Supporting Information

Highly efficient fabrication of lemon peel-derived carbon quantum dots for multicolor light-emitting diodes

Lingli Zhu[a], Cao Jin[b], Hongmin Yang[a, *], Dekui Shen[b, *], Haitao Hu[c], Mengjia Dou[c]

[a] School of Energy & Mechanical Engineering, Nanjing Normal University, Nanjing, China

[b] Key Laboratory of Energy Thermal Conversion and Control of Ministry of Education, School of Energy and Environment, Southeast University, Nanjing, China.

[c] Guangdong Provincial Key Laboratory of Extreme Conditions, Dongguan 523803, China

***Corresponding Author**

E-mail address: yanghongmin@njnu.edu.cn (Hongmin Yang), 101011398@seu.edu.cn (Dekui Shen)

Text S1:

Quantum yield measurement

The relative quantum yield (QY) of the CQDs can be calculated through the Equation (S1) as follow [1, 2]:

$$\varphi_x = \varphi_{std}(I_x/I_{std})(A_{std}/A_x)(\eta_x/\eta_{std})^2 \quad \text{(S1)}$$

where φ_x is the fluorescence QY; x represents the CQDs. std is the quinine sulfate, which was selected as the reference compound and dissolved in 0.1 M H_2SO_4 (φ_{std} = 0.54). η is the refractive index (1.33 for aqueous solution). A is the optical absorbance at the excitation wavelength of 340 nm. I is the integrated fluorescence intensity under the fluorescence emission spectrum. To reduce the interference of the reabsorption effects, the absorbance at excitation 340 nm were controlled to 0.05.

Text S2:

Fluorescence lifetime

The obtained TRPL decay curves were fitted using a multi-exponential function *R*(t) and the average lifetime (τ_{avg}) was calculated according to Equation (3) and (4) [12, 21].

$$R(t) = B_1e^{(-t/\tau_1)} + B_2e^{(-t/\tau_2)} \ldots\ldots + B_ne^{(-t/\tau_n)} \quad \text{(S1)}$$

$$\tau_{avg} = \left(B_1\tau_1^2 + B_2\tau_2^2 + \ldots\ldots B_n\tau_n^2\right) / \left(B_1\tau_1 + B_2\tau_2 \ldots\ldots\ldots + B_n\tau_n\right) \quad \text{(S2)}$$

where τ_1, τ_2 ... τ_n represent fluorescence decay lifetimes and B_1, B_2 ... B_n represent pre-exponential factors of τ_1, τ_2 ... τ_n, respectively.

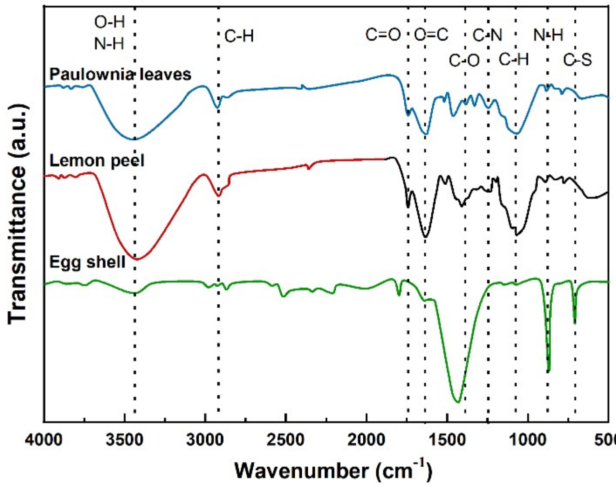

Fig. S1 FT-IR spectra of paulownia leaves, egg shell, and lemon peel.

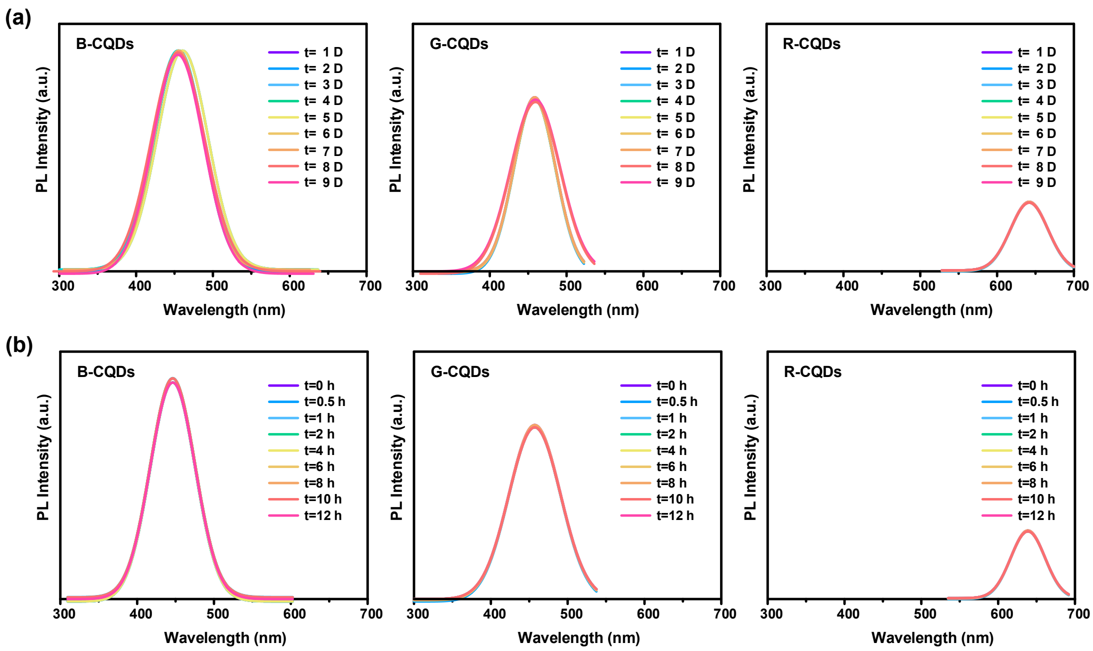

Fig. S2 The photostability of different CQDs (a) at room temperature and (b) under UV light irradiation.

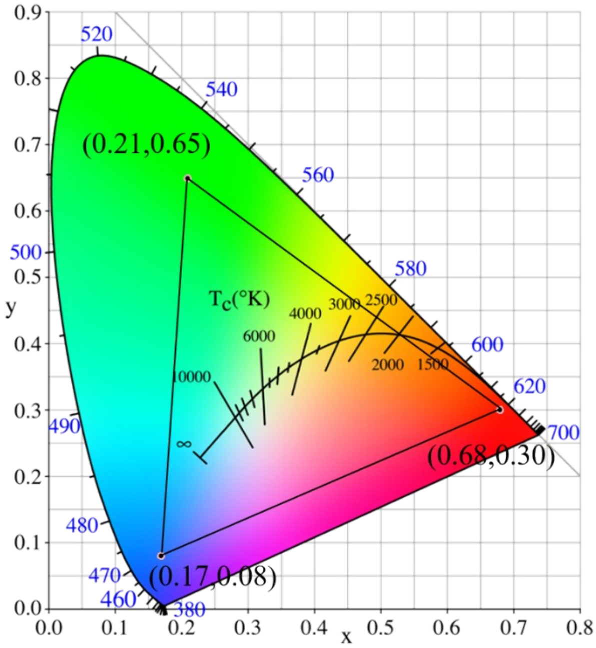

Fig. S3 CIE coordinates of LEDs fabricated from CQDs/starch fluorescent composites.

References

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