

## Supplementary Information

### Cesium Manganese Halide Perovskite-Analogue Nanocrystals with Highly Efficient Energy Conversion for Flexible Multifunctional Fibers

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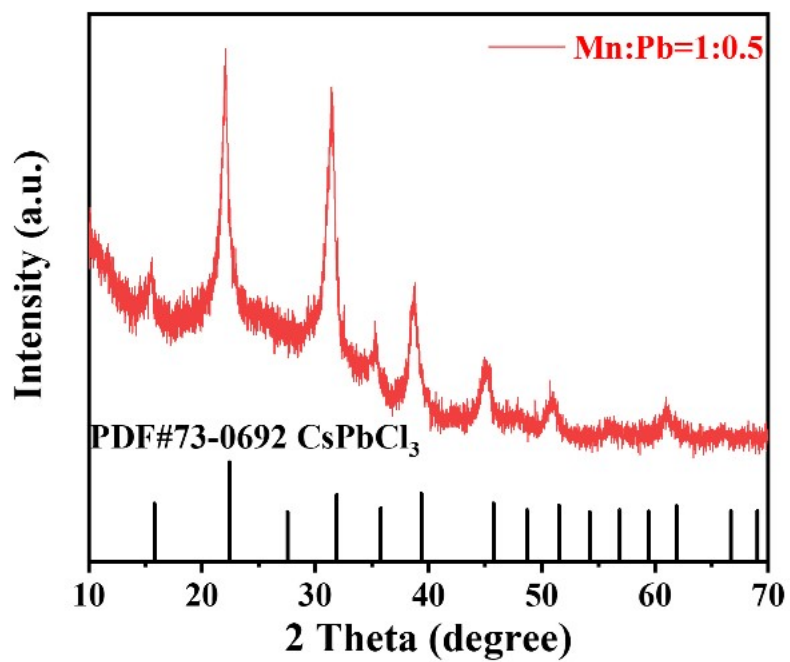


Fig. S1 XRD pattern of Pb<sup>2+</sup>-incorporated Mn-based PA NCs with Mn:Pb=1:0.5.

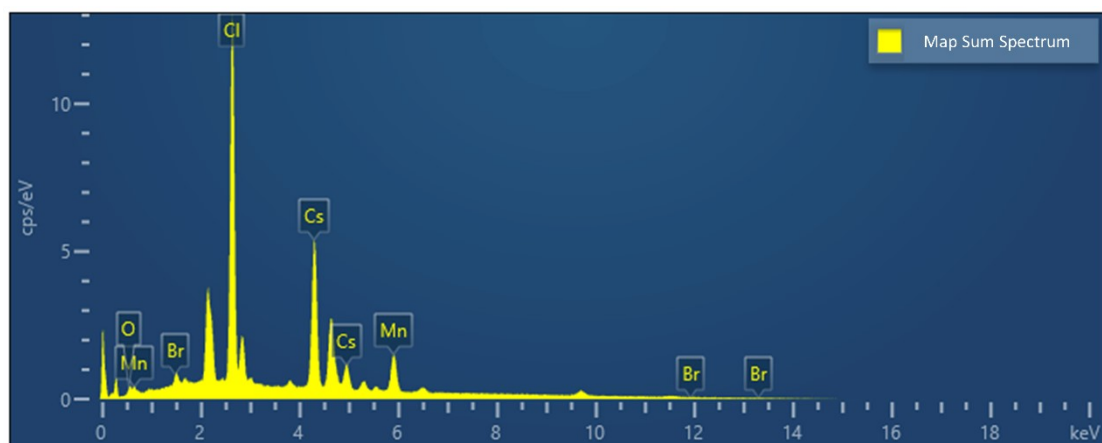
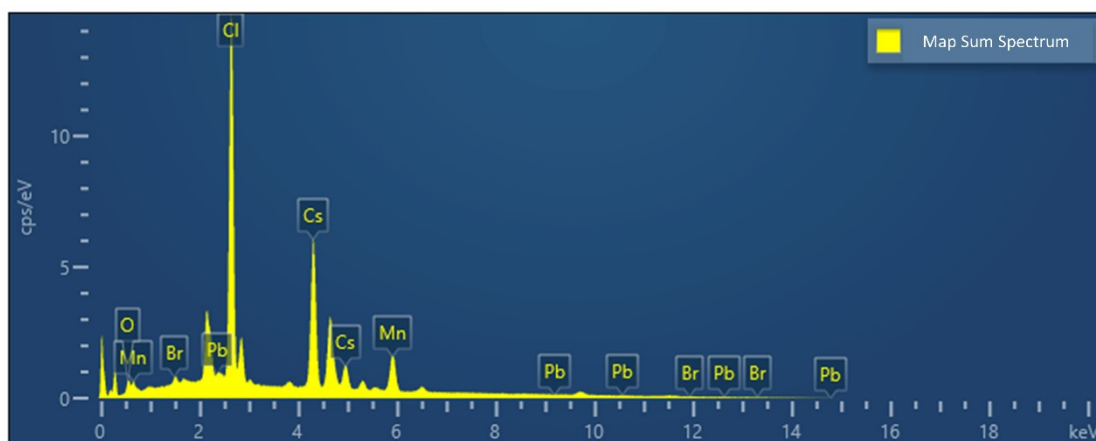


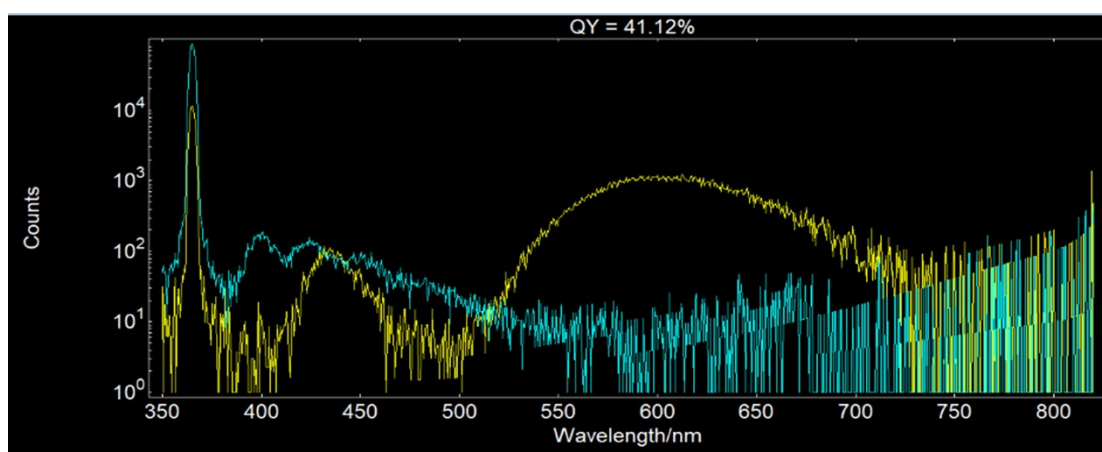
Fig. S2. EDS spectrum recording from Cs<sub>2</sub>Mn(Cl/Br)<sub>4</sub>·2H<sub>2</sub>O PA NCs, showing the existence of Cs, Mn, Cl, Br and O elemental signals.



**Fig. S3.** EDS spectrum recording from  $\text{Pb}^{2+}$  doped  $\text{Cs}_2\text{Mn}(\text{Cl}/\text{Br})_4 \cdot 2\text{H}_2\text{O}$  PA NCs ( $\text{Mn}:\text{Pb} = 1:0.05$ ), showing the existence of Cs, Pb, Mn, Cl, Br and O elemental signals.

**Table. S1** Ratio of elements in the products ( $\text{Mn}:\text{Pb} = 1:0.05$ ) and Pristine detected by EDS.

Sample	EDS (atomic ratio %)					
	Cs	Mn	Pb	Cl	Br	O
(Mn:Pb)						
Pristine	30.82	15.30	/	51.23	1.35	1.30
1:0.05	30.14	14.73	0.24	50.43	0.84	3.62



**Fig. S4.** Absolute PLQY of  $\text{Pb}^{2+}$  doped  $\text{Cs}_2\text{Mn}(\text{Cl}/\text{Br})_4 \cdot 2\text{H}_2\text{O}$  PA NCs ( $\text{Mn}:\text{Pb} = 1:0.40$ ) at 598 nm.

**Table. S2** Summary of Fitting Parameters for TRPL Profiles of PA NCs with Different Mn–Pb Ratios Using a Double-exponential Function for Mn<sup>2+</sup> emission.

Sample (Mn:Pb)	$\tau_1$ (ns)	$\tau_2$ (ns)	$\tau_{ave}$ (ns)	PLQY of Mn <sup>2+</sup>
1:0.05	0.36	4.82	3.26	2.84%

Sample (Mn:Pb)	$\tau_1$ ( $\mu$ s)	$\tau_2$ ( $\mu$ s)	$\tau_{ave}$ ( $\mu$ s)	PLQY of Mn <sup>2+</sup>
1:0.10	363.32	1617.25	1491.24	7.31%
1:0.15	488.49	1473.99	1367.47	26.14%
1:0.20	713.39	1465.63	1327.80	33.53%
1:0.40	717.27	1291.52	1081.71	41.12%

**Table. S3** Manganese-based perovskites.

formula	method	temperature (°C)	peak wavalength (nm)	PLQY (%)	refs
CsMnCl <sub>3</sub>	hot-injection	140	660	0.7	1
CsMnBr <sub>3</sub>	hot-injection	170	643	54	2
Cs <sub>3</sub> MnBr <sub>5</sub>	hot-injection	200	520	48	3
CsMn <sub>1-x</sub> Pb <sub>x</sub> (Cl/Br) <sub>3</sub> ·2H <sub>2</sub> O (x < 50%)	supersaturation recrystallization	room temperature	≈600	41.8	4
Cs <sub>2</sub> Mn <sub>1-x</sub> Pb <sub>x</sub> (Cl/Br) <sub>4</sub> ·2H <sub>2</sub> O	hot-injection	150	≈598	41.12	this work

## References

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