Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Beneficial Effects of Water in the Colloidal Synthesis of InP/ZnS Core-Shell Quantum Dots for Optoelectronic Applications

Parthiban Ramasamy,[a] *Bumjin Kim,*[a] *Min-Sang Lee*[b] *and Jong-Soo Lee*[a,]*

[a]Department of Energy Systems Engineering, DGIST, Daegu, 711-873, Republic of Korea
[b]Ecolumy Co., Ltd. University-Industry Cooperation Center, DGIST, Daegu, Republic of Korea

Table S1. Water content measurements for different reaction systems using Karl Fisher titration

Reaction system	**Measurement 1 (ppm)**	**Measurement 1 (ppm)**
With water	1807	1770
Without water	82	80
Only Tech OAm	274	257

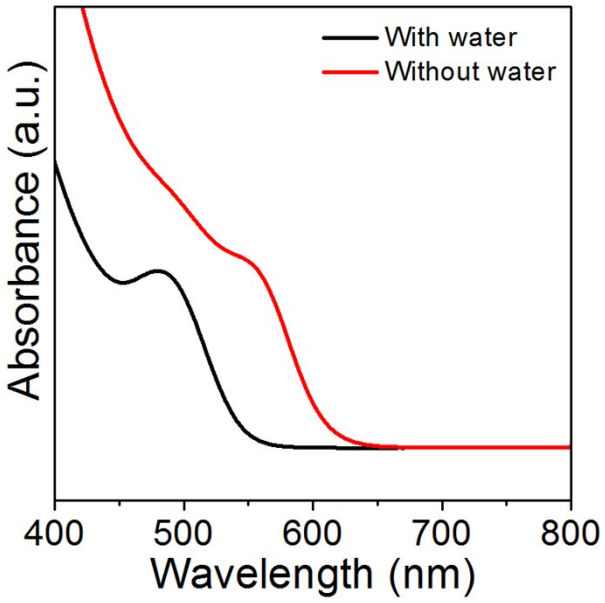

Fig. S1 Uv-vis absorption spectra of InP core QDs synthesized with and without water at 185 °C for 15 min.

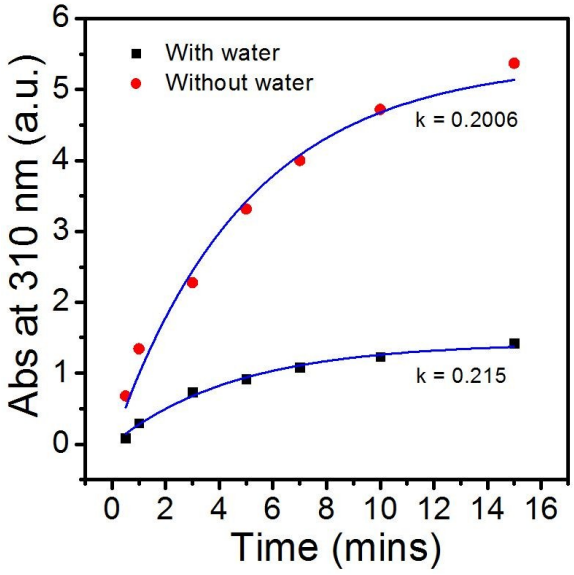

Fig. S2 Measured absorbance at 310 nm for the InP QDs synthesized with and without water. The data is fitted with rate equation $y = A*(1-exp^{-kt})$ to obtain rate constant. Where, A = max yield, here the absorbance number is taken as yield. k is rate constant and t is time. This is an approximate value, since we did not calculate the exact concentration of InP QDs at each time.

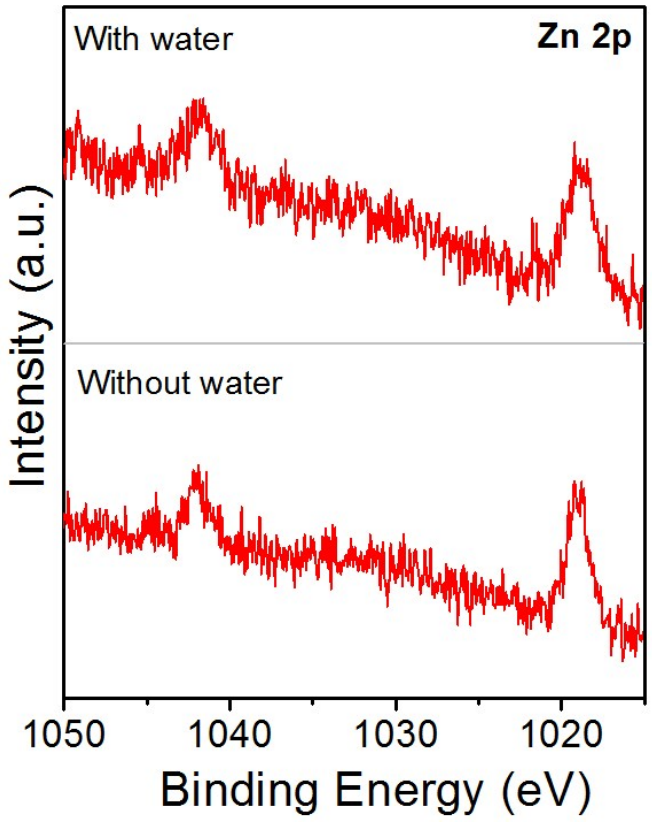

Fig. S3 Zn 2p XPS spectra of InP core QDs synthesized with and without water.

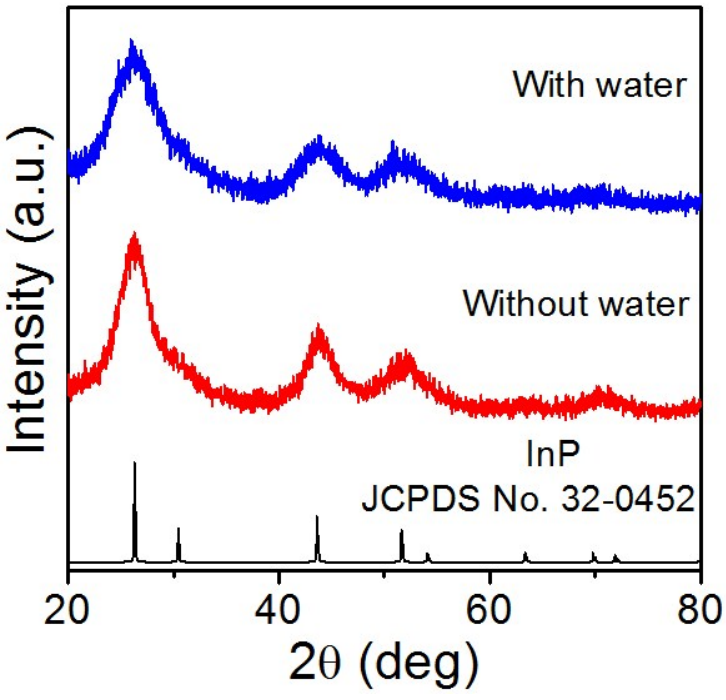

Fig. S4 XRD patterns of InP core QDs synthesized with and without water.

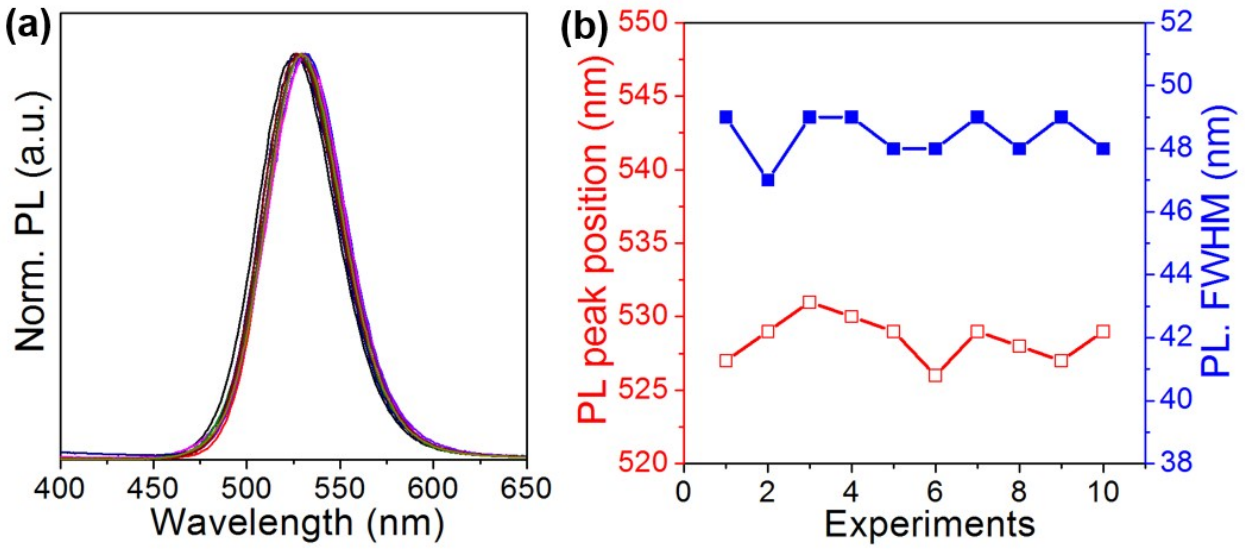

Fig. S5 PL spectra, peak position and FWHM of InP/ZnS QDs synthesized with water for 10 consecutive experiments.

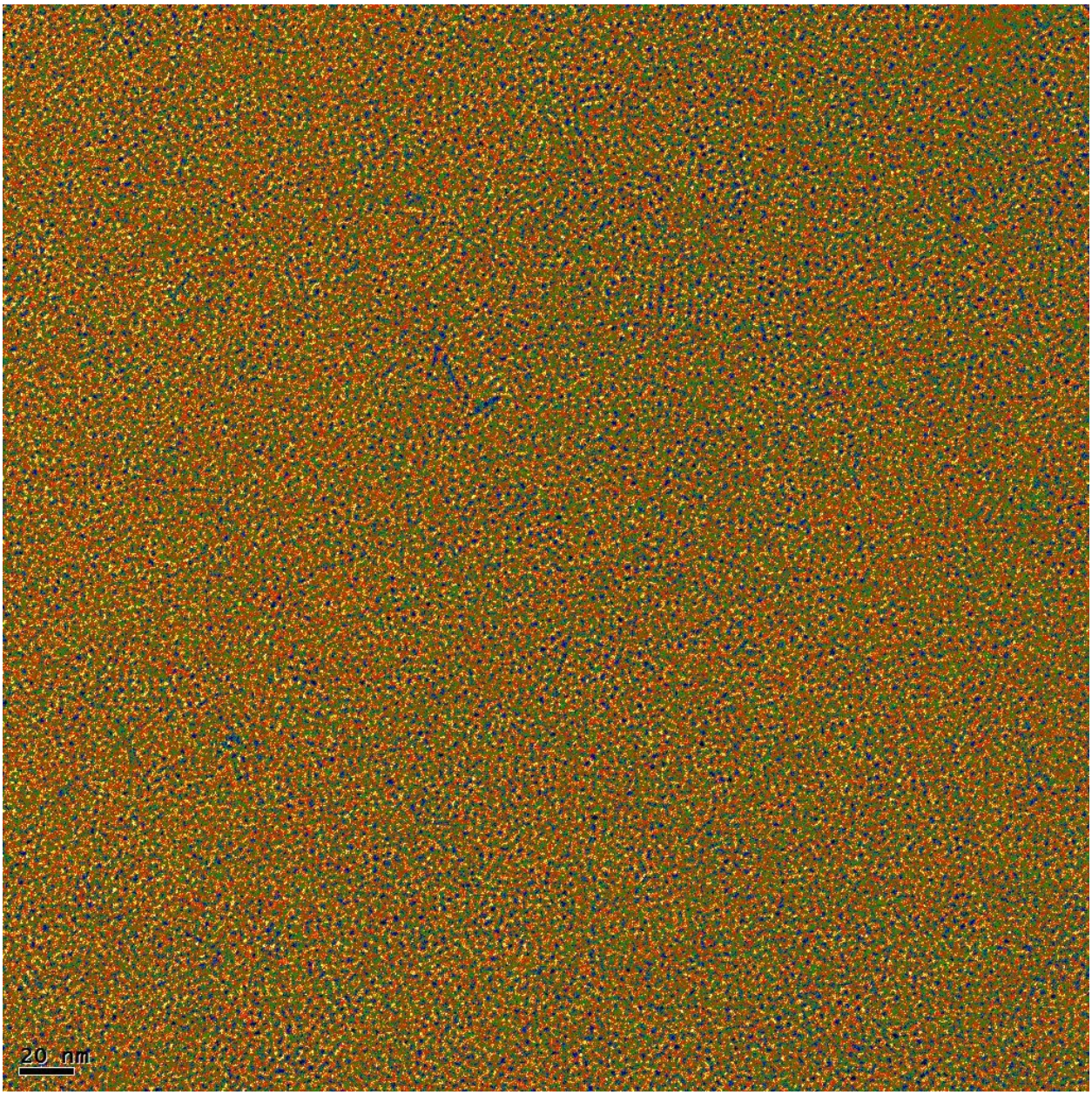

Fig. S6 TEM image of InP core QDs synthesized with water. Color scheme has been changed to clearly show the InP QDs. The blue dots represent the InP QDs.

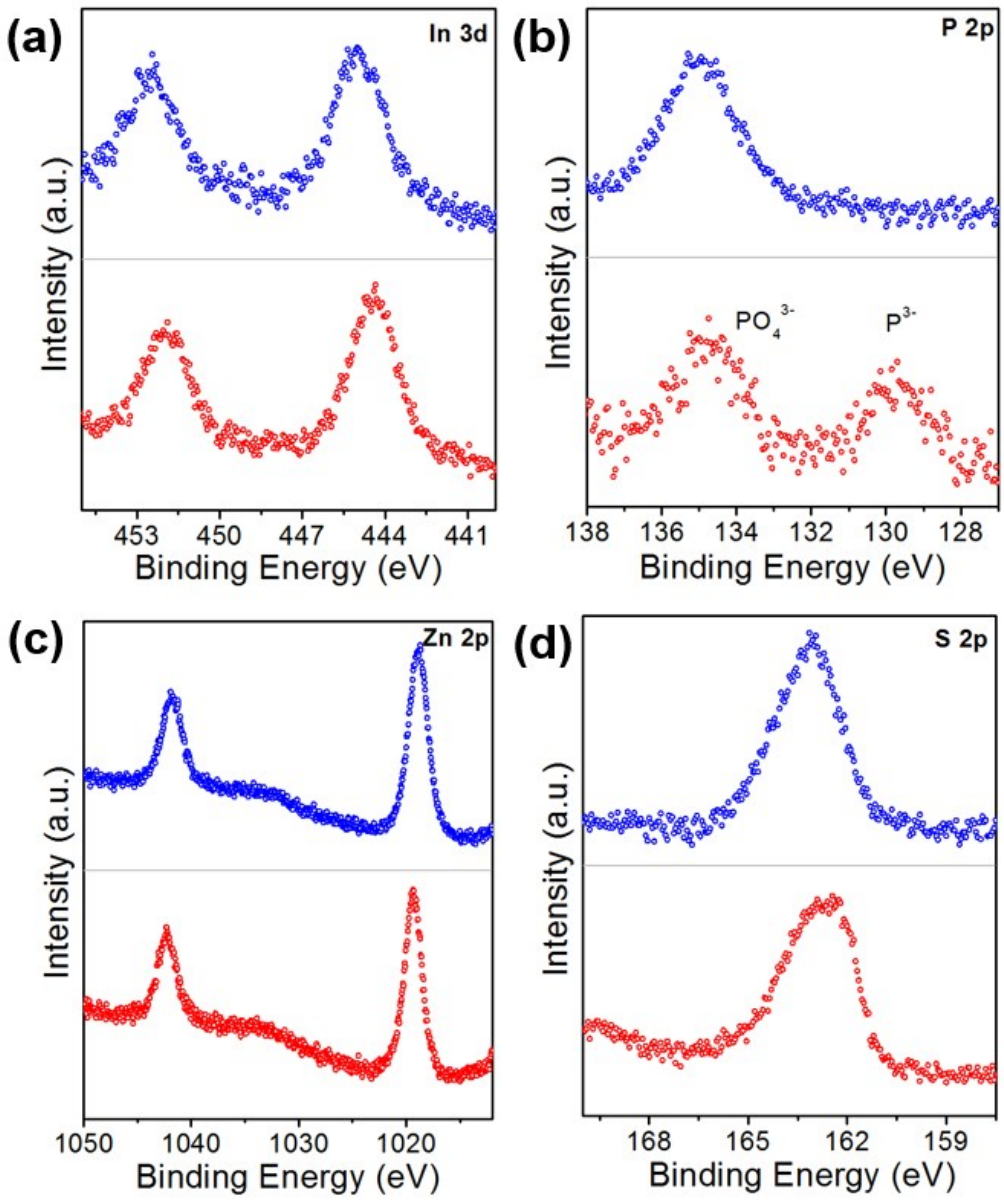

Fig. S7 Comparison of (a) In 3d (b) P 2p (c) Zn 2p and (d) S 2p XPS spectra of InP/ZnS QDs synthesized with (blue lines) and without water (red lines).

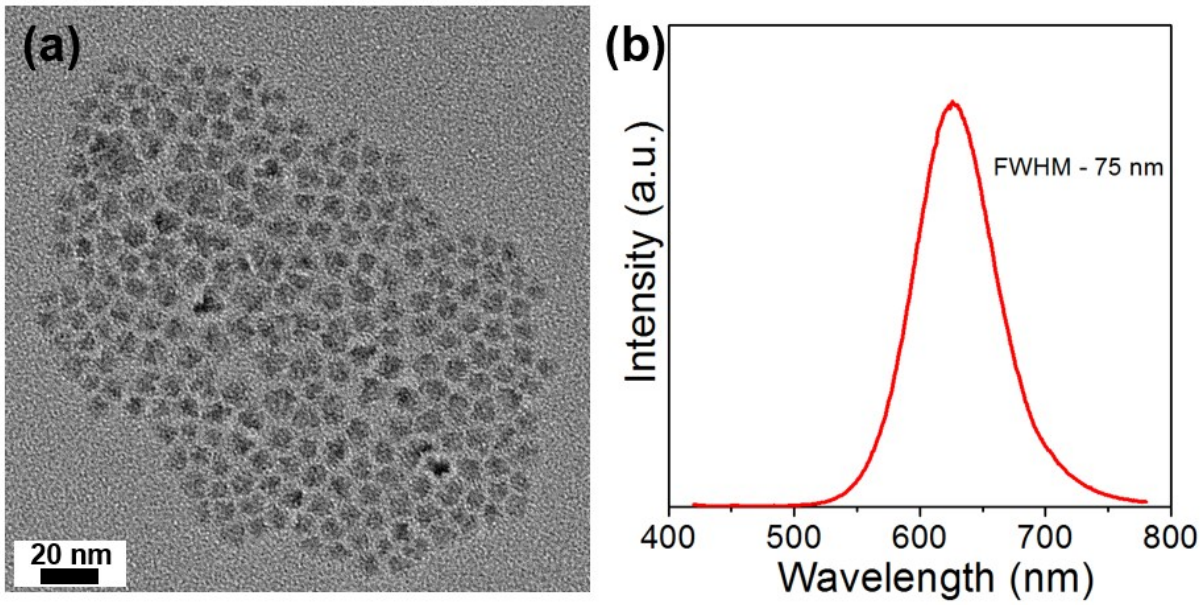

Fig. S8 TEM images and PL spectra of larger InP/ZnS QDs synthesized without water. For the thick ZnS shell we doubled the Zn and S precursor concentration and three layer of ZnS was coated to obtain larger particles.

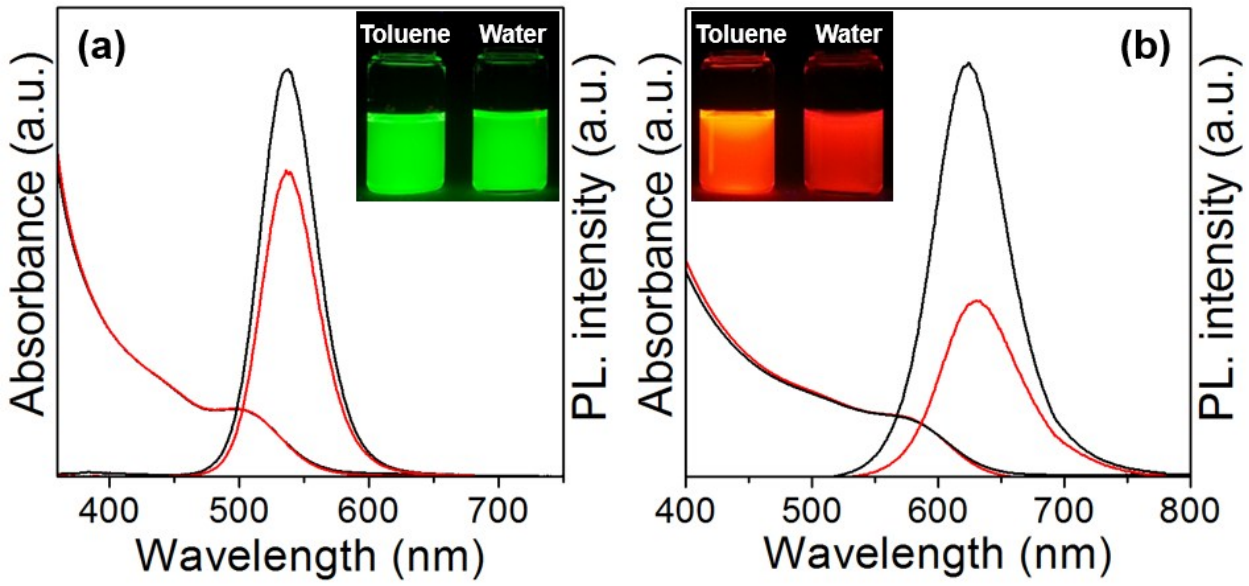

Fig. S9 Absorption and photoluminescence spectra of InP/ZnS QDs before and after aqueous phase transfer using MPA. (a) InP/ZnS QDs synthesized with water and (b) InP/ZnS QDs synthesized without water. Black lines: spectra in toluene, Red lines: spectra recorded in water, the absorbance of the samples before and after phase transfer was adjusted to be equal. Insets show the luminescent photograph of QDs dispersed in toluene (SA capped) and water (MPA capped).

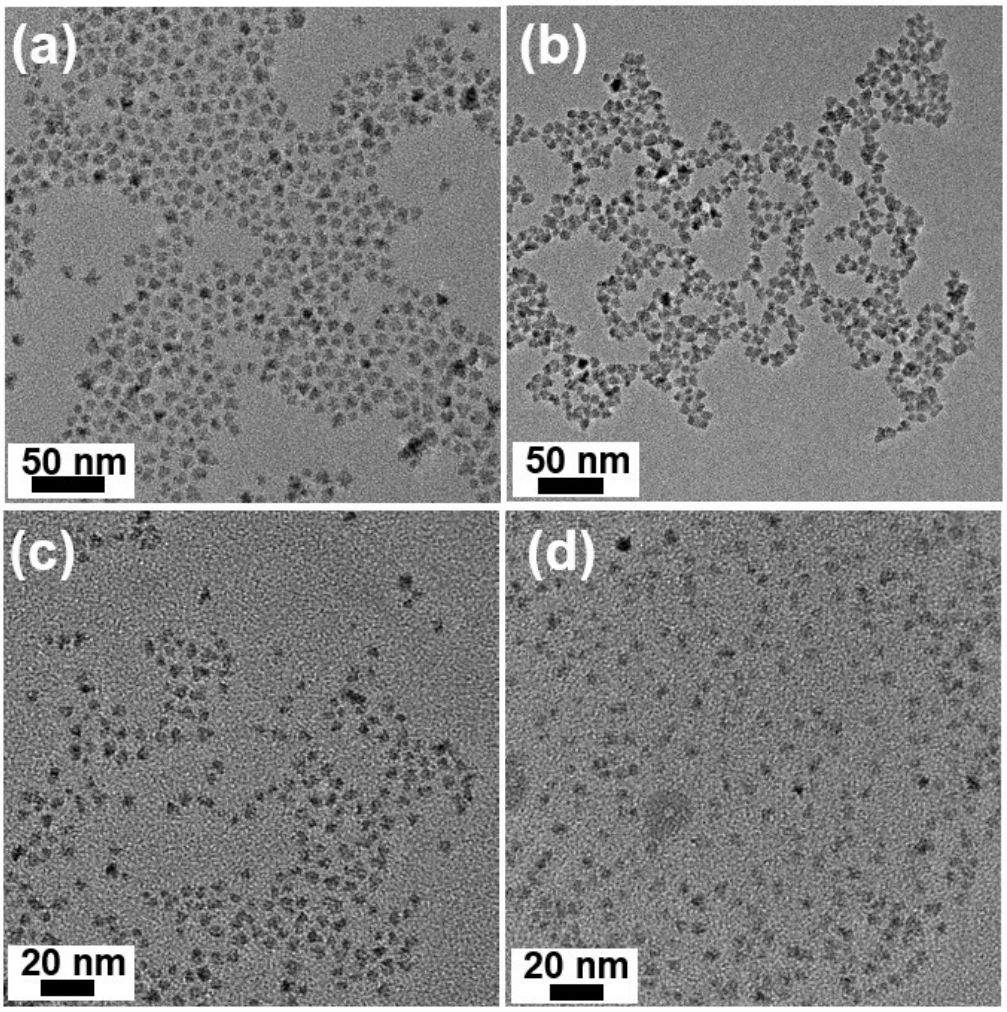

Fig. S10 TEM images of InP/ZnS QDs before and after aqueous phase change reactions. InP/ZnS QDs synthesized with water (a) before and (b) after phase change reaction. InP/ZnS QDs synthesized without water (c) before and (d) phase change reaction.

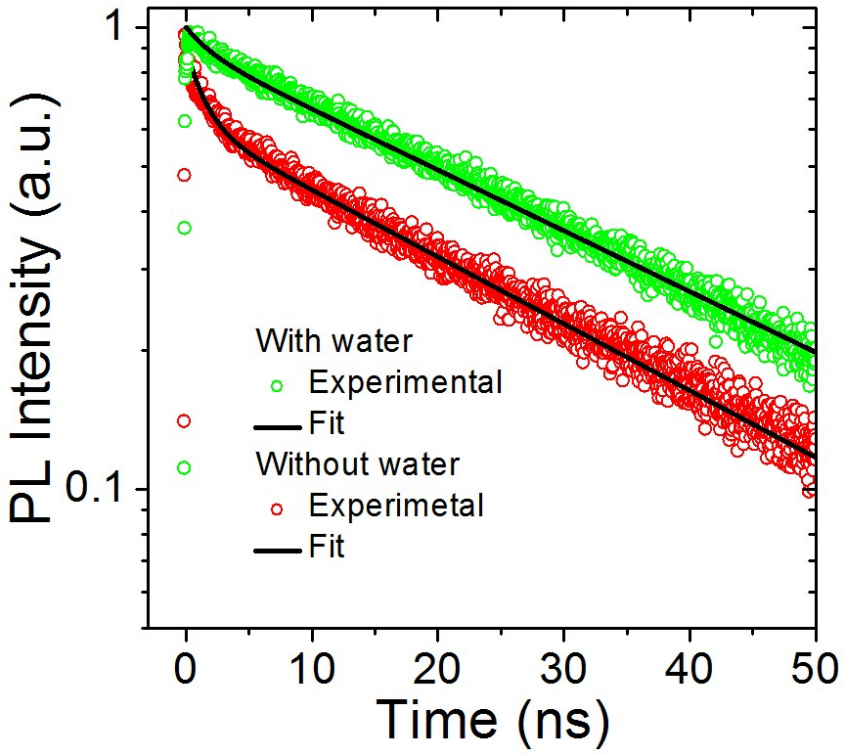

Fig. S11 Time resolved PL decay of InP/ZnS QDs synthesized with and without water.

Table S2. Photoluminescence lifetime components and amplitudes of the exponential fit curves for InP/ZnS QDs synthesized with and without water

	Emission (nm)	**A**	**τ_1 (ns)**	**B**	**τ_2 (ns)**
With water	530	0.1	2	0.9	33
Without water	625	0.31	1.5	0.69	30

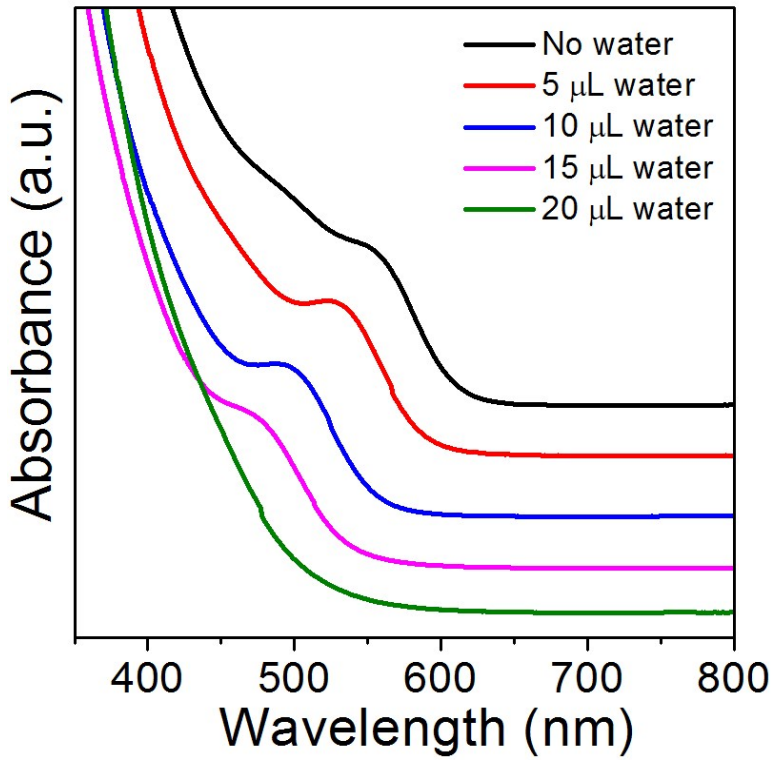

Fig. S12 Absorption spectra of InP QDs synthesized with different amounts of water.

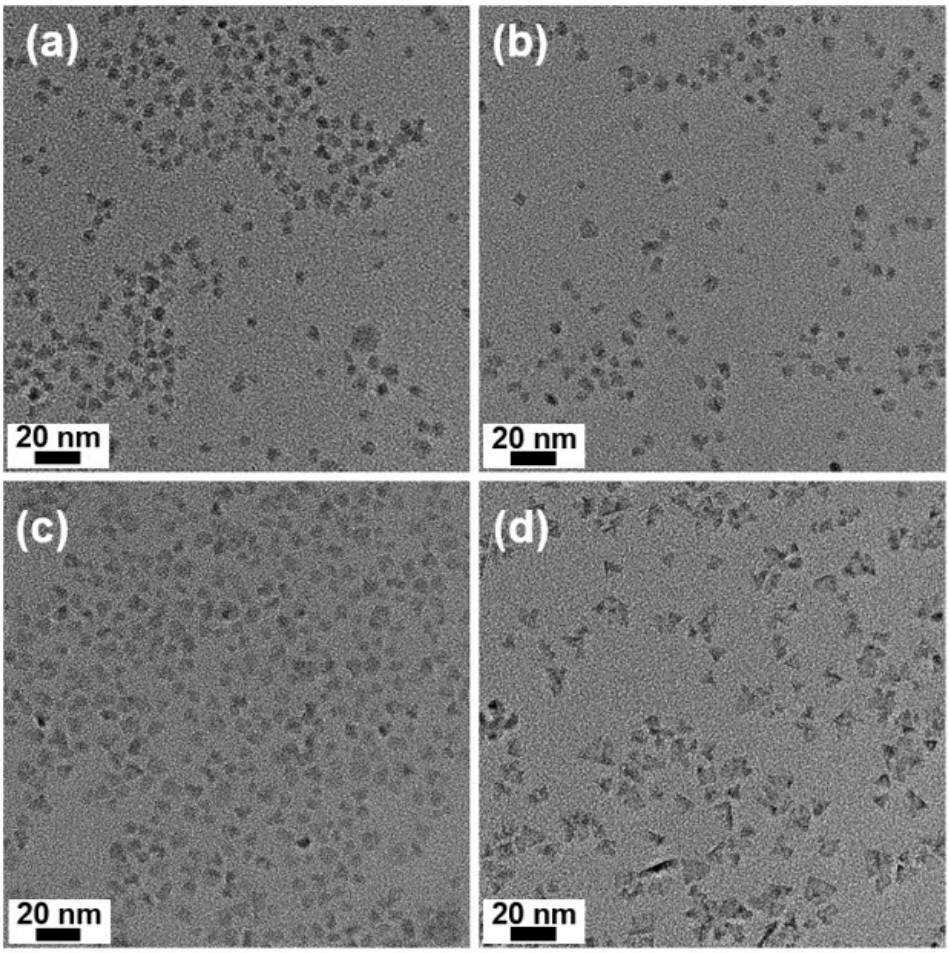

Fig. S13 TEM images of InP/ZnS QDs synthesized with different amounts of water. (a) 5, (b) 10, (c) 15 and (d) 20 μL water.

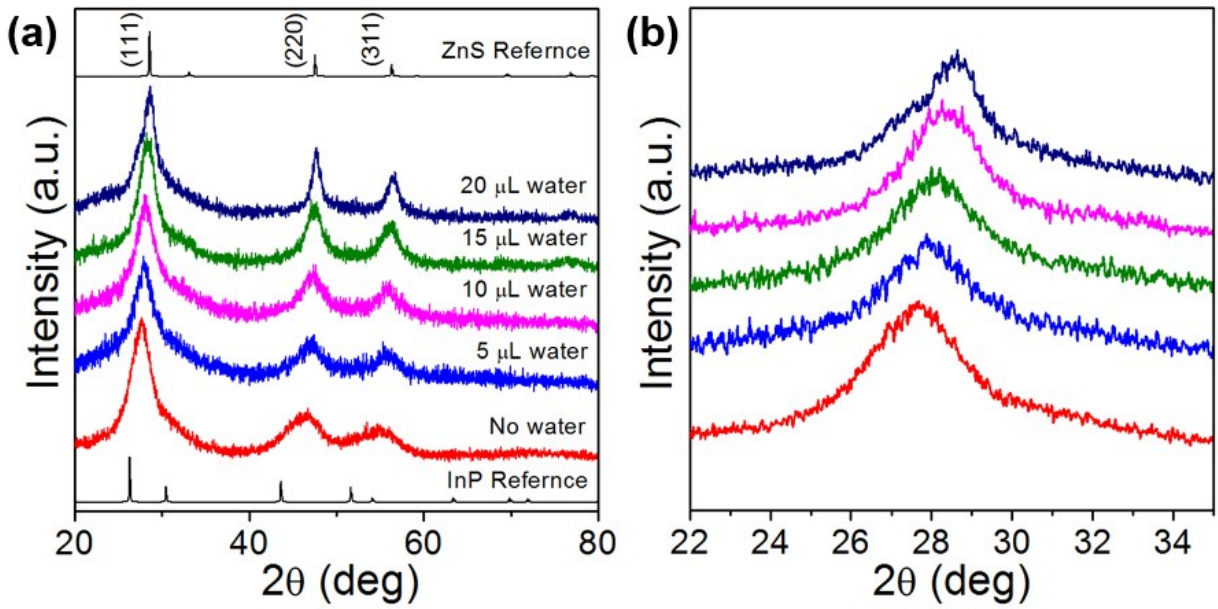

Fig. S14 (a) XRD patterns of InP/ZnS QDs synthesized with different amount of water. (b) magnified (111) peak to clearly show the shift towards higher angle.