

Supplementary information

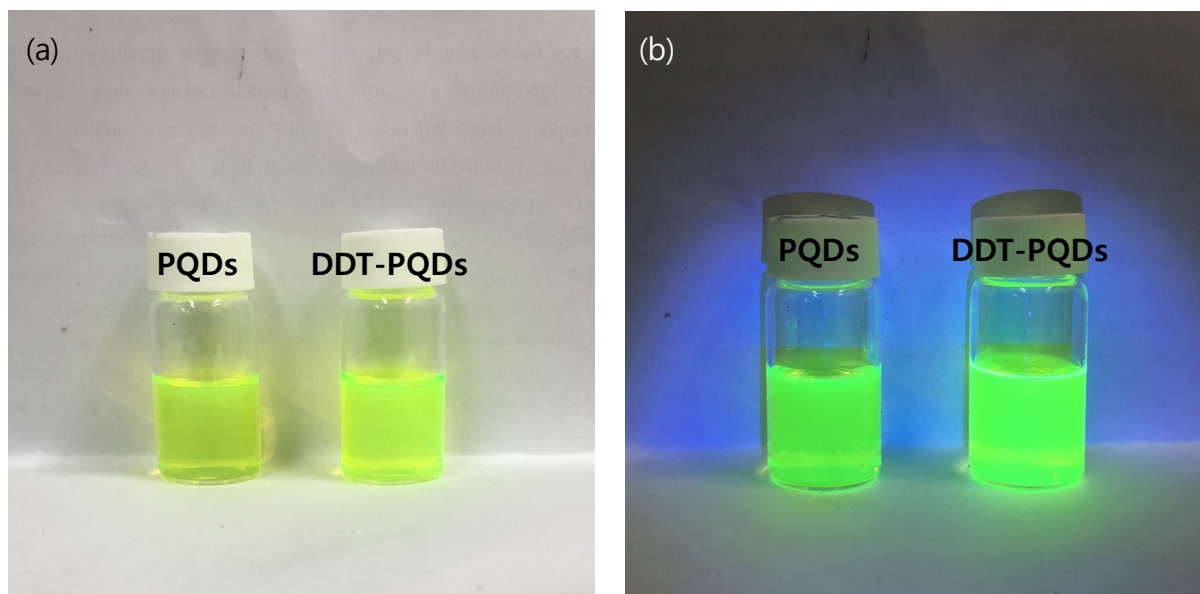


Fig S1. Photograph of PQDs and DDT-PQDs (a) under nature light; (b) under 365 nm UV radiation.

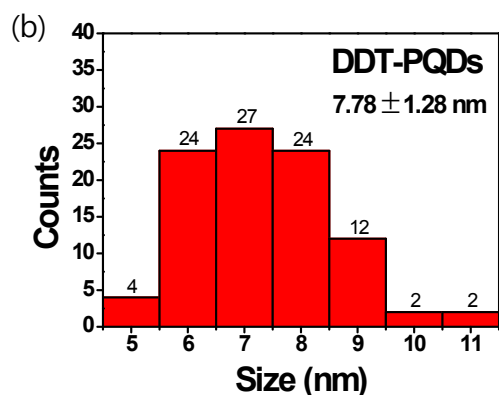
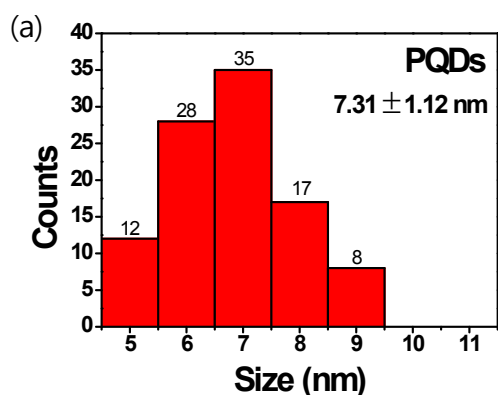


Figure S2. Size distribution of (a) PQDs and (b) DDT-PQDs. The data is counted from TEM images.

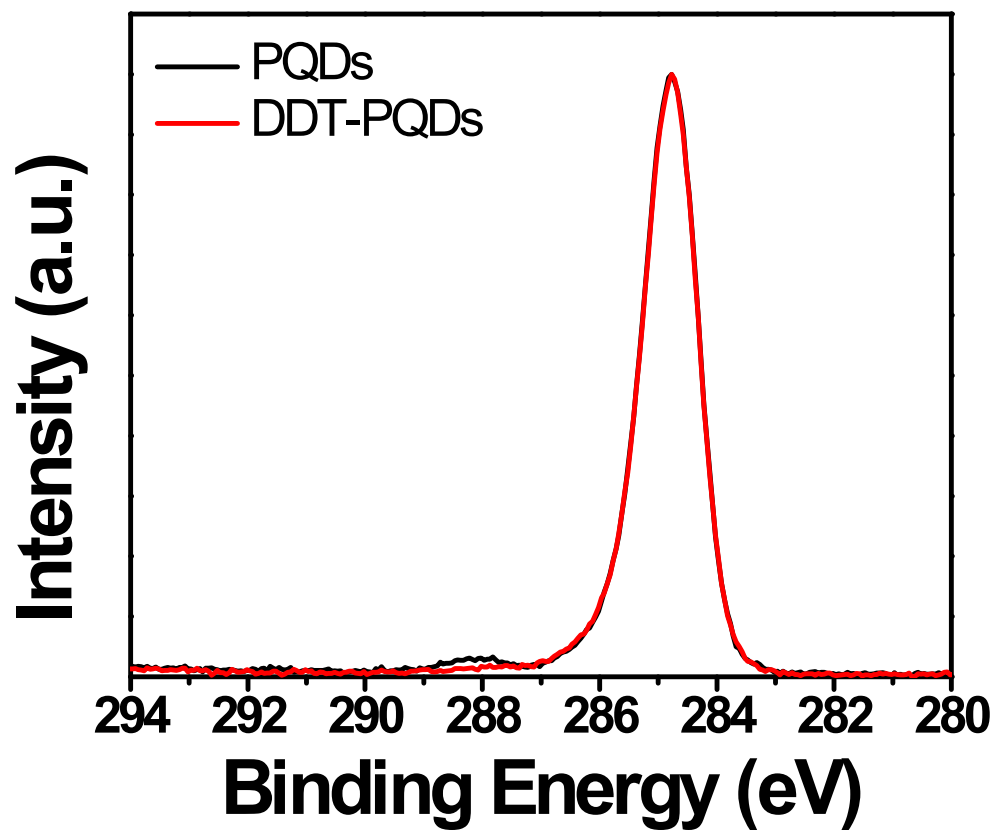


Fig S3. XPS spectra of calibration C1s peak at 284.8 eV of PQDs and DDT-PQDs.

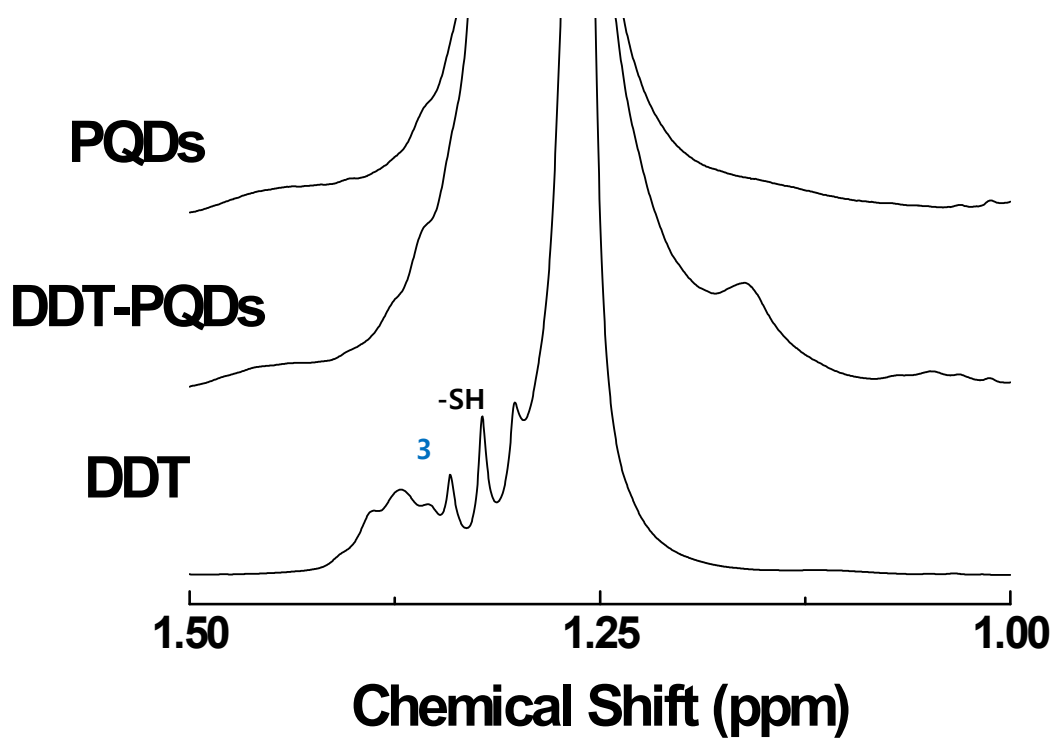


Fig S4. ¹H NMR spectra range from 1.0 ppm to 1.5 ppm for PQDs, DDT-PQDs and dodecanethiol in toluene-d₈. There are distinct triplet peaks of hydrogen in γ -methylene (3) and -SH functional group. On the other hand, there are no longer exist after DDT treatment.

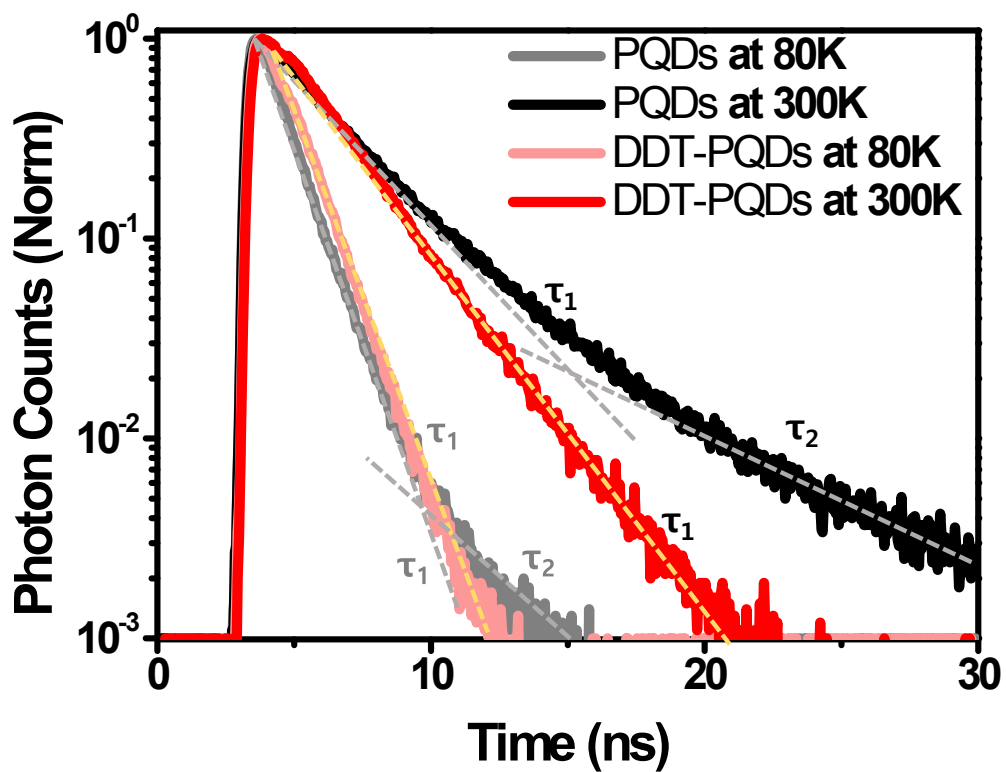


Fig S5. PL decay curves of PQDs and DDT-PQDs. DDT-PQDs has mono-exponential (τ_1 -) decay curve regardless of temperature. However, PQDs shows bi-exponential decay (τ_1 and τ_2) curves with increasing temperature.

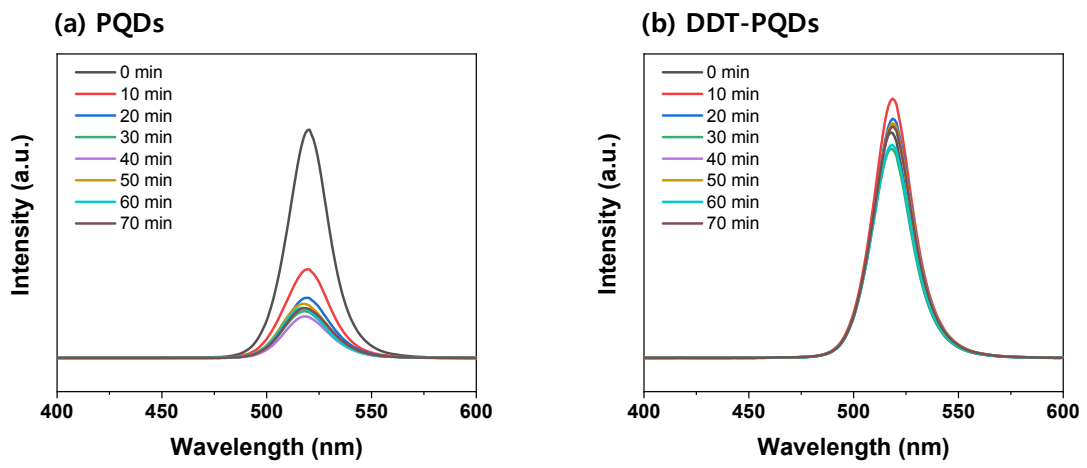


Fig. S6 Change of the PL emissions of the P-QDs and DDT-P-QDs as LEDs working time.

Table S1. Lifetime and Fractional Contribution of Different Decay Channels for (a) PQDs and (b) DDT-PQDs at various temperature from 80 K to 300 K

Temperature	τ_1 [ns]	f_1 [%]	τ_2 [ns]	f_2 [%]	τ_{avg} [ns]	χ^2
80K	1.04	94.7	3.17	5.3	1.15	1.09
100K	1.08	95.08	3.35	4.92	1.19	0.97
120K	1.07	94.73	3.29	5.27	1.19	0.82
140K	1.01	95.39	3.27	4.61	1.11	0.98
160K	1.08	95.13	3.13	4.87	1.18	1.07
180K	1.16	94.85	3.02	5.15	1.25	0.93
200K	1.23	93.22	2.77	6.78	1.33	0.84
220K	1.44	89.7	3.21	10.3	1.62	0.99
240K	1.62	85.65	3.36	14.35	1.87	1.16
260K	1.83	81.94	3.65	18.06	2.16	1.26
280K	1.97	71.6	3.91	28.4	2.52	1.14
300K	2.32	64.83	4.7	35.17	3.16	1.09

(a) PQDs

(b) DDT-PQDs

Temperature	τ_1 [ns]	f_1 [%]	τ_2 [ns]	f_2 [%]	τ_{avg} [ns]	χ^2
80K	1.22	100	-	-	1.22	0.80
100K	1.04	100	-	-	1.04	0.82
120K	1.05	100	-	-	1.05	0.88
140K	1.08	100	-	-	1.08	0.80
160K	1.11	100	-	-	1.51	0.70
180K	1.19	100	-	-	1.19	0.89
200K	1.26	100	-	-	1.26	0.77
220K	1.4	100	-	-	1.4	0.83
240K	1.51	100	-	-	1.51	0.80
260K	1.71	100	-	-	1.71	0.74
280K	1.91	100	-	-	1.91	0.99
300K	2.36	99.52	15.82	0.48	2.42	1.15