Electronic Supplementary Material (ESI) for Journal of Materials Chemistry B.

Electronic Supplementary Information

One-step catalase controllable degradation of C_3N_4 for N-doped carbon dots green fabrication and their bioimaging application

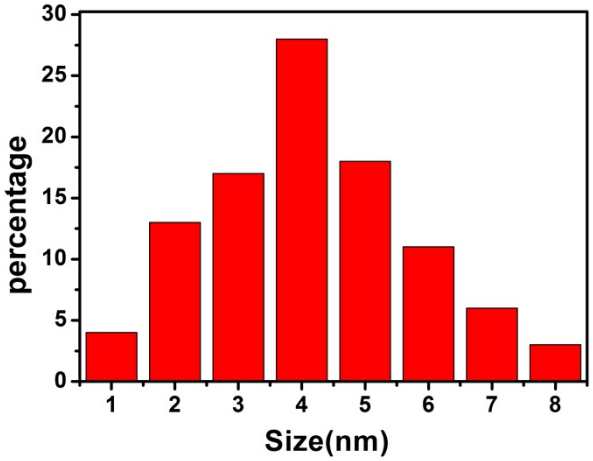

Fig. S1 Size distribution of the N-C dots

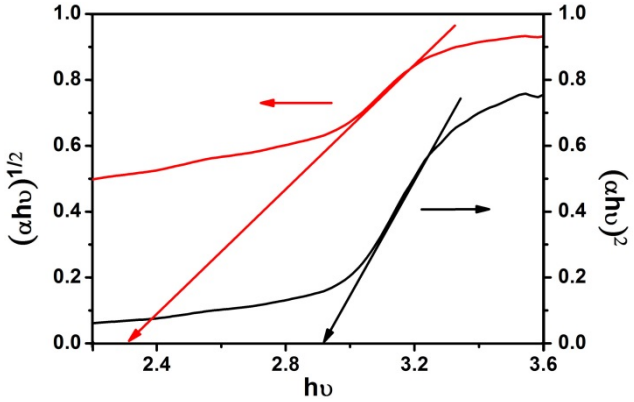

Fig. S2 Curves of hυ versus $(\alpha h\upsilon)^{1/2}$ and $(ah\upsilon)^2$ for N-C dots (red and black lines respectively)

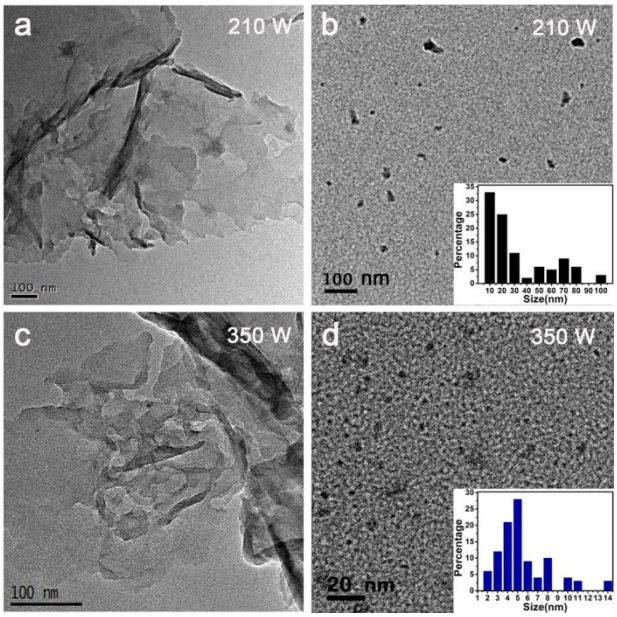

Fig. S3 TEM micrographs of C_3N_4 incubated with 5 mg CAT after 16 days under illumination intensity (a) 210 W and (c) 350 W. TEM micrographs of the produced particles incubated after 16 days with (b) intensity 210 W and (d) intensity 350 W. The insets in (b) and (d) depict histograms of the size distributions for the produced particles at various intensities.

Fig. S4 shows the two-electron process to form peroxides by water oxidation. To further prove that with illumination the C_3N_4 solution can produce H_2O_2, the electron transfer number was measured by rotating ring-disk electrode (RRDE) experiments at rotating speed of 1600 rpm (Fig. S4). Amperometric responses of Pt ring electrodes at a constant potential of 0.5 V vs SCE.[S1] The Pt ring current (I_{ring}) was clearly, and in the catalyzed oxygen evolution reaction (OER), the electron transfer number (n) was calculated to be 2.03, by using the following equation:

$$n = \frac{4I_{disk}}{I_{disk} + I_{ring}/N}$$

where N is the RRDE collection efficiency, measured to be 0.24 using the reversible $[Fe(CN)_6]^{4-}/[Fe(CN)_6]^{3-}$ system. In details, The RRDE electrode is dipped into 0.01 mol/L $K_3[Fe(CN)_6]$ in 0.1 mol/L KCl solution and rotated under different rotation rates (ω = 400, 900, 1600, 2500 rpm). Disk potential E_D is scanned from 0.4 V to -0.6 V vs. SCE at scan rate 10 mV/s, ring potential E_R is fixed to 0.497 V (the reduced product $[Fe(CN)_6]^{4-}$ can be oxidized at this potential), and the current-potential voltammograms are recorded during the electrode rotation. The RRDE measurement is shown in Fig. S5. The ratio of I_{ring}/I_{disk} is almost constant under various ω. The averaged collection efficiency N is 0.24.

This indicated a two-electron oxidation process to form H_2O_2 by C_3N_4.

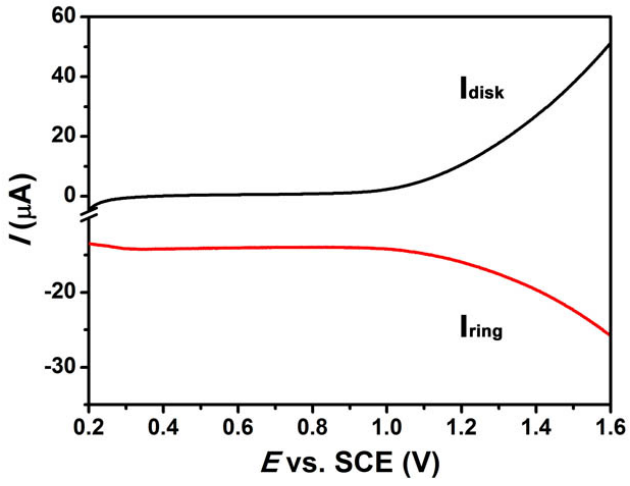

Fig. S4 The two-electron process to form peroxides by water oxidation. The black and red lines are disk and ring current, respectively. (The method to measure collection efficiency is shown in Fig. S5)

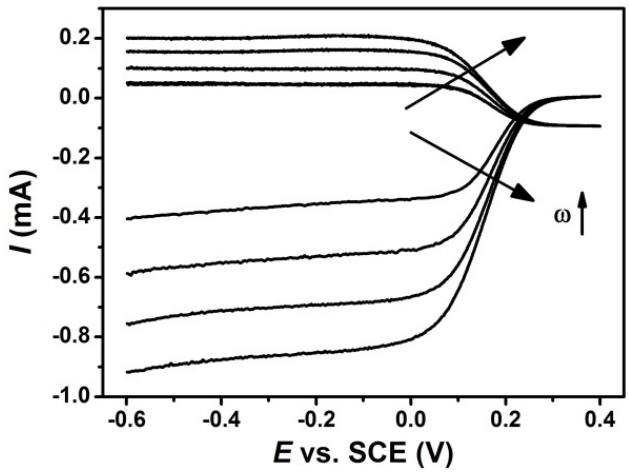

Fig. S5 The current-potential voltammograms during the electrode rotation

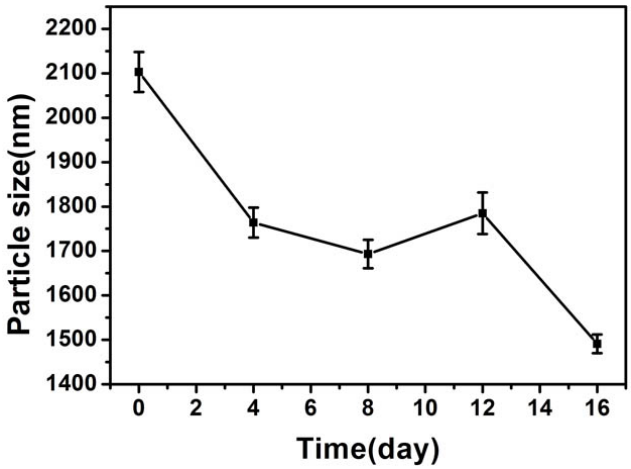

Fig. S6 The error bar of particles average size of the particles incubated with 5 mg CAT in dark.

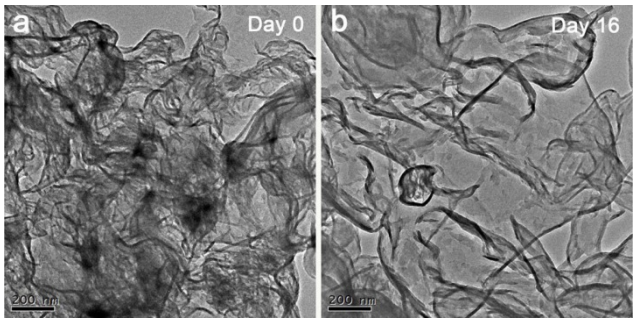

Fig. S7 TEM micrographs of C_3N_4 incubated with 5 mg CAT in dark for (a) 0 day, and (b) 16 days.

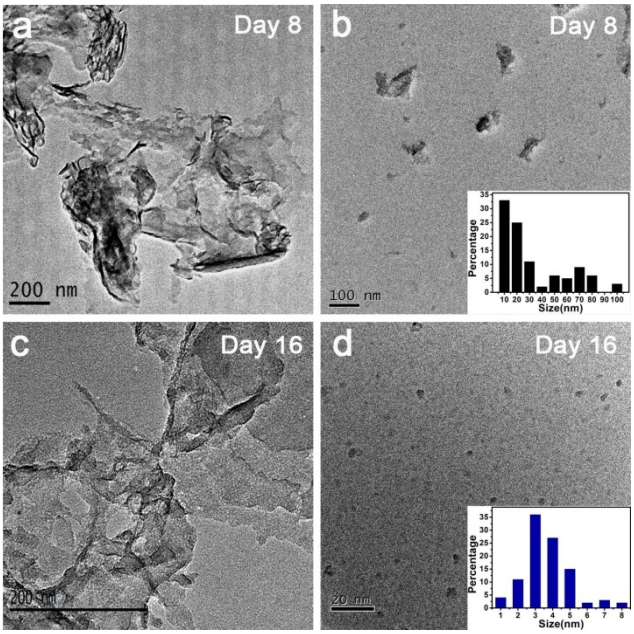

Fig. S8 TEM micrographs of C_3N_4 incubated with 5 mg CAT and 4 μL H_2O_2 in dark (a) after 8 days and (c) after 16 days. TEM micrographs of the produced particles incubated with intensity 350 W (b) after 8 days and (d) after 16 days. The insets in (b) and (d) depict histograms of the size distributions for the produced particles at various intensities.

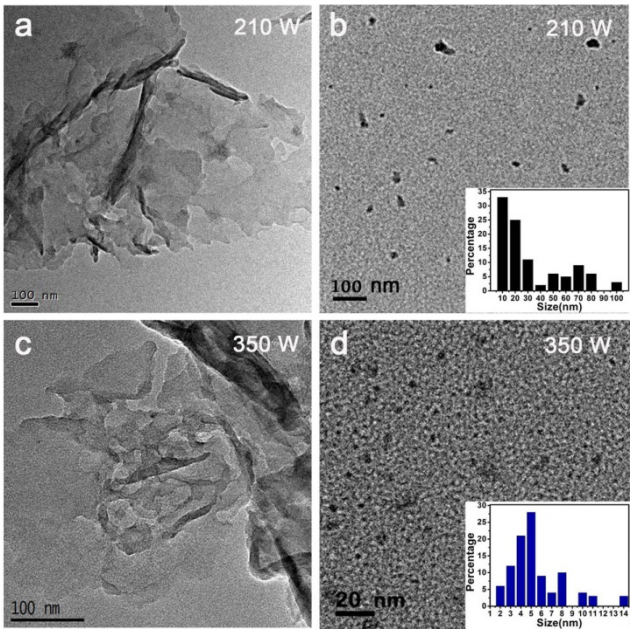

Fig. S9 TEM micrographs of C_3N_4 incubated with 10 mg CAT and illumination intensity 350 W (a) after 8 days and (c) after 16 days. TEM micrographs of the produced particles incubated with 10 mg CAT and illumination intensity 350 W (b) after 8 days and (d) after 16 days. The insets in (b) and (d) depict histograms of the size distributions for the produced particles at various intensities.

References

S1. Y. Zhao, R. Nakamura, K. Kamiya, S. Nakanishi and K. Hashimoto, *Nat. Commun.*, 2013, **4**.