

# Supporting Information

## Phosphorus and Nitrogen Dual-Doped Hollow Carbon Dot as a Nanocarrier for Doxorubicin Delivery and Biological Imaging

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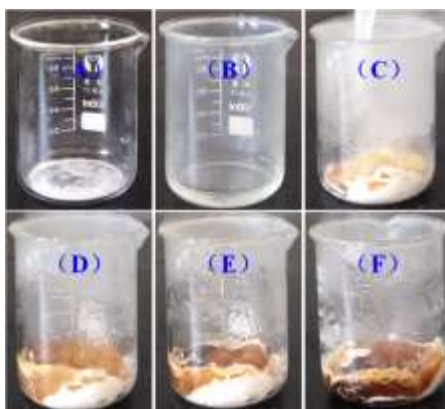
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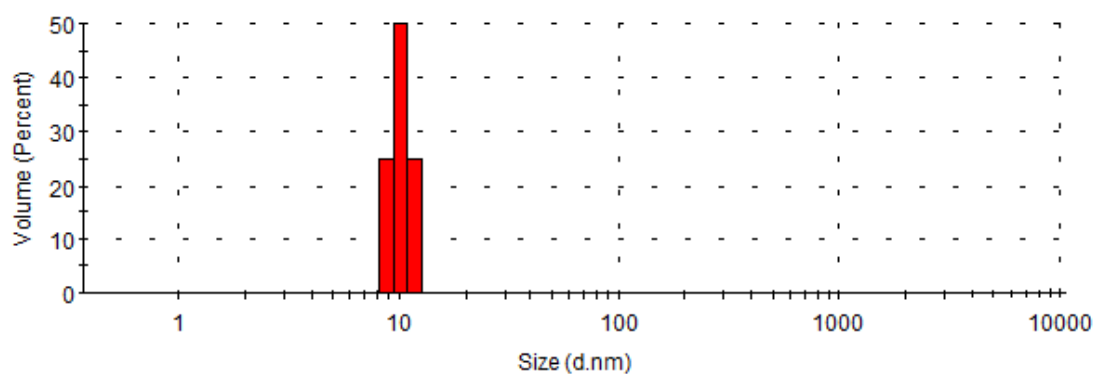
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**Figure S1.** Photographic images of the reaction products when 6.0 mL EDA and 4.0 mL concentrated  $\text{H}_3\text{PO}_4$  were added in 0.40 g glucose at (A) 0, (B) 15, (C) 30, (D) 60, (E) 120, and (F) 180 s. The volume changes from A to F with foam.



**Figure S2.** Size distribution histogram obtained from DLS measurement of PNHCDs in aqueous solution.

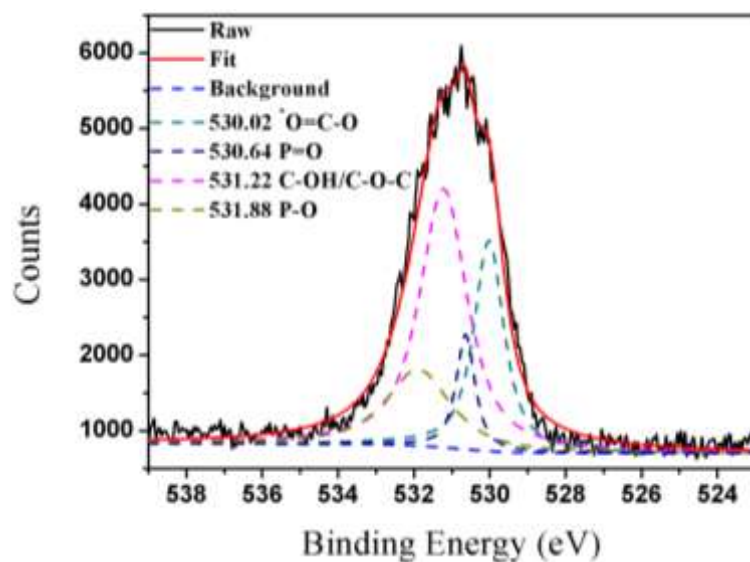
**Table S1.** Elemental analysis of the as-synthesized PNHCDs: (a) elemental content and (b) relative number of atom in a PNHCD.

(a)

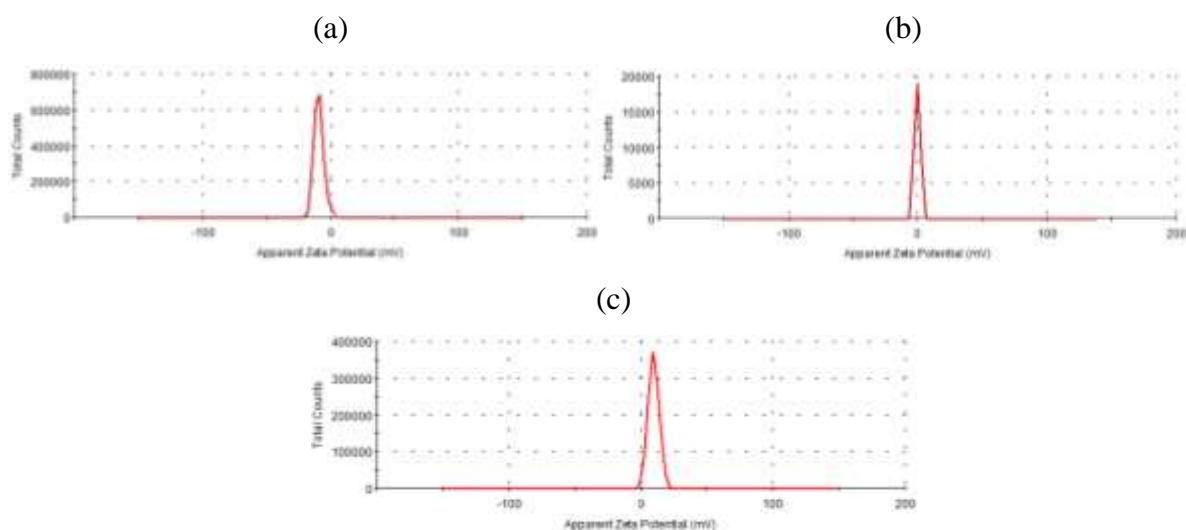
Sample name	Elemental content (weight %)				
	C	H	N	P	O (calculated)
PNHCDs	18.92	7.37	17.04	14.58	42.09

(b)

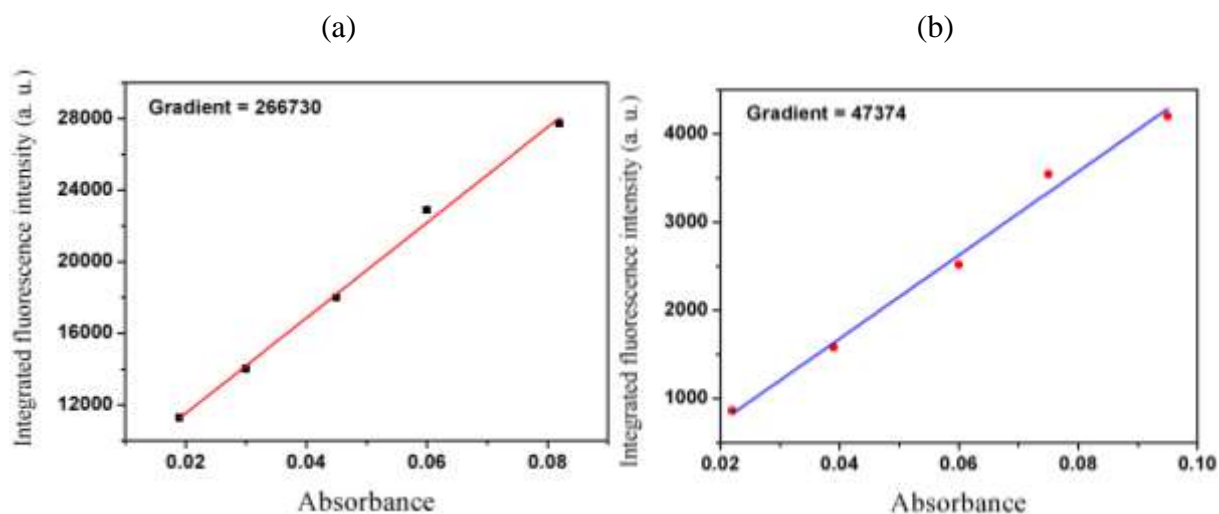
Sample name	Relative number of atom					Empirical formula
	C	H	N	P	O	
PNHCD	10	47	8	3	17	$\text{C}_{10}\text{H}_{47}\text{N}_8\text{P}_3\text{O}_{17}$



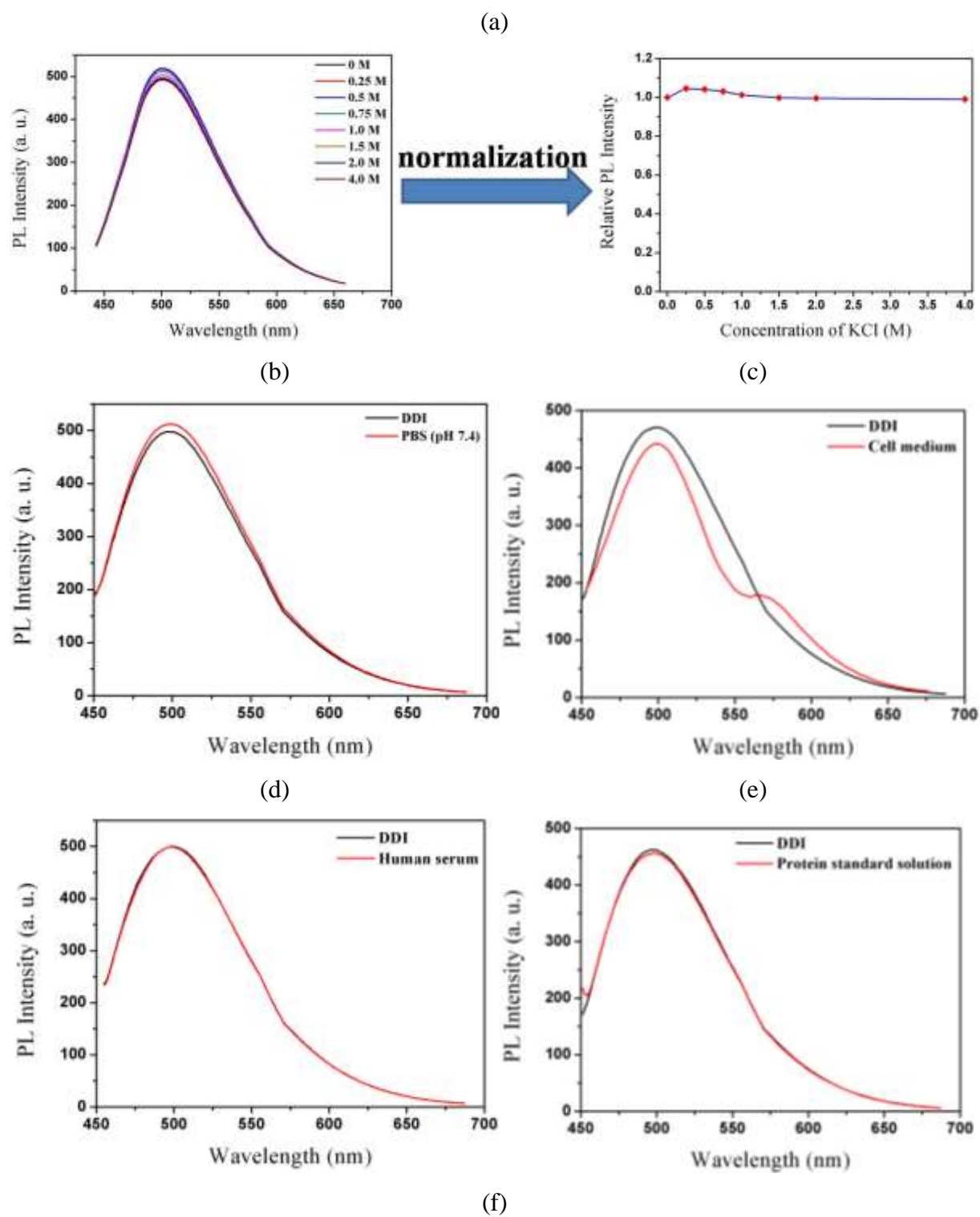
**Figure S3.** O 1s XPS of PNHCDs.

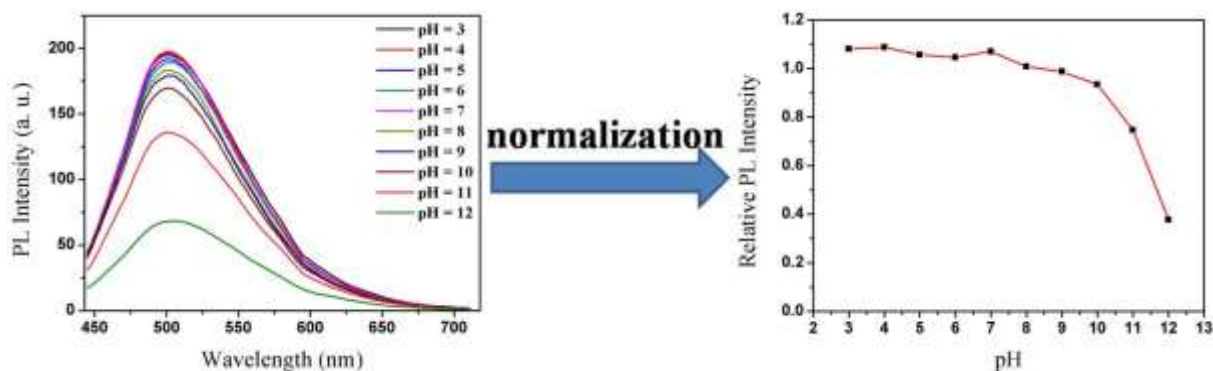


**Figure S4.** Zeta potential of (a) PNHCDs, (b) PNHCDs-DOX, and (c) DOX.

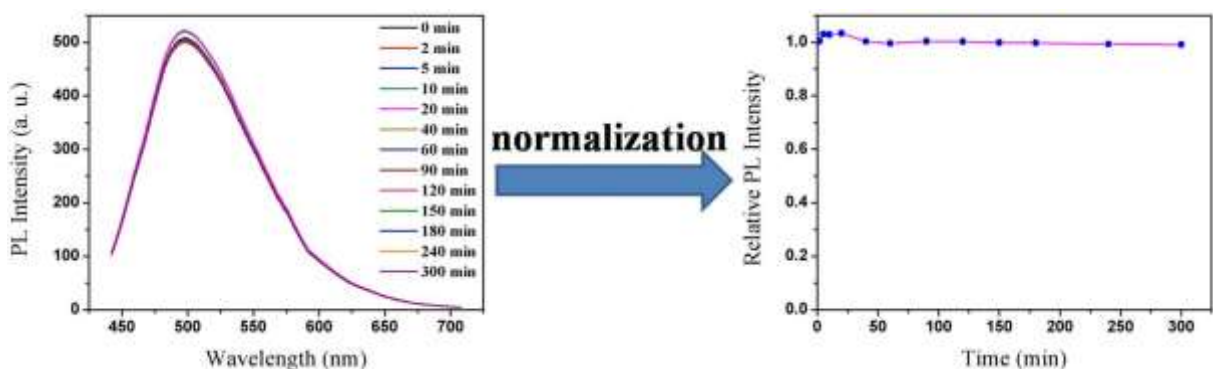


**Figure S5.** Plots of integrated PL intensity against absorbance of (a) quinine sulfate and (b) PNHCds at excitation and absorption wavelengths of 380 nm.

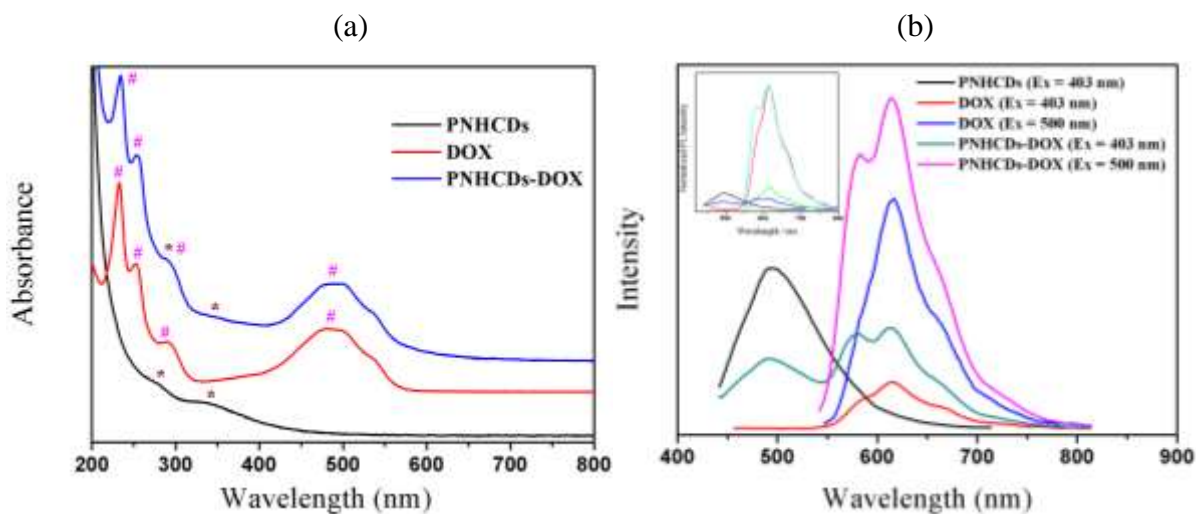




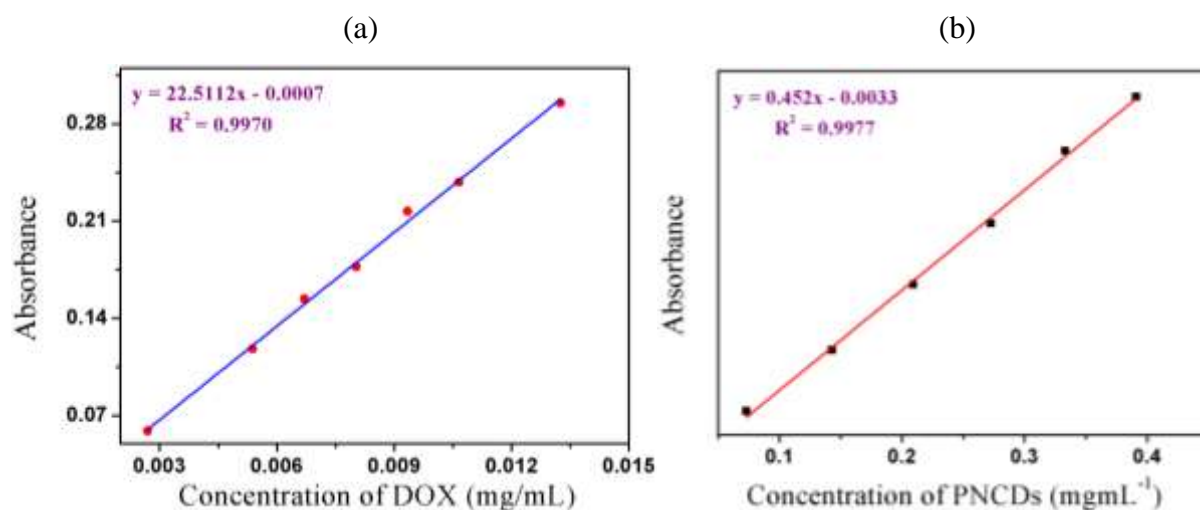
(g)



**Figure S6.** Stability of PNHCDs: (a) Effect of ionic strengths on the fluorescence intensity of PNHCDs ( $0.10 \text{ mg mL}^{-1}$ ). The ionic strength was controlled by various concentrations of KCl. Effect of (b) PBS (pH 7.4, 20 mM), (c) cell medium (90% DMEM and 10% FBS), (d) human serum ( $0.50 \text{ mg mL}^{-1}$ ), and (e) protein standard solution ( $0.53 \text{ mg mL}^{-1}$ ) on the fluorescence intensity of PNHCDs ( $0.10 \text{ mg mL}^{-1}$ ). (f) Effect of pH on the fluorescence intensity of PNHCDs ( $0.10 \text{ mg mL}^{-1}$ ). (g) Dependence of fluorescence intensity on UV excitation time for PNHCDs in DDI water ( $0.10 \text{ mg mL}^{-1}$ ).



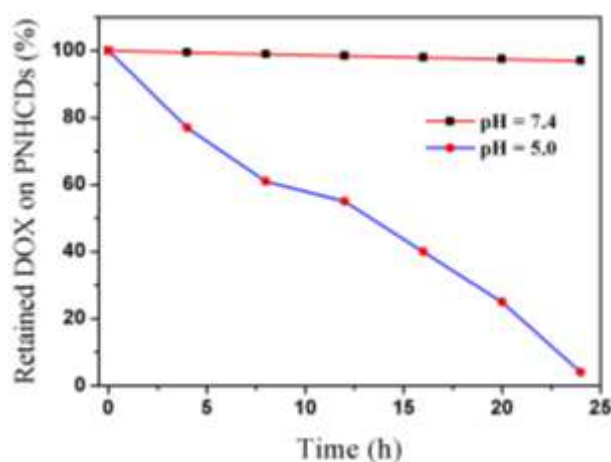
**Figure S7.** (a) UV-vis absorption and (b) photoluminescence emission spectra of PNHCDs, DOX, and PNHCDs-DOX.



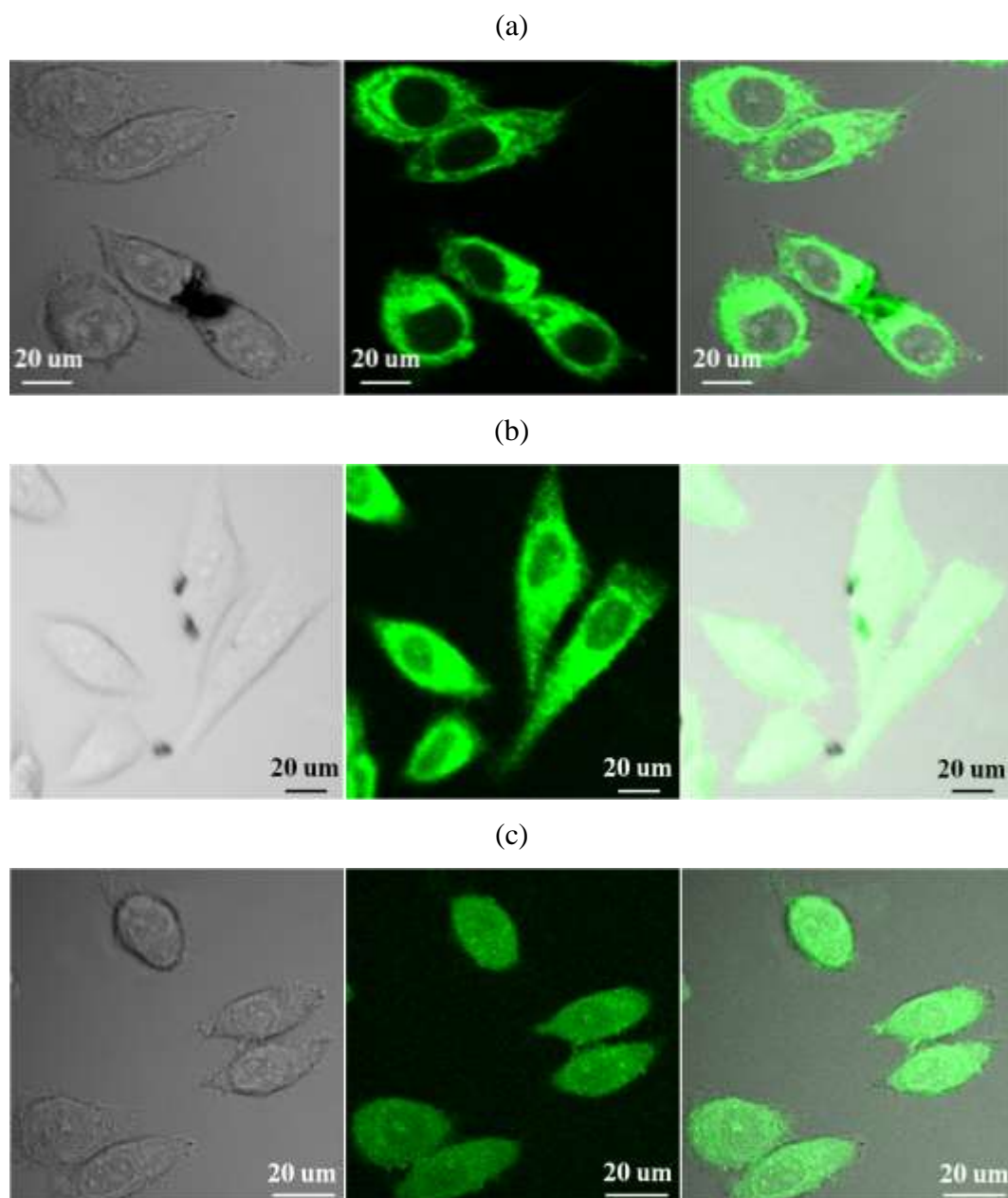
**Figure S8.** Plots of absorbance against concentration of (a) DOX at 488 nm and (b) PNHCDs at 336 nm.

**Table S2.** Absorbance of PNHCDs-DOX at 336 and 488 nm and the loading ratio of DOX.

Trial	1		2		3	
Wavelength (nm)	336	488	336	488	336	488
Absorbance	0.073	1.339	0.074	1.337	0.071	1.342
Weight of PNHCDs in 1.0 mL solution (mg)	0.169		0.171		0.164	
Weight of DOX in 1.0 mL solution (mg)	0.0595		0.0594		0.0596	
Loading ratio of DOX (%)	35.21		34.74		36.34	
Average loading ratio of DOX (%)	35.43					



**Figure S9.** Profiles for release of DOX from PNHCDs-DOX at different pH.



**Figure S10.** LSCM images of SiHa cells incubated with  $0.30 \text{ mg mL}^{-1}$  PNHCDs for (a) 5 h, (b) 10 h, and (c) 20 h observed under bright field (left panel),  $488/500 \pm 25 \text{ nm}$  (middle panel), and their merged images (right panel), respectively.