

Supporting Information for

Europium doped Layered Double Hydroxide with Spectral Conversion Property toward Enhanced Photosynthesis

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Reagents and Materials. Analytical grade $\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ (99.5%), $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ (99.5%), $\text{Eu}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$ (99.5%) and NaOH (99%) were purchased from Beijing Chemical Co. Ltd. Hogland nutrient solution was purchased from Beijing Coolaber Co. Ltd. Deionized water was used throughout the experimental process.

Calculation details. The calculations in this work were performed using the CASTEP code in Materials Studio version 8.0 software package (Accelrys Software Inc., San Diego, CA)¹. The spin-polarized DFT+U calculations were performed using a plane wave implementation² with the generalized gradient approximation (GGA) Perdew-Burke-Ernzerhof (PBE) as the exchange-correlation functional³. The ultrasoft pseudopotential⁴ was applied to describe the ionic cores to improve transferability and reduce the number of plane waves required in the expansion of the Kohn-Sham orbitals referred to in previous work⁵⁻⁸. The DFT dispersion correction was dealt with the Tkatchenko-Scheffler method to describe the weak interaction like hydrogen bonding and van der Waals force⁹. The cutoff energy was set as 400 eV to balance the cost and effectiveness¹⁰. The geometry optimization was based on the following points: (1) an energy tolerance of 1.0×10^{-5} eV/atom, (2) a maximum displacement tolerance of 1.0×10^{-3} Å, and (3) a maximum force tolerance of 0.03 eV/Å. When calculating the density of states, the k-point meshes for the Brillouin zone integrations were $5 \times 5 \times 1$ in the a-, b-, and c- directions.

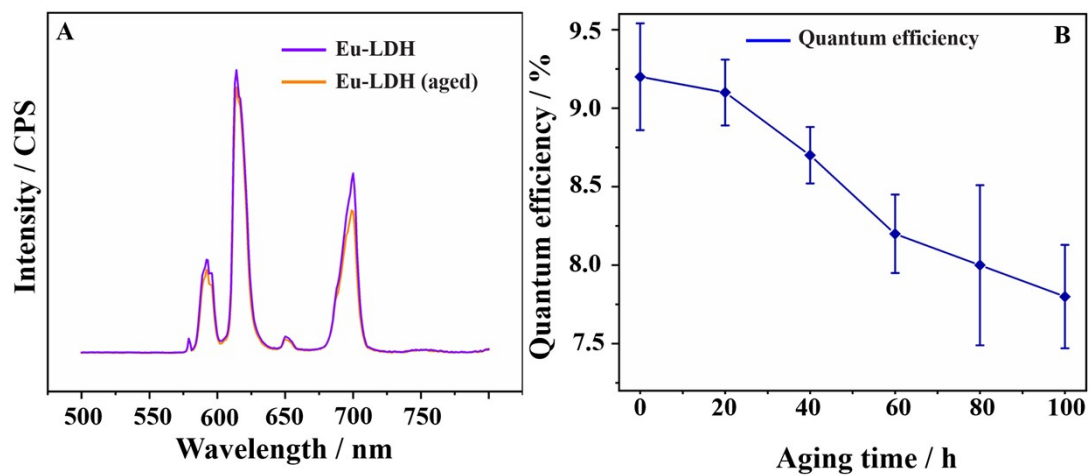


Figure. S1 (A) Photoluminescence spectra and (B) Quantum efficiency of Eu-LDH before and after aging for 100 h by ultraviolet accelerated weatherometer.



Figure. S2 Photograph of Eu-LDH treated seedling with the promoted flower bud formation growth state.

Table S1. The flower bud formation time information.

Sample	CK	mixed solution	LDH	Eu-LDH
Time (day)	45.0±1.52	45.8±2.86	45.4±2.07	43.4±1.14*

In table S1, time represents the day after the transplantation. The result was calculated in the way by mean ± SD. * represents significant difference with CK by the Duncan test ($p < 0.05$).

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