Supplementary material for

Engineering mesoporous silica nanoparticles for improved oral delivery of Vancomycin

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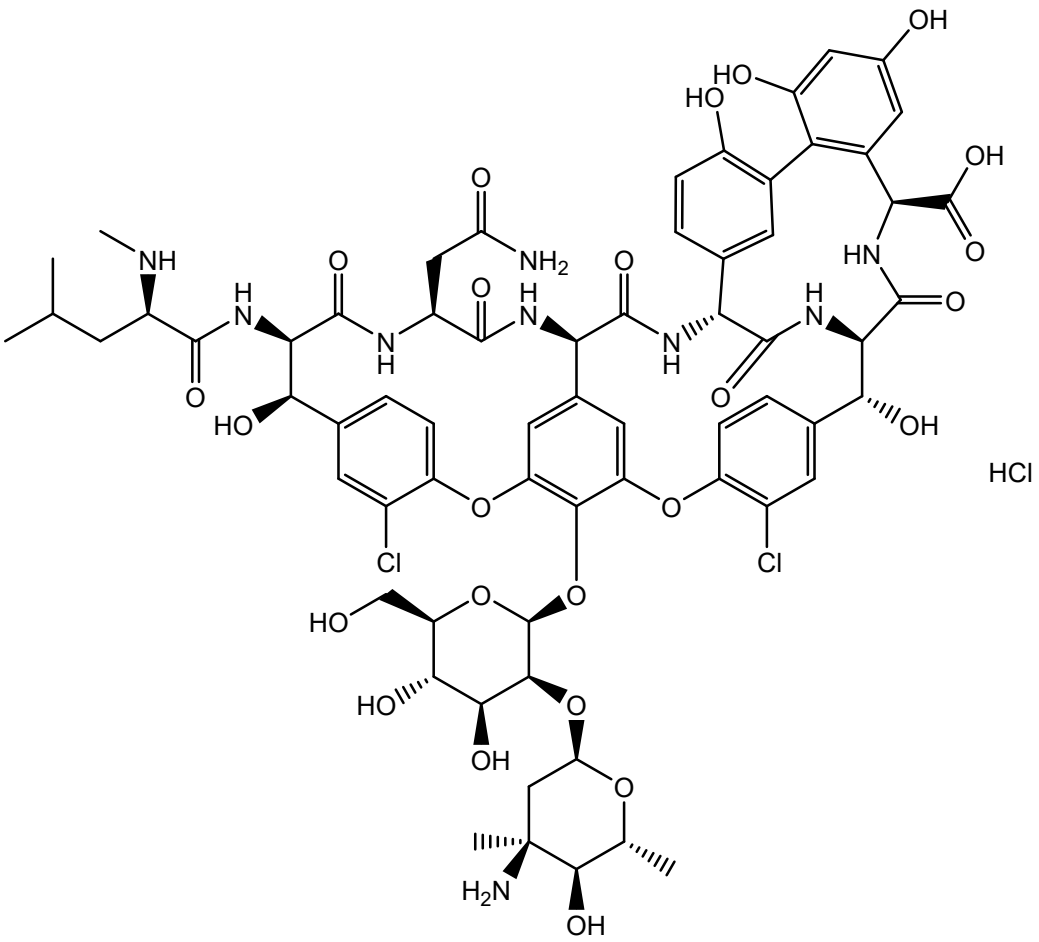


Figure S1. Molecular structure of Vancomycin hydrochloride

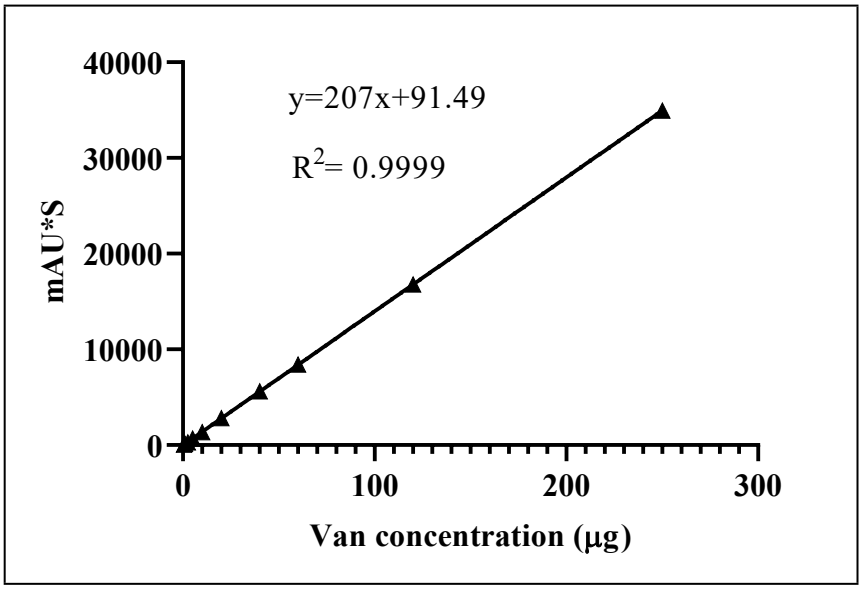
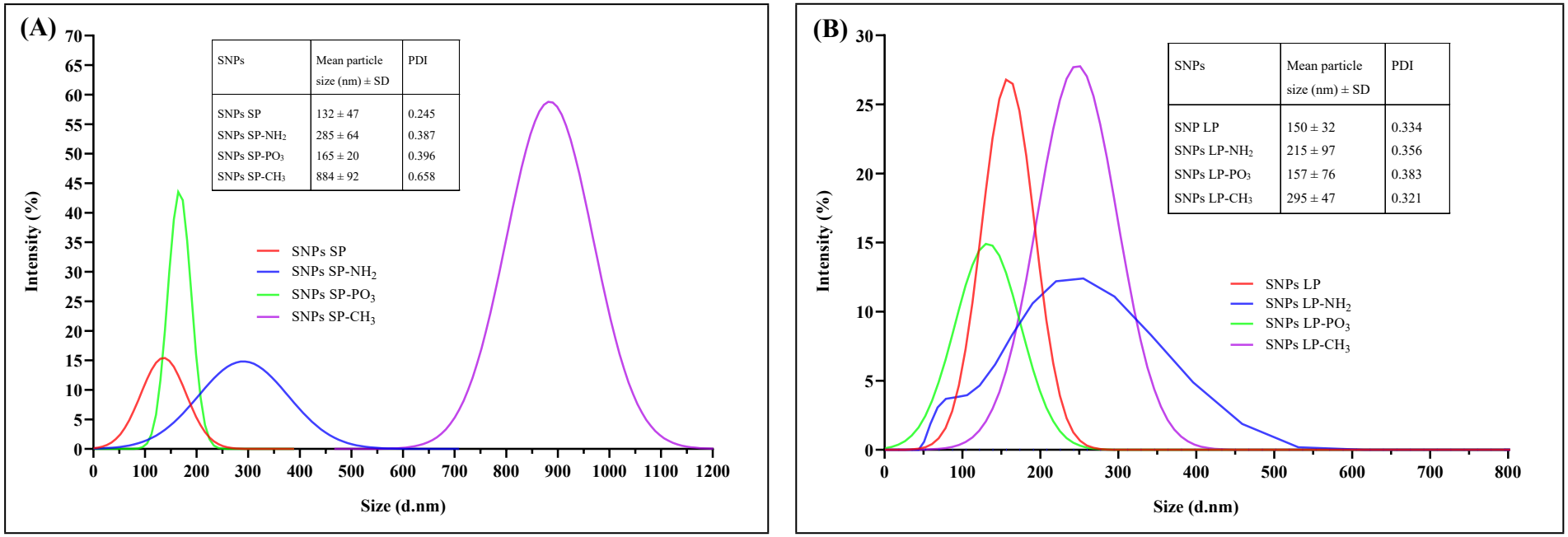


Figure S2. Calibration curve of Vancomycin

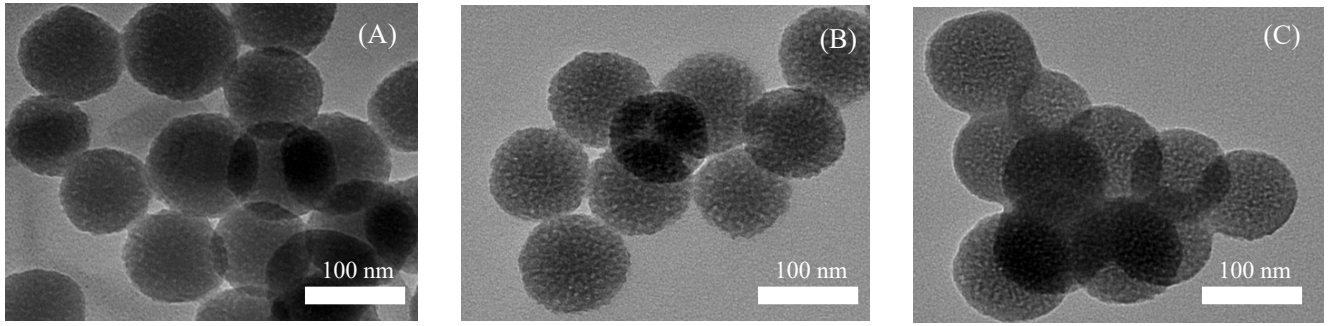


SNPs	Mean particle size (nm) ± SD	PDI
SNPs SP	132 ± 47	0.245
SNPs SP-NH_2	285 ± 64	0.387
SNPs SP-PO_3	165 ± 20	0.396
SNPs SP-CH_3	884 ± 92	0.658

SNPs	Mean particle size (nm) ± SD	PDI
SNP LP	150 ± 32	0.334
SNPs LP-NH_2	215 ± 97	0.356
SNPs LP-PO_3	157 ± 76	0.383
SNPs LP-CH_3	295 ± 47	0.321

Figure S3. Size distribution (by intensity) of SNPs with/without functional groups. (A) SNPs SP and (B) SNPs LP. Each individual peak on the graph represents one measurement

Functionalised SNPs SP



Functionalised SNPs LP

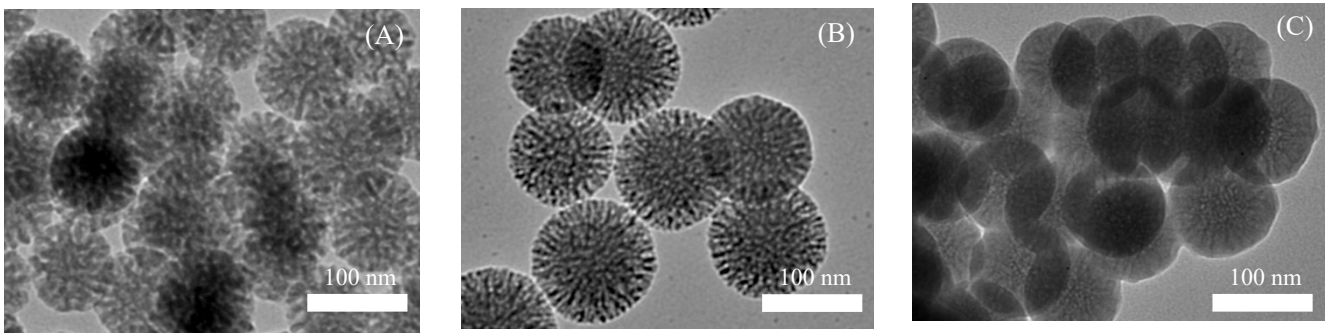


Figure S4. TEM images of (A) SNPs-NH_2, (B) SNPs-PO_3 and (C) SNPs-CH_3

Functionalised SNPs SP

Functionalised SNPs LP

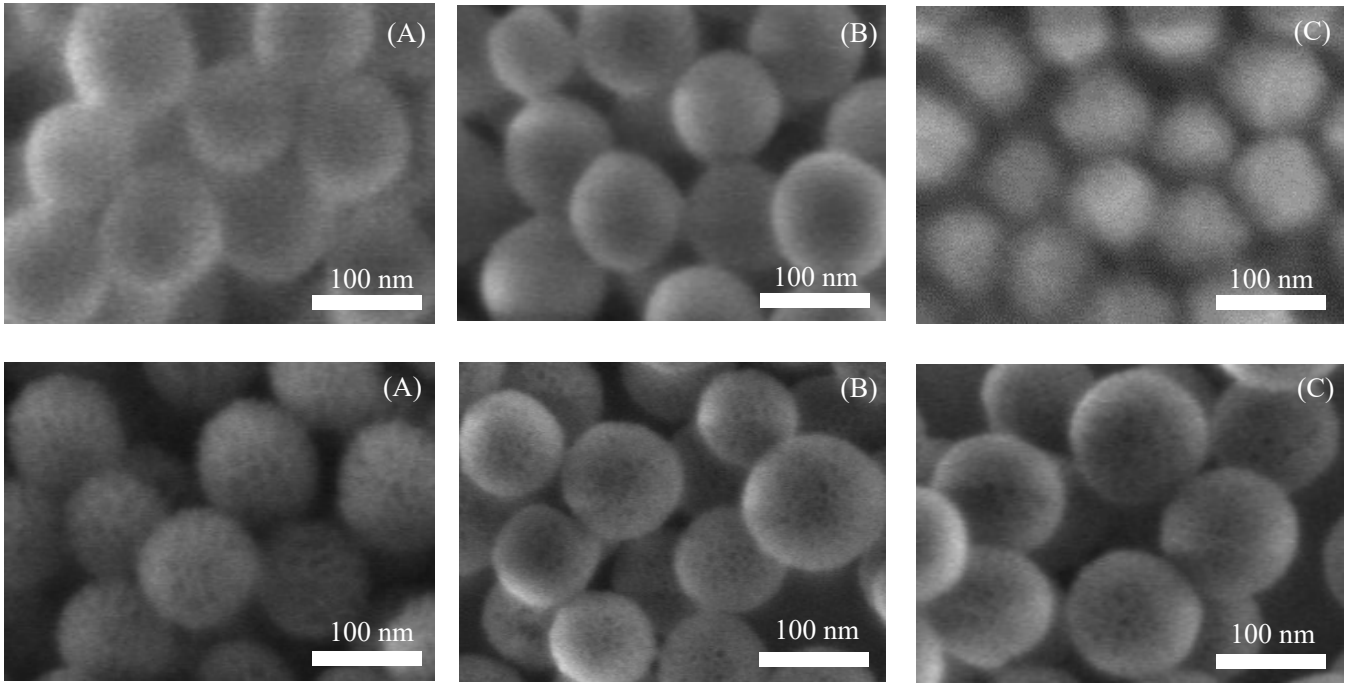


Figure S5. SEM images of (A) SNPs-NH_2, (B) SNPs-PO_3 and (C) SNPs-CH_3

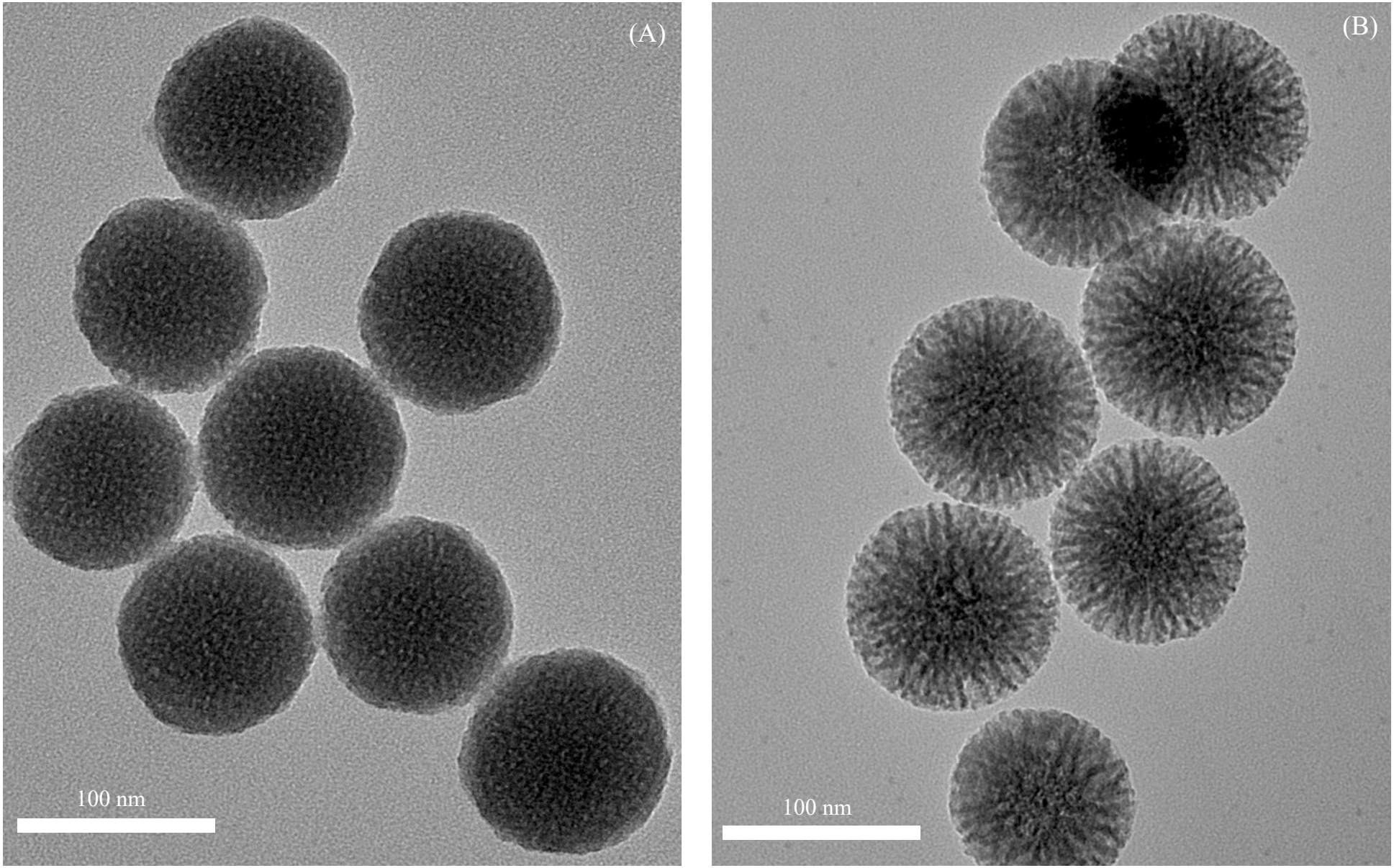


Figure S6. TEM images of (A) SNPs SP and (B) SNPs LP showing SNPs rough outer surfaces

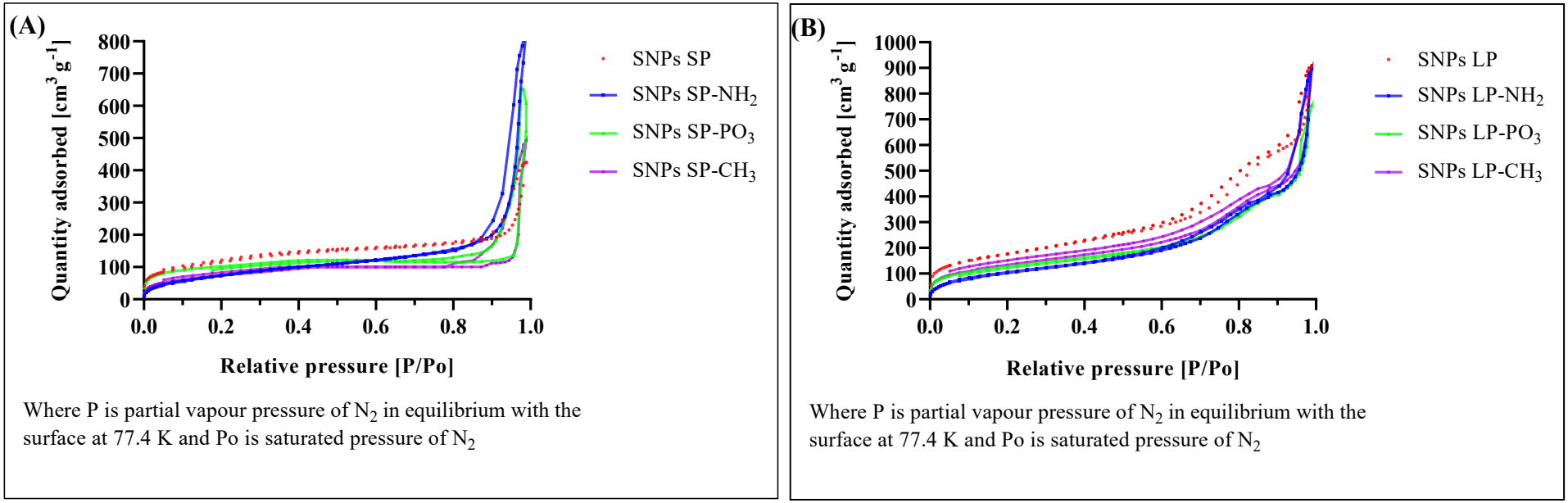


Figure S7. N_2 adsorption/desorption isotherms of (A) SNPs SP and (B) SNPs LP with/without functional groups

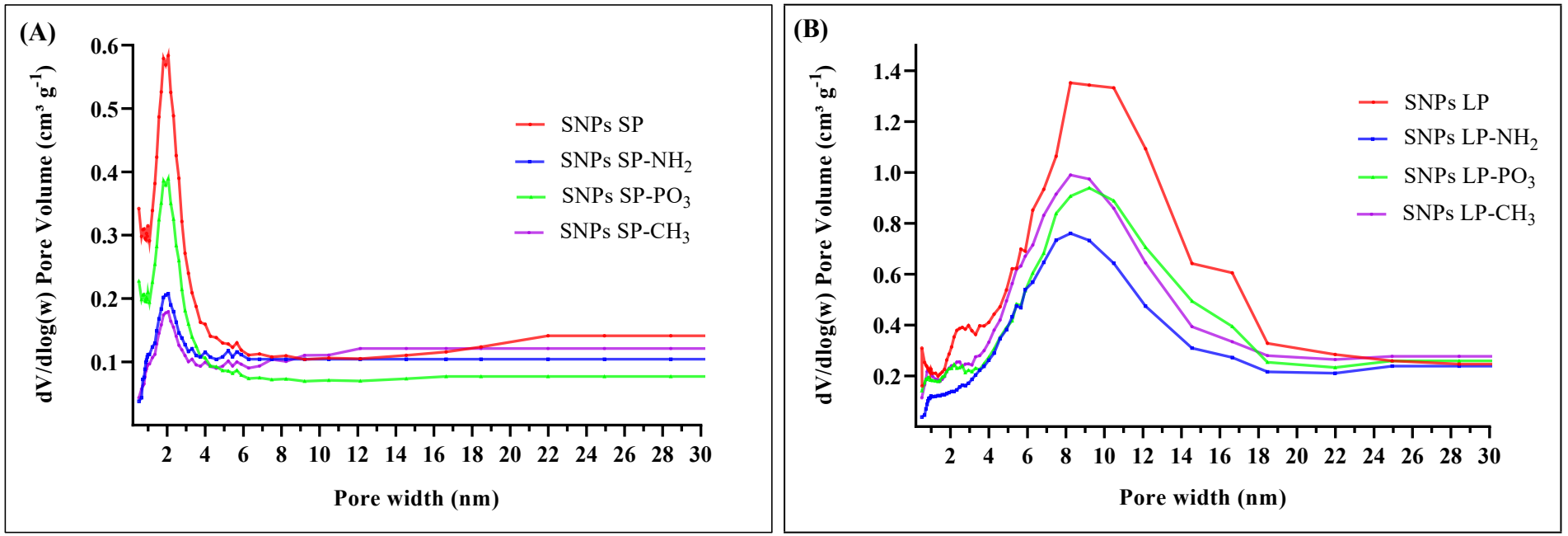


Figure S8. Pore size distributions (BJH Adsorption dV/dlog(w) Pore Volume) of (A) SNPs SP and (B) SNPs LP with/without functional groups

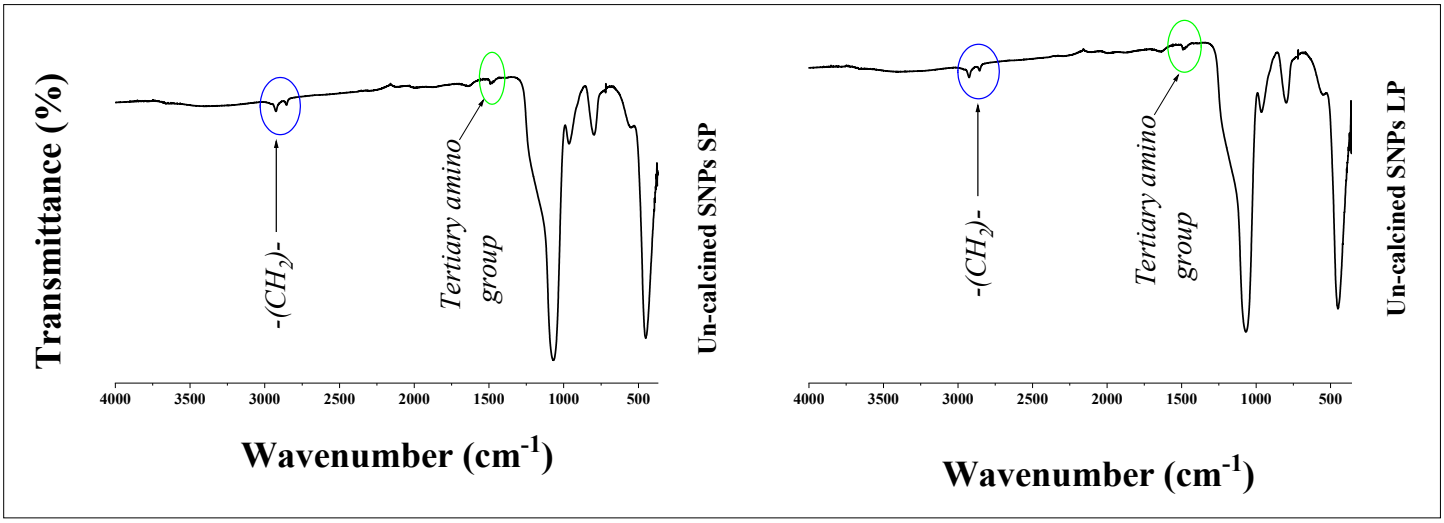


Figure S9. FTIR spectra of un-calcined SNPs (before calcination) showing the alkyl and tertiary amino groups characteristic of CTAC and TEA

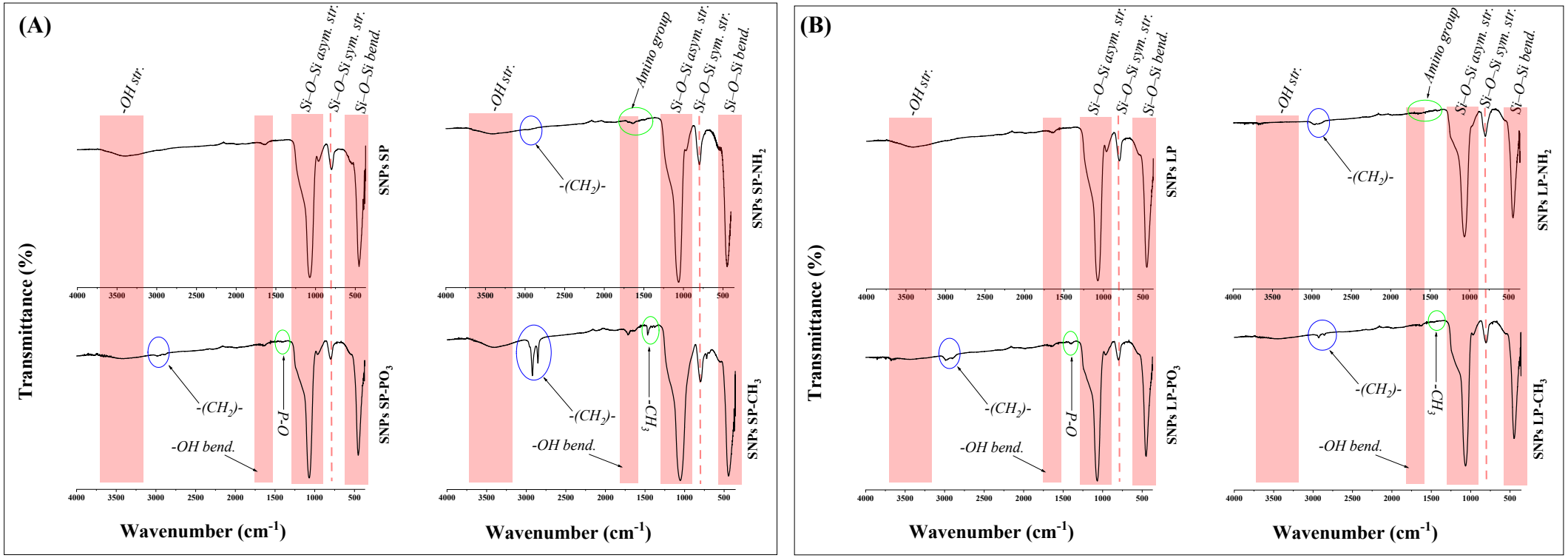


Figure S10. FTIR of functionalized (A) SNPs SP and (B) SNPs LP

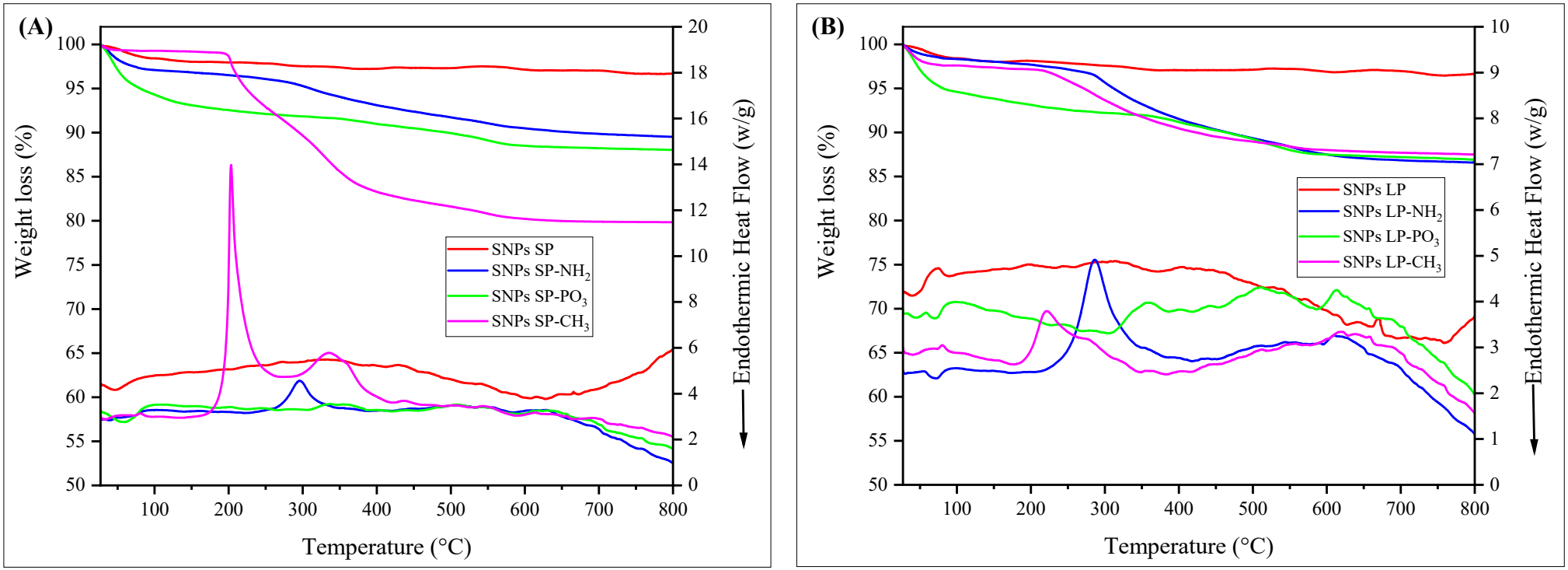


Figure S11. TGA and DSC of functionalised (A) SNPs SP and (B) SNPs LP

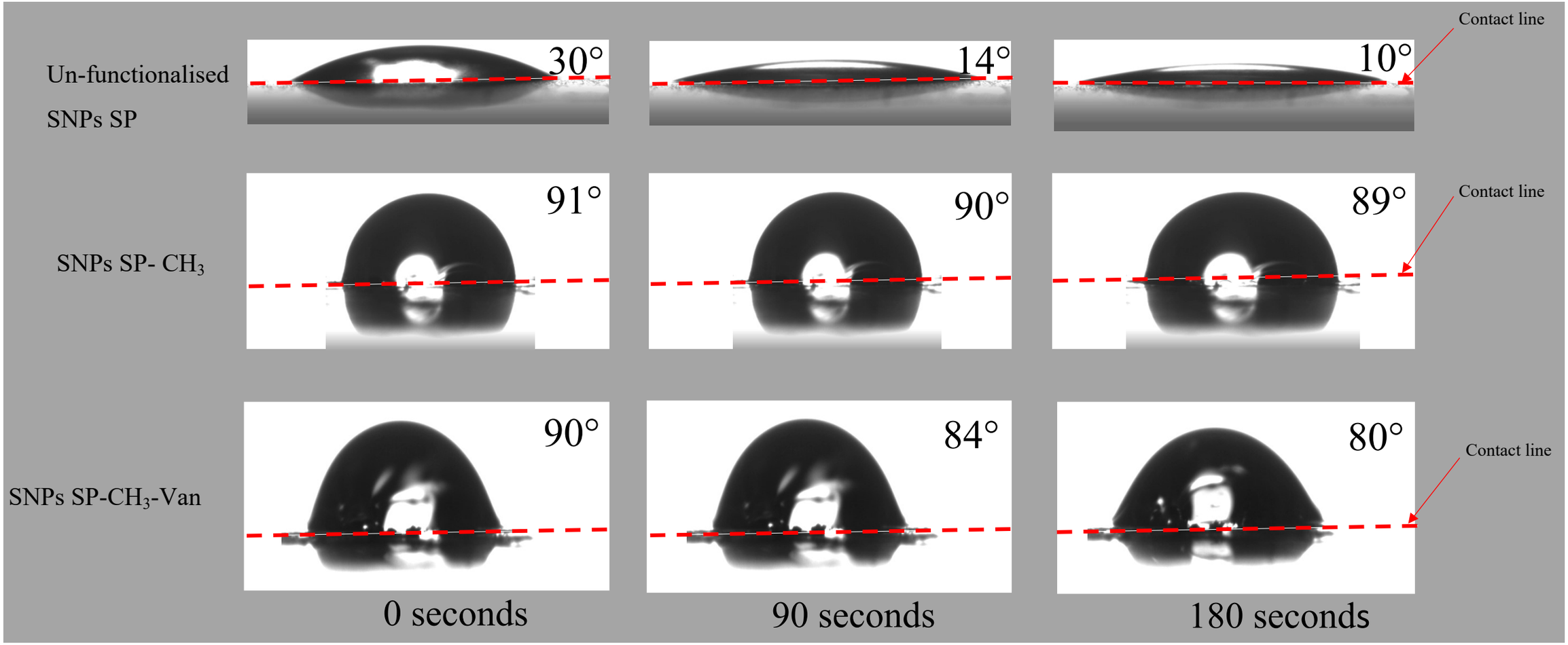


Figure S12. Images of water droplet interacting with the surface of SNPs SP with/without functional groups. Contact angles for Van-loaded SNPs SP-CH_3 show that SNPs SP-CH_3 do not lose their hydrophobic characteristics once loaded with Van loading.

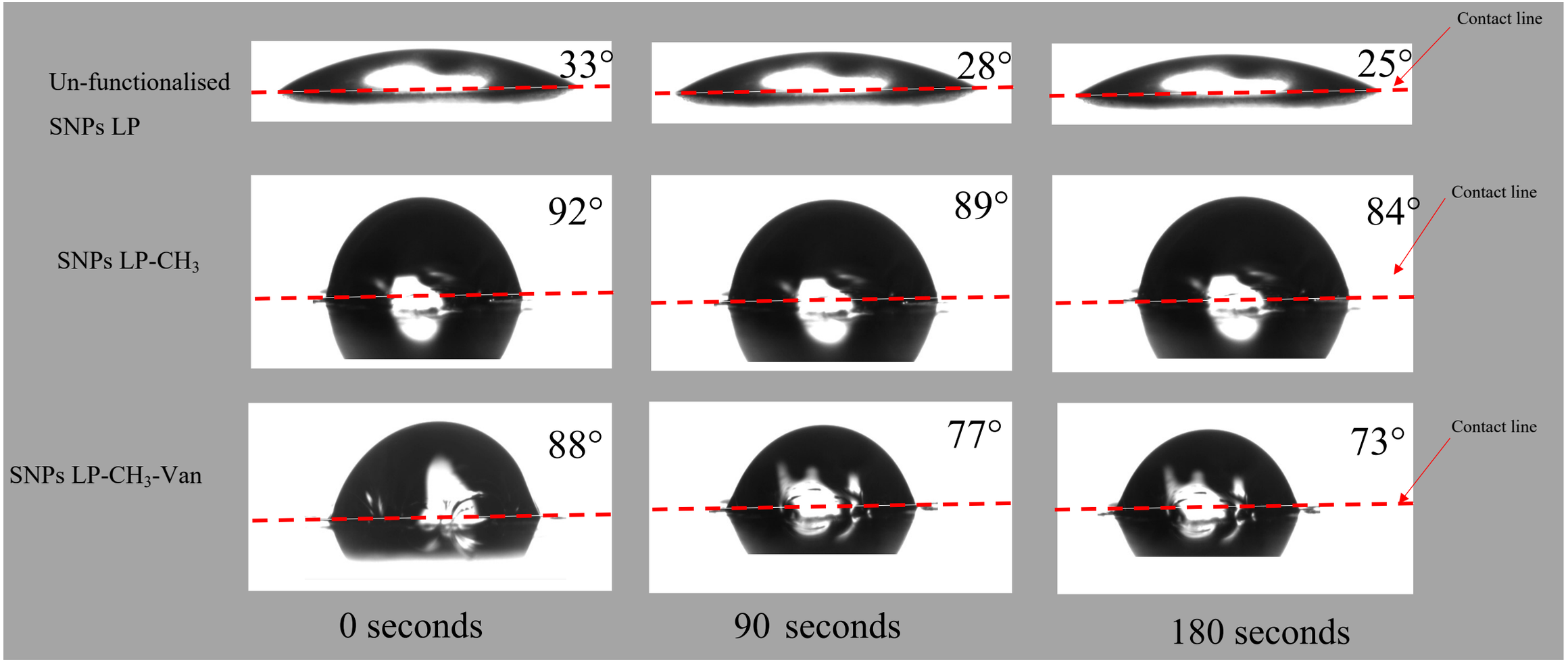


Figure S13. Images of water droplet interacting with the surface of SNPs LP with/without functional groups. Contact angles for Van-loaded SNPs LP-CH_3 show that SNPs LP-CH_3 do not lose their hydrophobic characteristics once loaded with Van loading.

Table S14. Binding energies and concentrations (at %) of different elements on the surface of un-functionalised and functionalised SNPs

Peak detail	Binding energy (eV)	Concentration (at %)							
		SNPs SP				SNPs LP			
		SNPs SP	SNPs SP-NH_2	SNPs SP-PO_3	SNPs SP-CH_3	SNPs LP	SNPs LP-NH_2	SNPs LP-PO_3	SNPs LP-CH_3
C 1s	282	-	17.63	7.49	58.33	-	19.84	8.74	15.76
N 1s	397	-	2.39	-	-	-	3.69	-	-
O 1s	531	70.71	56.05	67.82	28.53	70.98	54.36	67.62	60.79
Si 2p	102	29.29	23.93	24.69	13.15	29.02	22.10	23.65	23.44

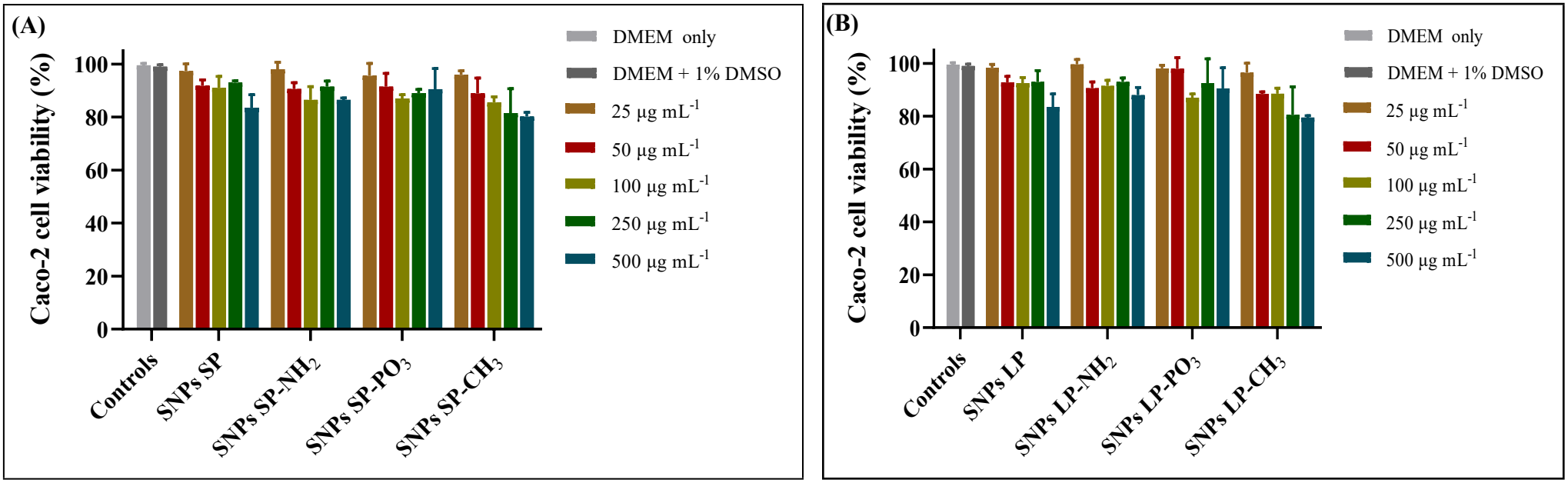


Figure S15. In vitro cytotoxicity assays of (A) SNPs SP and (B) SNPs LP. The values are presented as means ± SDs of n = 3

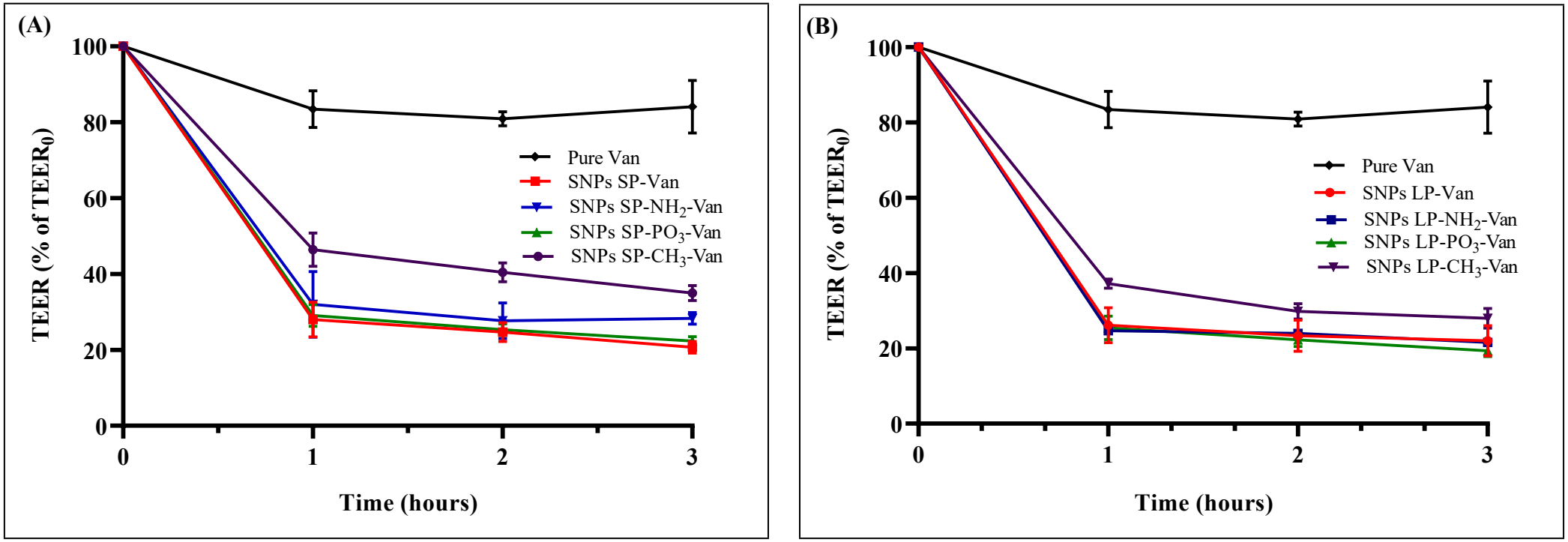


Figure S16. TEER values of (A) Van-loaded SNPs SP and (B) Van-loaded SNPs LP during 3 h of transport experiment. TEER values are presented as means ± SDs (n=3) considering the TEER values of un-treated Caco-2 cells (Caco-2 cell monolayers with only HBSS or HBSS+1% DMSO without SNPs).