Electronic Supplementary Material (ESI) for Biomaterials Science.

Supporting Information

for

The next generation cell-penetrating peptide and carbon dot conjugated nano-liposome for transdermal delivery of curcumin

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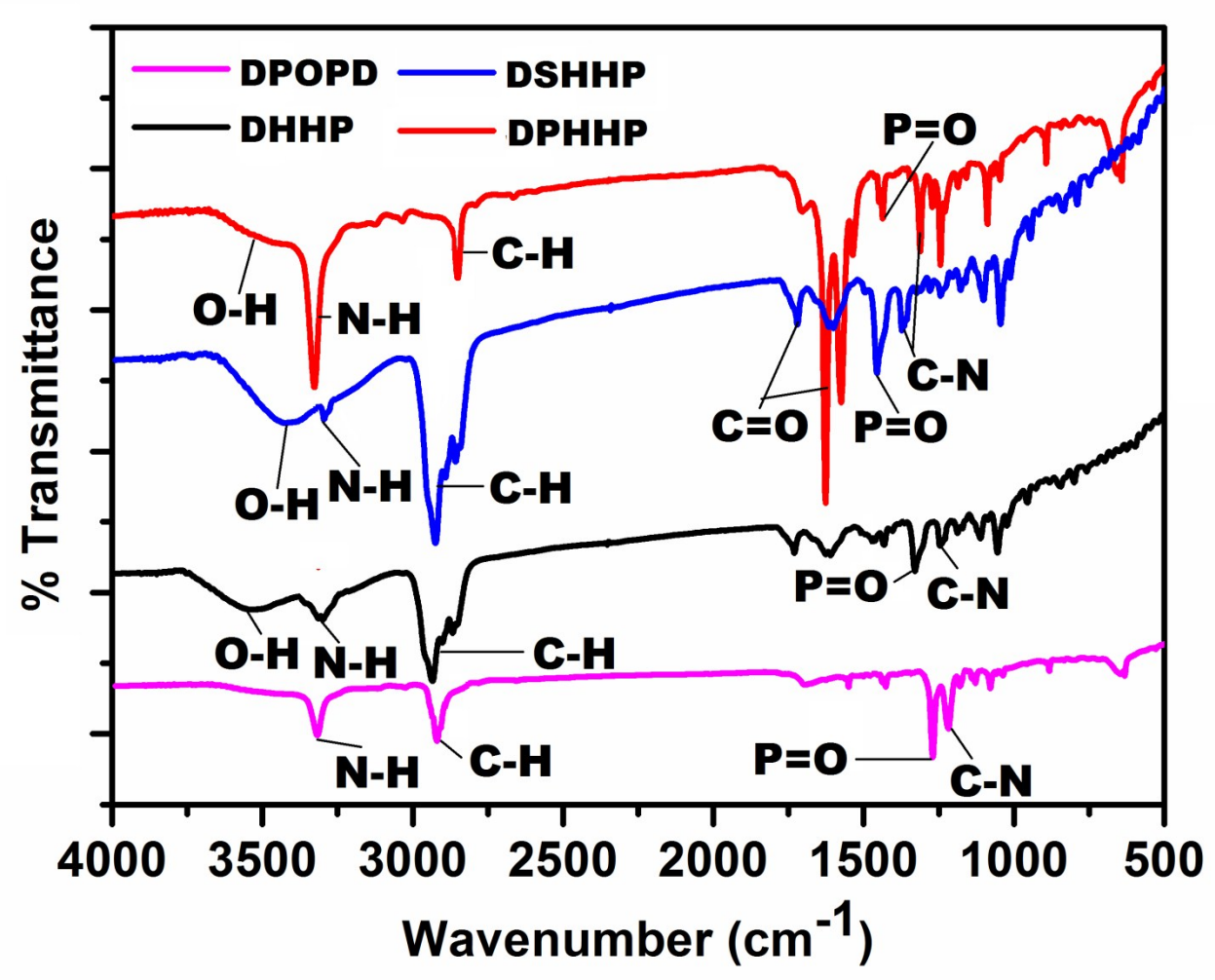

Figure S1: FT-IR spectra of 2-((1,3,2-dioxaphospholan-2-yl)oxy)propane-1,3-diamine (DPOPD), 1,3-diaminopropan-2-yl (2-hydroxyethyl) hydrogen phosphate (DHHP), 1,3-dipalmitamidoprpan-2-yl (2-hydroxyethyl) hydrogen phosphite (DPHHP) and 1,3-distearamidopropan-2-yl (2-hydroxyethyl) hydrogen phosphite (DSHHP).

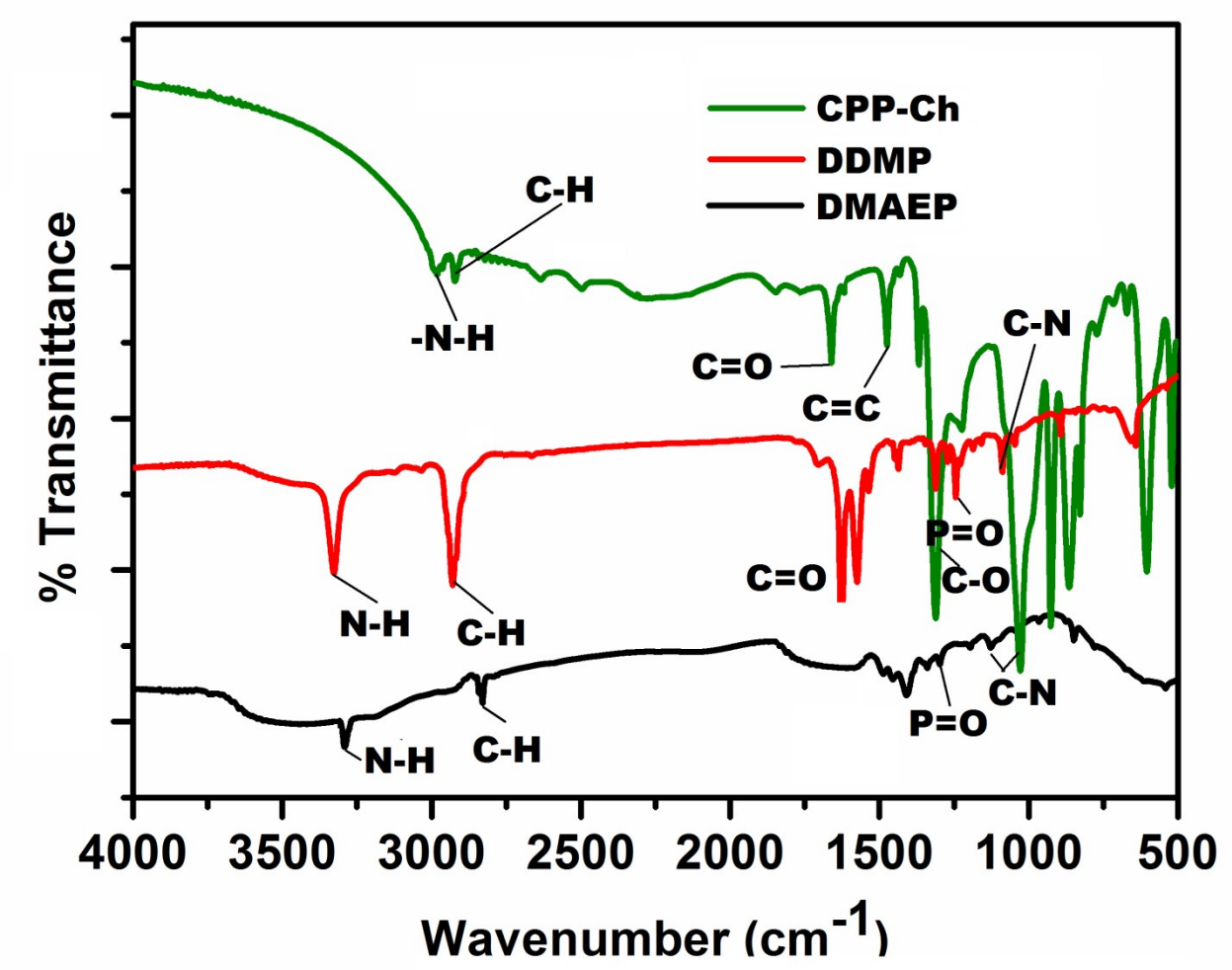

Figure S2: FT-IR spectra of 1,3-diaminopropan-2-yl (2-(dimethyl(2-(methylamino)ethyl)ammonio)ethyl) phosphate (DDMP), 2-(dimethyl (2-methylamino)ethyl)ammonio) ethylammmonio)ethyl (1,3-ditetradecanamidopropan-2-yl)phosphate (DMAEP) and CPP-cholesterol conjugates (CPP-Ch).

S1: 1H-NMR spectroscopy

Figure S3, S4 and S5 represents the ^{1}H-NMR spectra of prepared lipids (DMAEP, DPHHP and CDs-DSHHP) dissolve in $CDCl_3$. The proton signal of long hydrophobic chain merged at one point and appeared at 1.26-1.29 ppm in all the three lipids. DPHHP shows a peak at 8.32 ppm is corresponded to the –NH group and 1.85 ppm referred to –OH group bonded to phosphorous. The signal at 3.48 ppm is corresponded to the free –OH group at the end. The peak due to free –OH group is disappeared in the spectra of CDs-DSHHP, while the other peaks get shifted after the conjugation of CDs. In the ^{1}HNMR spectra of DMAEP, some extra peaks due to

presence of trimethylethane-diamine moiety were obtained. The peaks at 3.68 and 1.92 ppm are due to methyl protons bonded with N-atom and-NH protons, respectively. All the ^{1}HNMR spectra are in accordance with the proposed structure and no extra peak was obtained. The brown color numerical values indicate the chemical shift values of each proton. This proves the successful formation of pure lipid products.

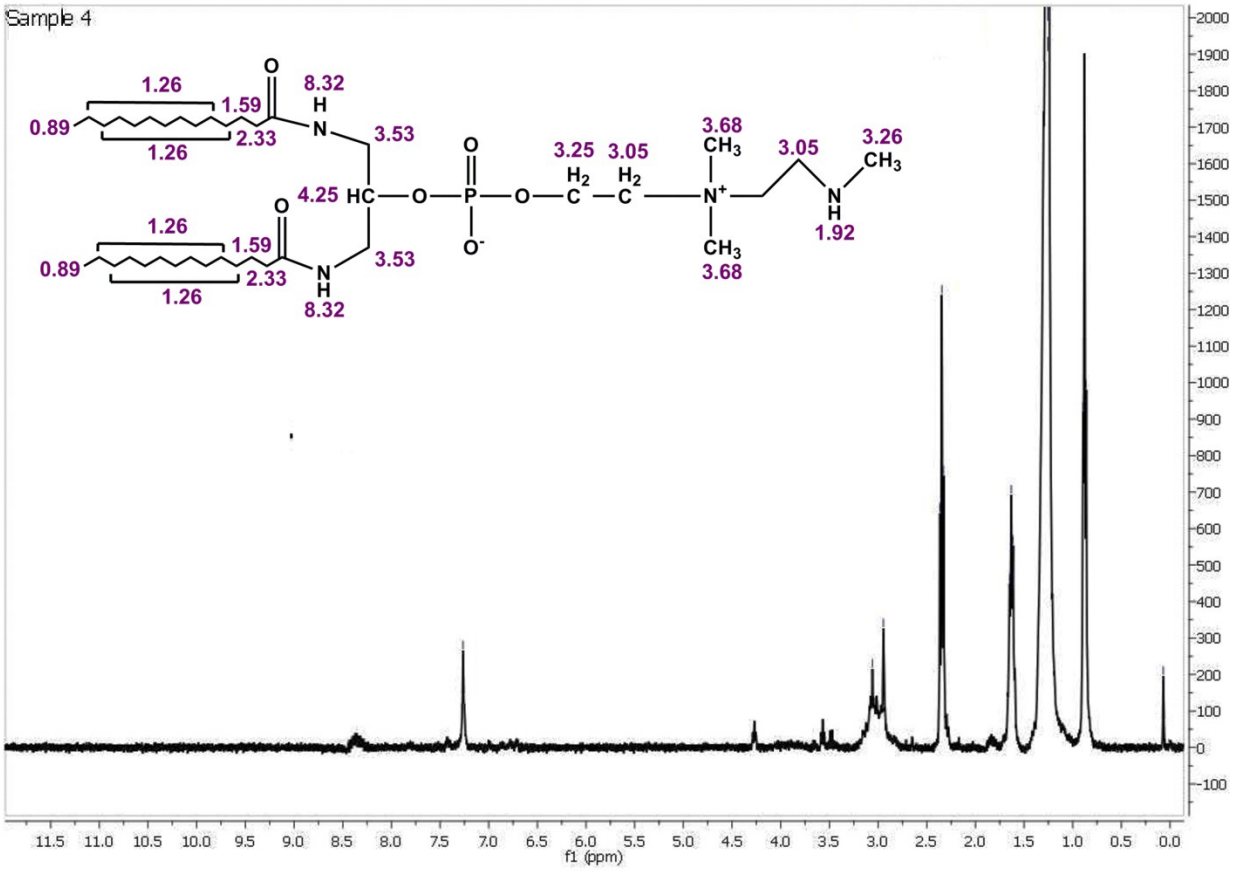

Figure S3: 1H-NMR spectra of 2-(dimethyl (2-methylamino)ethyl)ammonio) ethylammmonio)ethyl (1,3-ditetradecanamidopropan-2-yl)phosphate (DMAEP).

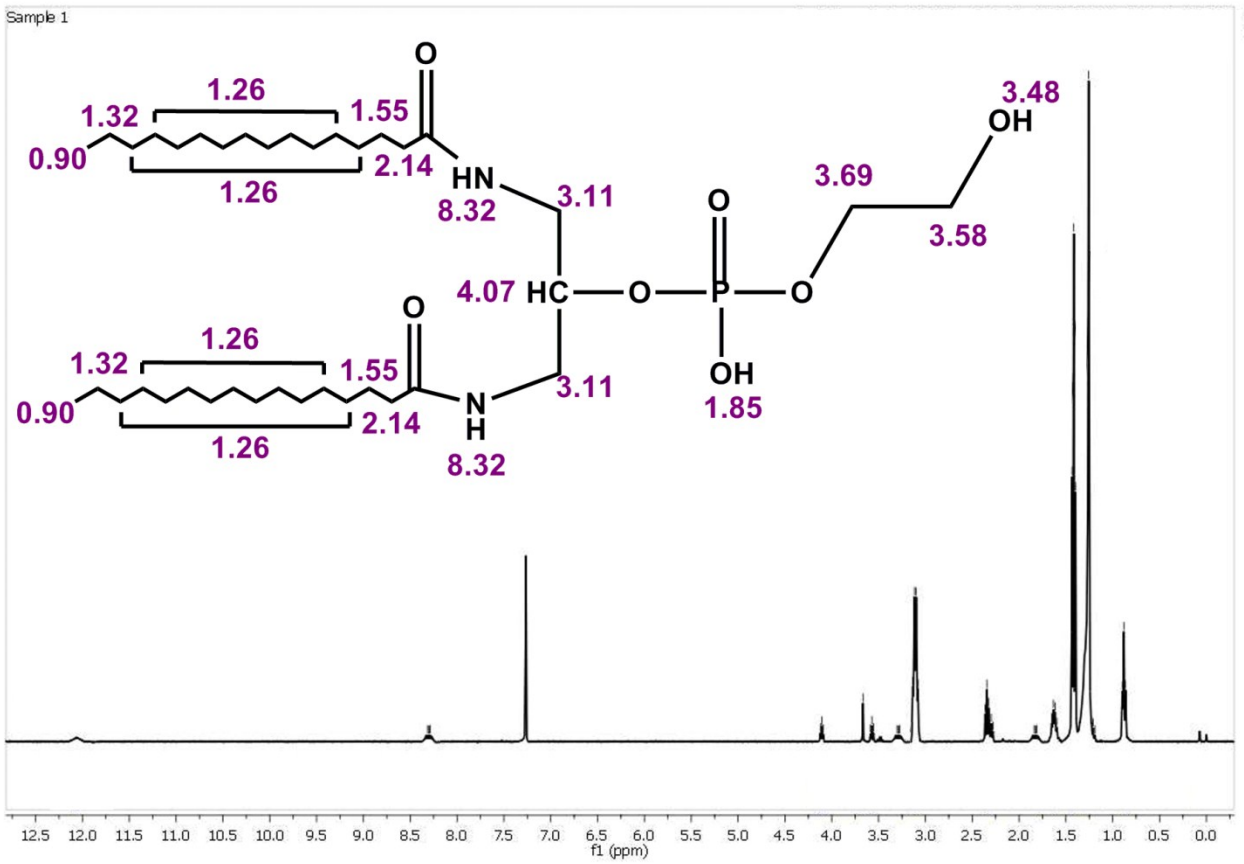

Figure S4: 1H-NMR spectra of 1,3-dipalmitamidoprpan-2-yl (2-hydroxyethyl) hydrogen phosphite (DPHHP).

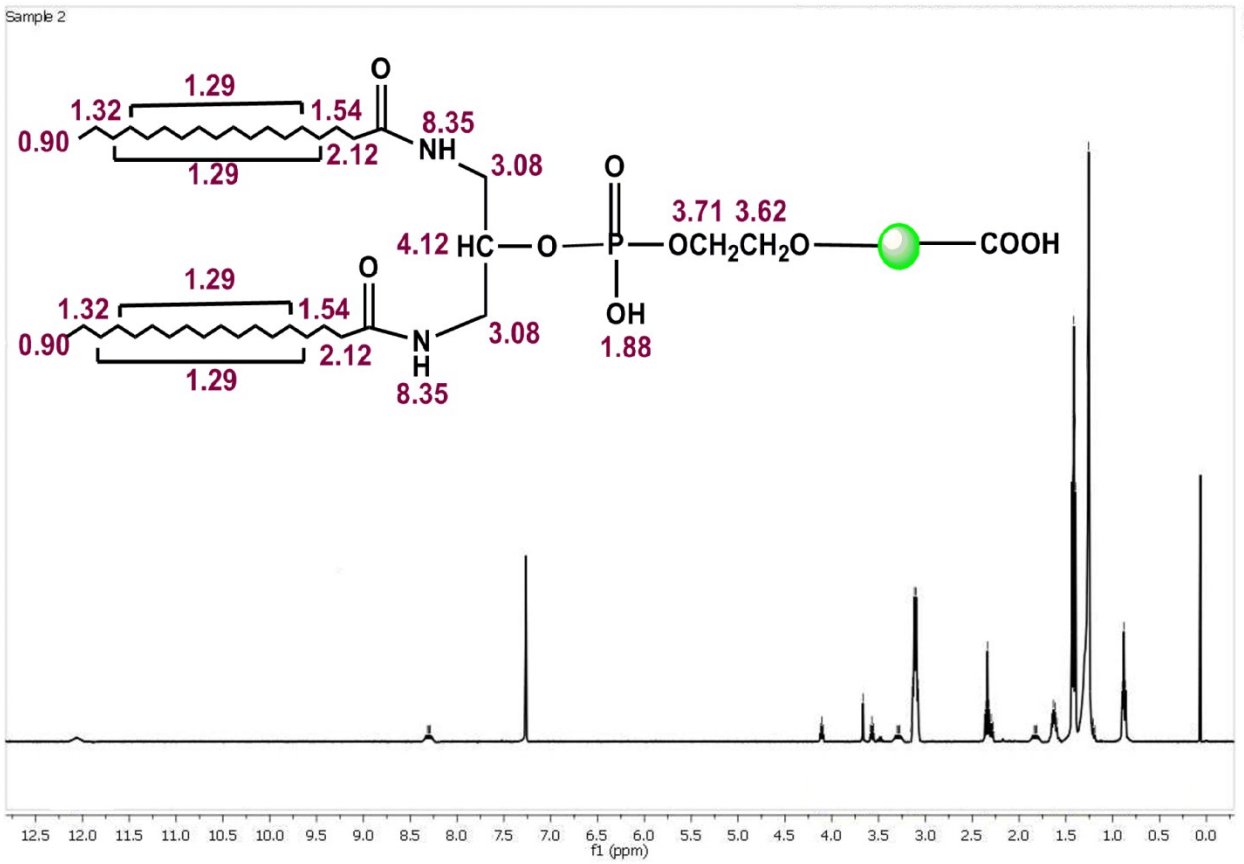

Figure S5: 1H-NMR spectra of CDs-1,3-distearamidopropan-2-yl (2-hydroxyethyl) hydrogen phosphite (CDs-DSHHP).

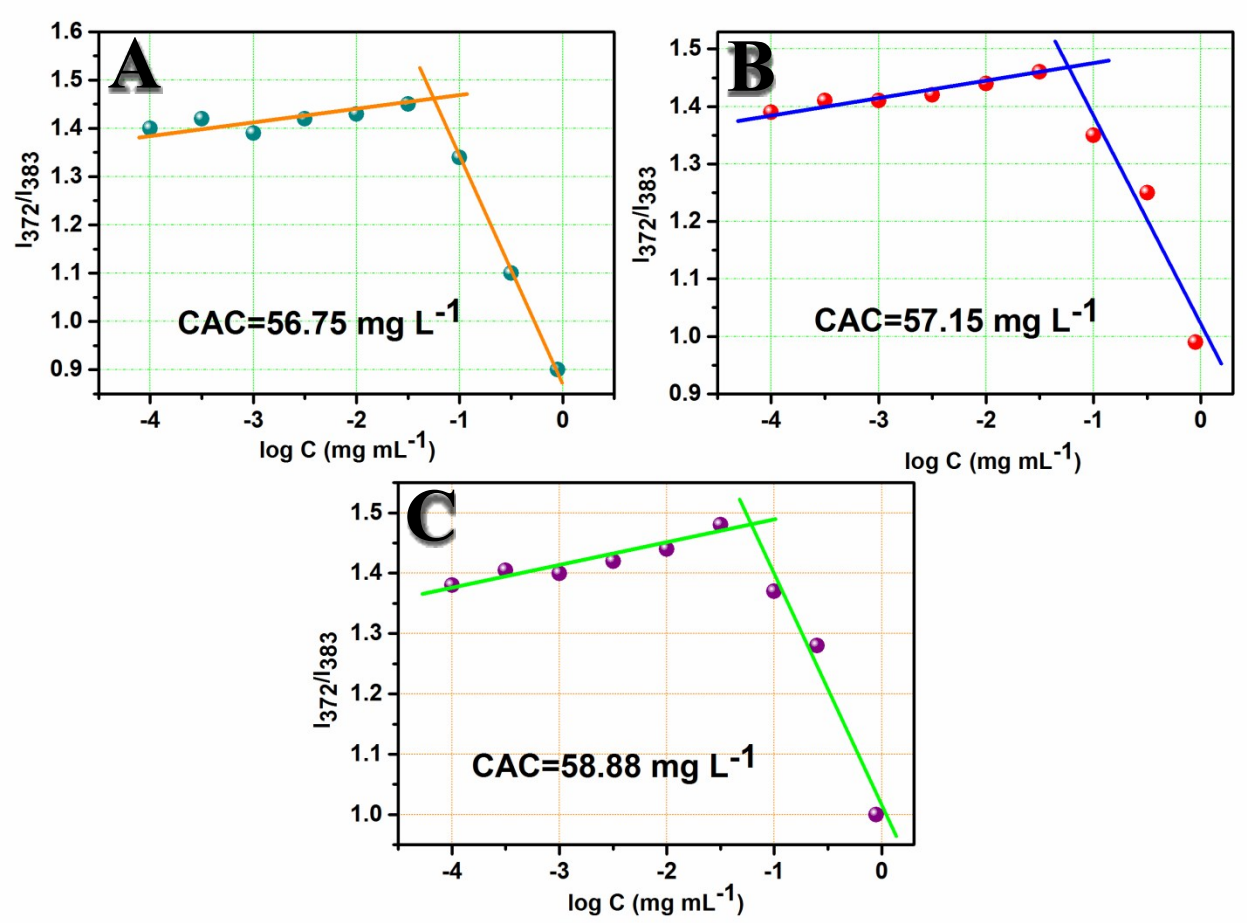

Figure S6: Critical aggregation concertation of (A) CLs, (B) CDLs, and (C) RCDLs.

Table S1: Stability of various liposomes while storage at room temperature.

Liposomes	**Time (month)**	**% EE*±SD****	**Diameter ±SD** (nm)**
RCDLs	0	94.2±0.3	128.1±1.6
	1	93.7±0.3	130.2±1.5
	2	92.5±0.2	132.0±1.6
	3	90.7±0.2	135.1±1.7
CDLs	0	84.7±0.2	132.2±1.3
	1	81.7±0.2	135.3±1.5
	2	78.5±0.2	139.3±1.7
	3	75.1±0.1	142.6±1.8
CLs	0	70.1±0.2	140.0±1.4
	1	67.5±0.2	143.1±1.4
	2	63.1±0.1	145.9±1.5
	3	59.8±0.1	150.0±1.6

*%EE= % Encapsulation efficiency; **SD= standard deviation of three replicate values

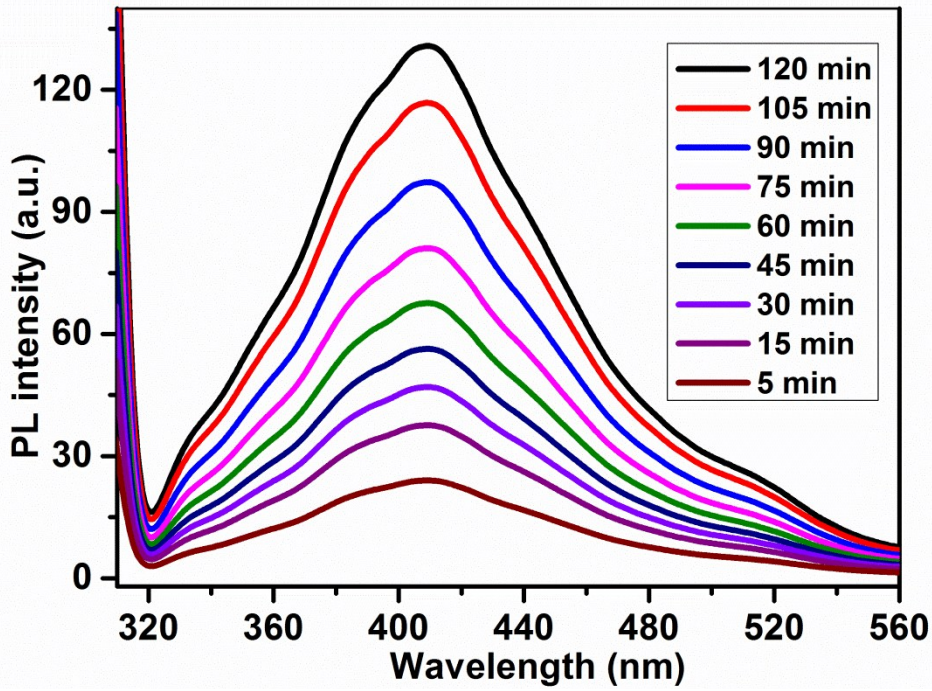

Figure S7: PL spectra of CDLs extracted from acceptor compartment of Franz type diffusion cell, after different time intervals.

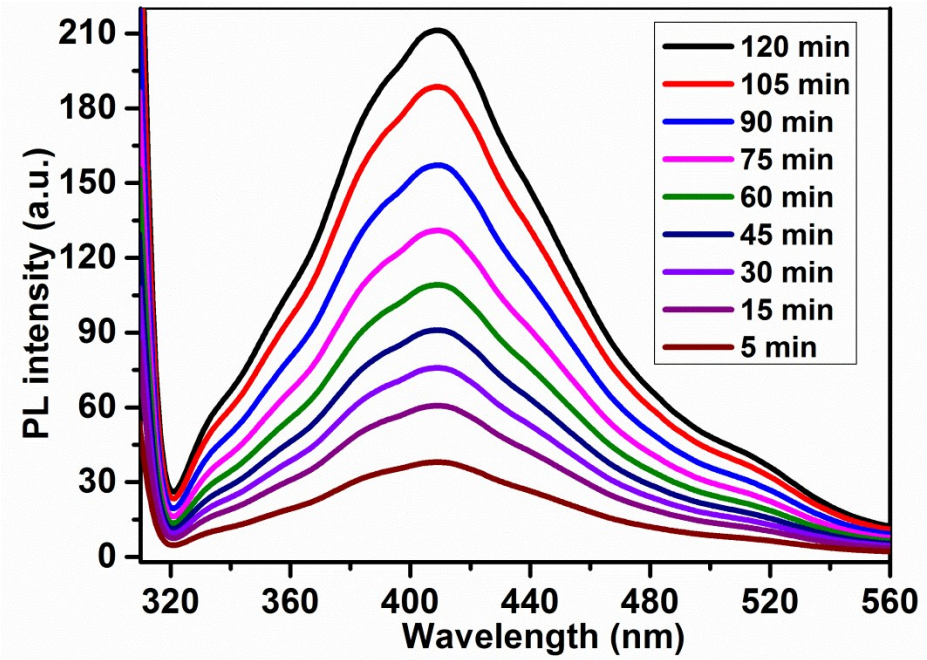

Figure S8: PL spectra of RCDLs extracted from acceptor compartment of Franz type diffusion cell, after different time intervals.