Supporting information

Separation of mono-dispersed $CH_3NH_3PbBr_3$ perovskite quantum dots via dissolution of nanocrystals

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1. Experimental Section

Materials

Lead (Ⅱ) bromide powder ($PbBr_2$, 99.999%) and methylammonium (MABr, 98.0%) were purchased from Aldrich and Wako respectively. *N*,*N*-Dimethylformamide, chloroform, and toluene were purchased from Wako Pure Chemical Industries. All the chemicals were used without purification.

Preparation of $MAPbBr_3$ QDs

$MAPbBr_3$ QDs were fabricated following the ligand-assisted reprecipitation. 3.6 mg MABr and 14.7 mg $PbBr_2$ was dissolved in 1 mL of DMF as a good solvent contained 4 μL of *n*-octylamine and 0.1 mL of oleic acid. 1 ml of precursors solution was dropped into 25 mL of vigorously stirring chloroform as a poor solvent. Obtained dispersions were centrifuged at 9000 rpm for 10 min.

Preparation of size controlled $MAPbBr_3$ QDs via Ostwald ripening.

3 ml of $MAPbBr_3$ QDs dispersions were stored into water bathe at the 50℃ for 1, 2, 3, 4 hours followed by cloud $MAPbBr_3$ QDs dispersions were centrifuged at 9000 rpm for 10 min.

Preparation of samples for TEM observation.

Several micro-litres of the $MAPbBr_3$ QDs dispersions were dropped on Cu TEM grid and dried into vacuum box for overnight.

Preparation of $MAPbBr_3$ QDs with a membrane filter.

To analyze XRD patterns of $MAPbBr_3$ QDs, MAPbBr3 QDs with a membrane filter. 12 ml of $MAPbBr_3$ QDs dispersions were filtered with a membrane filter (pore size is 25 nm) and the filtered solid sample was dried under the vacuum at room temperature.

Characterization

X-ray diffraction (XRD) patterns of the samples were obtained from in-plane diffraction using membrane filters and were measured on a Rigaku Smart Lab (using Cu Kα radiation at 45 kV and 200 mA). The samples were observed by a JEOL JSM-6700F scanning electron microscope (SEM) (accelerating voltage of 10 kV) and a JEOL JEM-2100F transmission electron microscope (TEM) (accelerating voltage of 200 kV). Visible absorption spectra of the samples were obtained on a JASCO V-670 spectrophotometer (detecting wavelength range of 400 to 600 nm). Photoluminescence (PL) spectra of samples were obtained with HORIBA FluoroMax-2 luminescence spectrometer (exciting wavelength of 370 nm and detecting wavelength range of 400 to 600 nm). Photoluminescence quantum yield (PLQY) were measured using a Hamamatsu C9920−01 integral sphere system. Photoluminescence lifetimes were obtained using a Hamamatsu C11367 Quantaurus-Tau.

2. Supporting Results

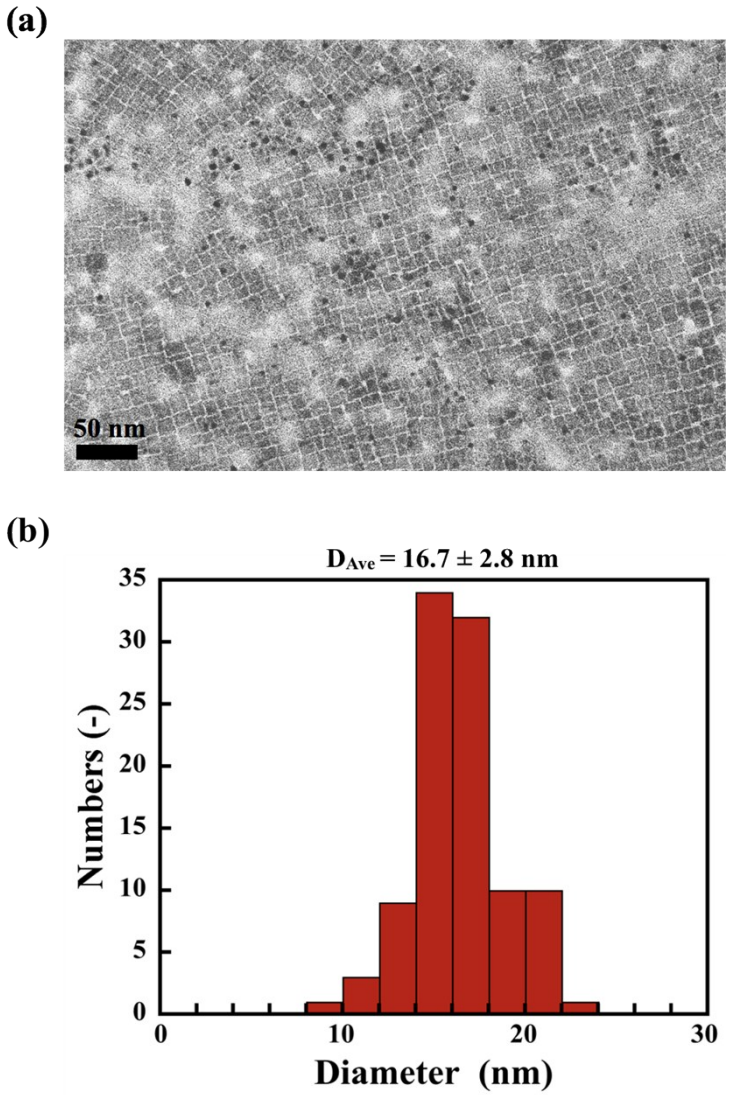

Figure S1 (a) TEM image, and (b) size distribution histogram of square-shaped $MAPbBr_3$ PeNCs obtained from supernatant without aging.

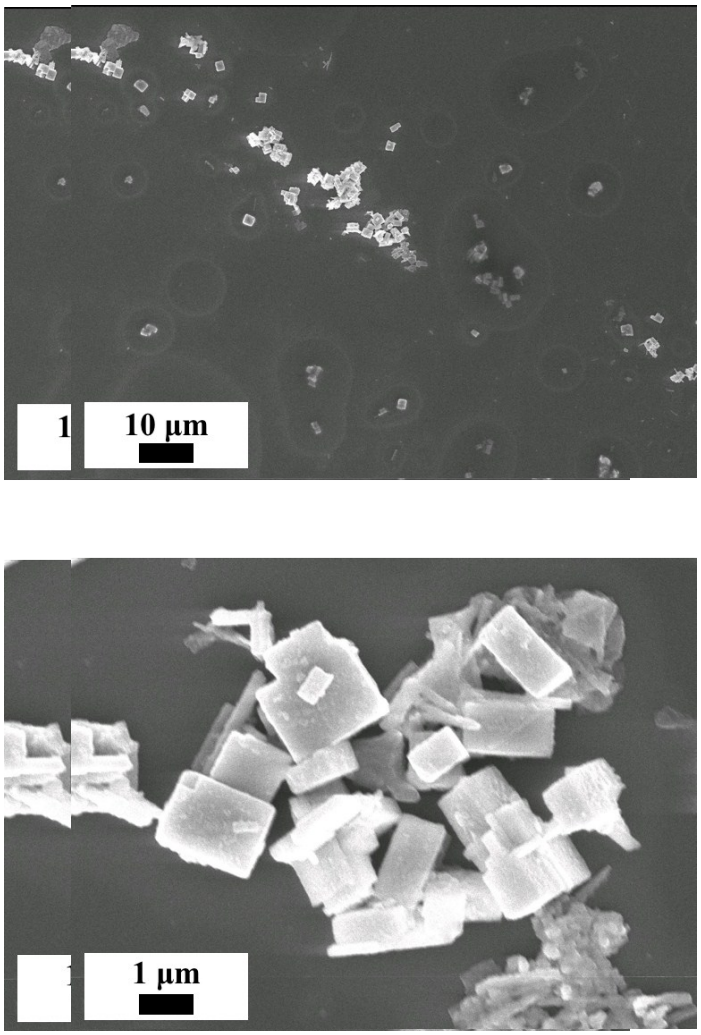

Figure S2 SEM image of gMAPMAPhBr microcrystals obtained from 1 hour aged suspension without centrifugation.

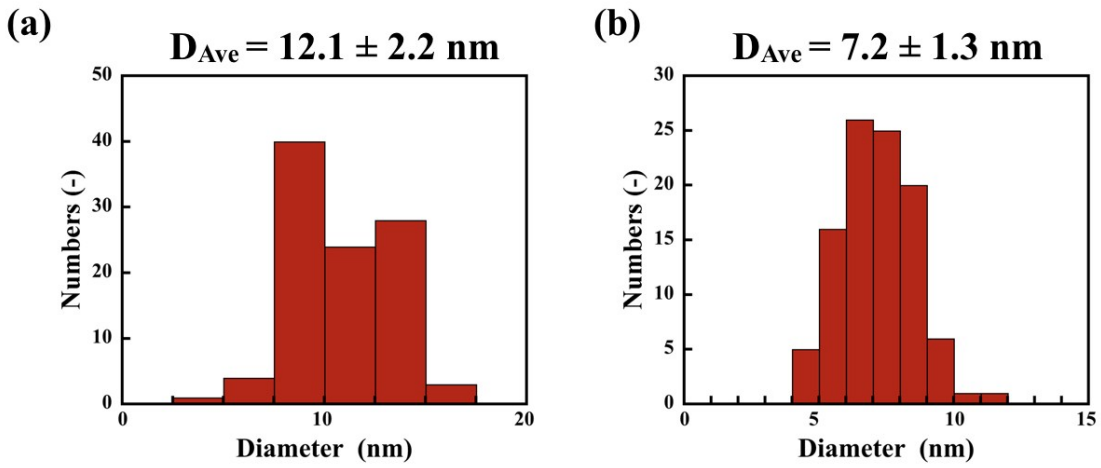

Figure S3~~2~~ Size distribution histogram of size-controlled $MAPbBr_3$ PeNCs, (a) aged for 1 hour, (b) 2 hours.

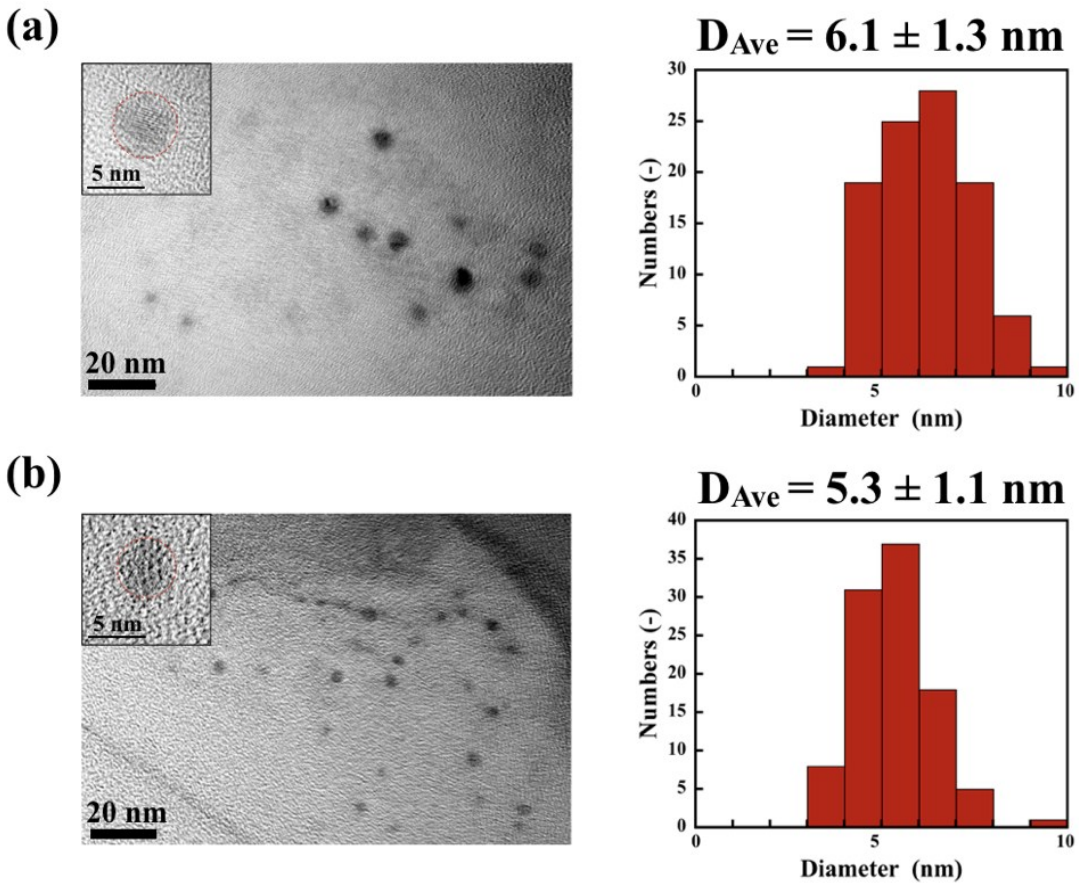

Figure S~~4~~3 TEM images and size distribution histogram of size-controlled $MAPbBr_3$ PeQDs, (a) aged for 3 hours, (b) 4 hours.

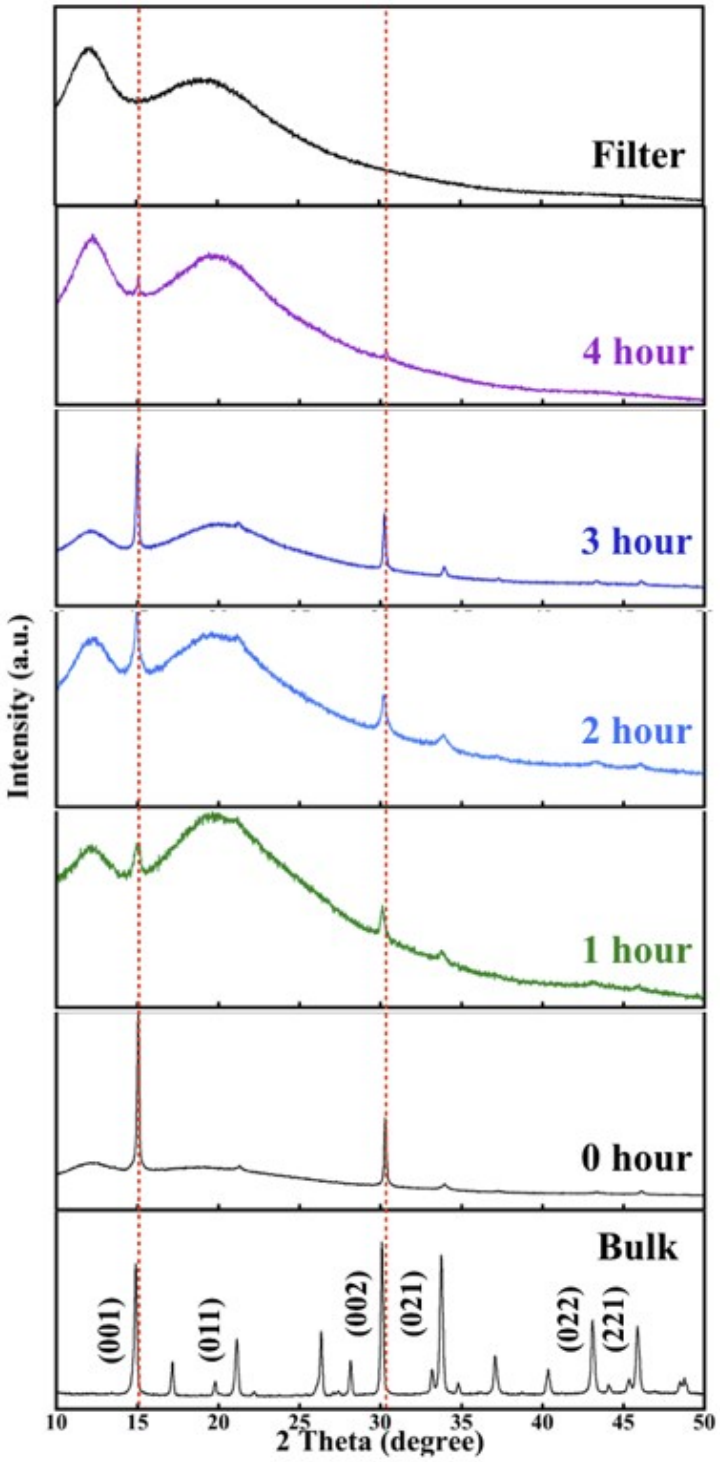

Figure S54 XRD patterns of $MAPbBr_3$ PeNCs aged for 0, 1, 2, 3, 4 hours, and filter / bulk samples as a reference.

Table S1 PL decay time constants, short-lifetimes, and long lifetimes of $MAPbBr_3$ PeNCs dispersions aged for 0 - 4 hours at 50℃.

Aging times / h	A1	A2	τ_1 / ns	τ_2 / ns
0	7.8×10^2	3.9×10^2	9.5	32.2
1	8.3×10^2	3.7×10^2	9.3	31.1
2	23.9×10^2	19.1×10^2	4.7	10.1
3	28.7×10^2	95.9×10^2	1.6	5.1
4	30.0×10^2	99.2×10^2	1.2	5.1