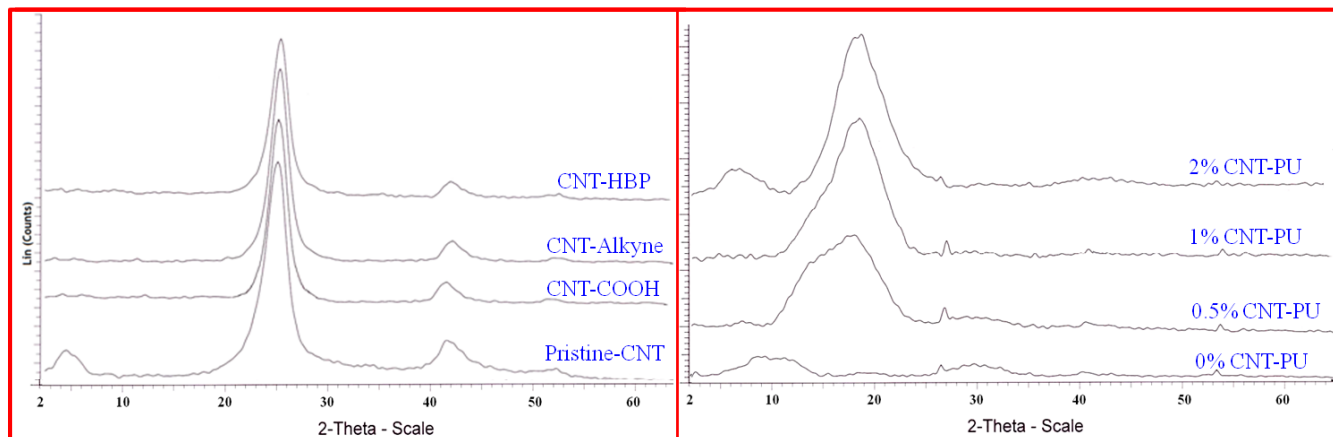


Figure S10. XRD profiles of various CNTs and CNT-PUs

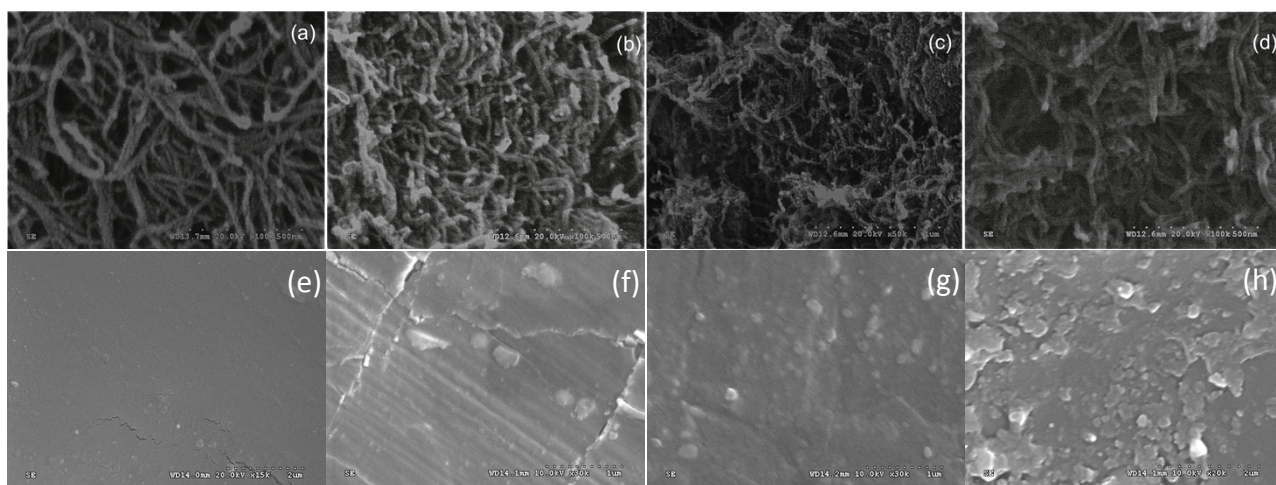


Figure S11. FE-SEM images of (a) pristine CNT, (b) CNT-COOH, (c) CNT-Alkyne, (d) CNT-HBP, (e) 0% CNT-PU, (f) 0.5% CNT-PU, (g) 1% CNT-PU and (h) 2% CNT-PU

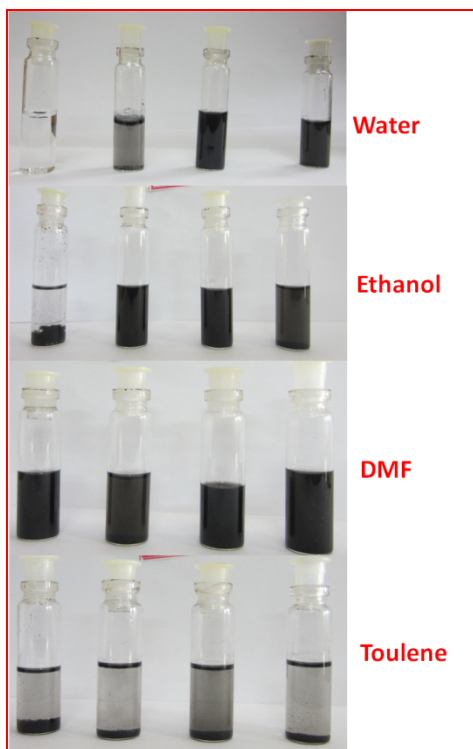


Figure S12. Photographs of vials containing the dispersions of (a) Pristine CNT (b) CNT-COOH (c) CNT-Alkyne and (d) CNT-HBP (left to right) in various solvents.

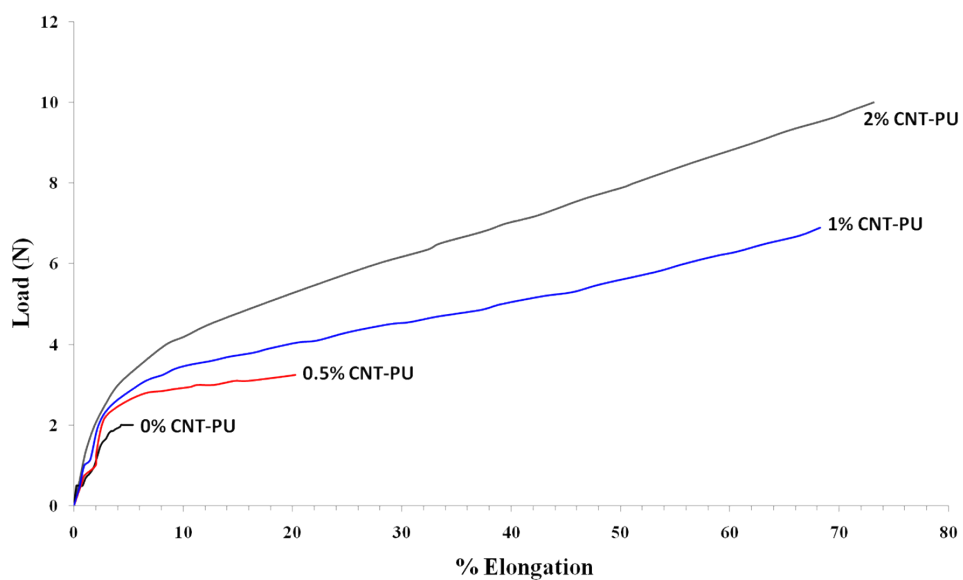


Figure S13. Stress vs. strain curves of (UTM analysis) various CNT-PUs

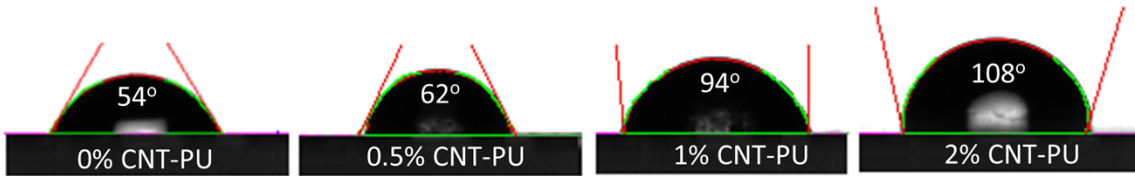


Figure S14. Contact angle measurements of different CNT-PU films

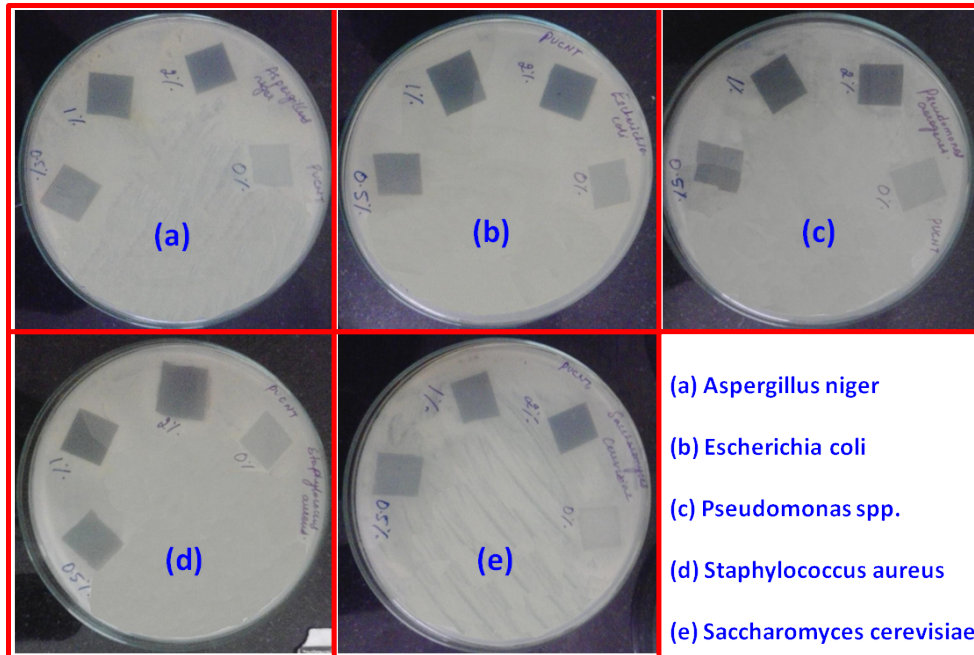


Figure S15. Antimicrobial activity of CNT-PU coating films on different bacteria and fungus.

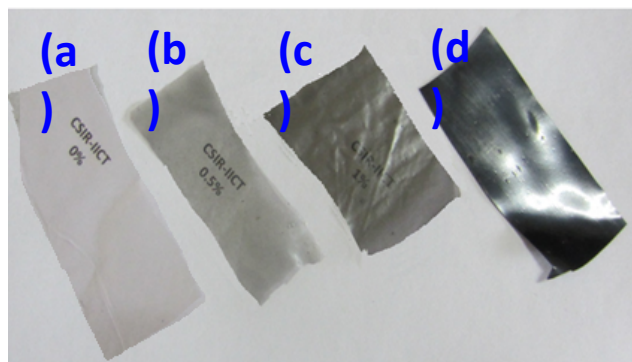


Figure S16. Photographs of (a) 0% CNT-PU (pure) (b) 0.5% CNT-PU (c) 1% CNT-PU (d) 2% CNT-PU

Table S1. TGA profile of various CNTs

Sample code	Onset decomposition Temperature (T_{ON}) (°C)	10%, wt loss temperature (T_{d10}) (°C)	% wt remaining at 500°C	% wt remaining at 600°C	% wt remaining at 700°C
CNT	583.90	652.71	98.32	94.93	85.20
CNT-COOH	572.14	630.42	97.35	92.65	82.62
CNT-alkyne	470.72	620.62	95.36	91.24	84.28
CNT-HBP	379.94	390.57	73.05	51.26	35.65

Table S2. Raman profile of pristine CNT, CNT-COOH, CNT-Alkyne and CNT-HBP

Sample code	D peak(cm⁻¹)	G peak(cm⁻¹)	I_D/I_G	FWHM (D-band)	FWHM (G-band)
CNT	1312.42	1573.99	1.88	54	67.5
CNT-COOH	1318.91	1573.34	1.99	57.38	67.5
CNT-alkyne	1318.91	1566.21	1.86	50.63	64.13
CNT-HBP	1318.91	1590.22	1.94	54	64.13

Table S3. Solubility behavior of various CNT samples in different solvent systems

Compounds	Time	Water	Ethanol	DMF	Toluene
CNT	15min	-	-	+	-
CNT-COOH	15min	±	+	+	±
CNT-Alkyne	15min	+	+	+	±
CNT-HBP	15min	+	+	+	±
CNT	3h	-	-	+	-
CNT-COOH	3h	-	+	+	-
CNT-Alkyne	3h	+	+	+	-
CNT-HBP	3h	+	+	+	-
CNT	6h	-	-	+	-
CNT-COOH	6h	-	+	+	-
CNT-Alkyne	6h	+	+	+	-
CNT-HBP	6h	+	+	+	-
CNT	24h	-	-	+	-
CNT-COOH	24h	-	+	+	-
CNT-Alkyne	24h	+	+	+	-
CNT-HBP	24h	+	+	+	-

Table S4. Mechanical properties of CNT-PU hybrids (from UTM analysis)

Sample code	Tensile strength (N/mm²)	Elongation at break(%)
0%CNT-PU	1.25	10.74
0.5%CNT-PU	2.031	40.5
1%CNT-PU	4.31	136.5
2%CNT-PU	6.25	146.3

Table S5. TGA profile of various CNT-PU

Sample code	Onset decomposition Temperature (T_{ON}) (°C)	10%, wt loss temperature (T_{d10}) (°C)	50%, wt loss temperature (T_{d50}) (°C)	% wt remaining at 350°C
	0%CNT-PU	247.02	286.67	335.45
0.5%CNT-PU	251.91	284.40	336.02	40.09
1%CNT-PU	254.45	291.21	339.42	42.61
2%CNT-PU	256.34	292.34	343.39	45.90

Table S6. The electrochemical parameters measured from the Tafel plots of different CNT-PU hybrid coatings along with bare metal.

Sample code	Coating thickness (μm)	E_{corr} (mV)	I_{corr} (nA/cm ²)	Polarization resistance (R_p) (kOhm cm ²)	Corrosion rate (C_R) (mm/yr)
Bare mild steel panel	-	-476.6	3.86×10^3	8.85	0.047
1%CNT-PU	67	-474.4	1.12×10^3	490.64	0.012
2%CNT-PU	69	-200.0	164	3502.07	0.0019

Table S7. Shape recovery behavior of various CNT-PU samples

Sample code	% Elongation	100 % Shape recovery time (approximately)	
		Room Temp.	At 60°C
0.5% CNT-PU	30	40 sec	20 sec
1% CNT-PU	130	25 sec	10 sec
2% CNT-PU	130	20 sec	10 sec