Supporting Information

Text. S1 Analysis of LED light intensity

The ordinary current light intensity irradiance meters typically test the light intensity of a light source at a certain wavelength range (e.g. centered around 250 nm or 365 nm), which are applicable for LED360 but not for LED280 and LED310. The iodometric method was then used to determine the light intensity of the LED280 and LED310 light sources in this study. A solution containing 0.6 mol/L KI, 0.1 mol/L KIO_3 and 0.01 mol/L $Na_2B_4O_7$ was used and the following photochemical reaction occurred when the solution was exposed to ultraviolet light:

$$8I^- + IO_3^- + 3H_2O \xrightarrow{UV} 3I_3^- + 6OH^- \qquad (1\text{-}1)$$

Previous studies have shown that the quantum yield, Φ, of the above photochemical reaction process is related to the illumination wavelength and there exists a linear relationship between the quantum yield of photochemical reaction and the illumination wavelength as described below (Goldstein et al., 1998; Rahn et al., 2010; Bolton et al., 2011) :

$$\Phi = 3.5583 - 0.0113\lambda \qquad (1\text{-}2)$$

From the above relationship, the quantum yields of the LED 280 and LED310 were calculated to be 0.3943 and 0.0553, respectively.

As the I_3^- species has a characteristic ultraviolet absorption peak at 352 nm, its absorbance, A_{352}, can be measured by an ultraviolet spectrophotometer. The following equation describes that A_{352} is proportional to the light intensity and the illumination

time of the photochemical reaction:

$$A_{352} = \frac{E_{\mathrm{p}} \cdot \Phi \cdot \varepsilon}{h\upsilon_{\lambda} \cdot N_{\mathrm{A}} \cdot H} = k \cdot E_{\mathrm{p}} \cdot t \qquad (1\text{-}3)$$

where E_p, ε, ν_λ, N_A, H, k, and t are average light intensity in mW/cm^2, absorption coefficient of I_3^- in L/(cm·mol), frequency of light source in Hz, Avogadro's number, and reactor height in centimeter, and illuminating time, respectively. From eq. (1-3), the light intensities of the LED280 and LED310 were calculated to be 1.37 and 1.67 mW/cm^2, respectively.

The illumination intensity of LED360 can be determined by an irradiance meter However, the average illumination intensity in the reactor needs to be determined by further calculations. Previous studies have shown that the attenuation of the ultraviolet light intensity in homogeneous medium conforms to the following exponential decay model of equation (1-4) (Kirk et al., 2010), and the average light intensity of an entire plate reactor can be obtained by the following integral calculation equation (1-5):

$$\ln(I_z / I_0) = -k_d \cdot z \qquad (1\text{-}4)$$

$$I_{ave} = \frac{1}{z}\int_0^z I_z \mathrm{d}z = \frac{I_0 - I_z}{\ln(I_0 / I_z)} \qquad (1\text{-}5)$$

where I_0 and I_Z are the light intensities in mW/cm^2 at the top and the bottom of the reactor, respectively, k_d is the attenuation coefficient of the UV light in cm^{-1}, and z is the reactor height in cm. The illumination intensities of the LED360 at the top and bottom of reactor were measured to be 8.06 mW/cm^2 and 1.10 mW/cm^2, respectively, and the average illumination intensity of LED360 in the reactor was then calculated to be 3.49 mW/cm^2.

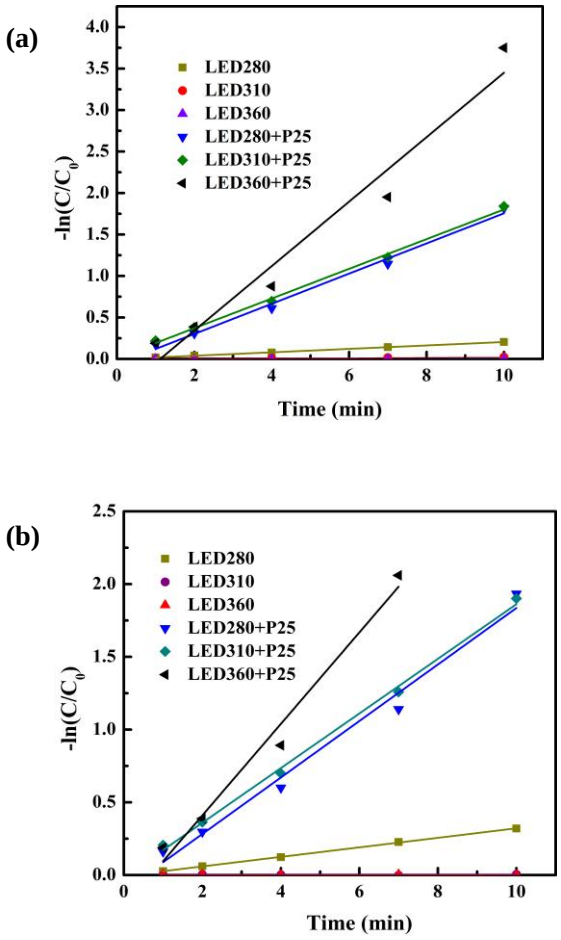

Fig. S1. Time courses of -ln(C/C_0) of CMIT (a) and MIT (b) by phtolysis and photocatalysis over P25. Initial CMIT and MIT concentration were 1 mg/L and 0.33 mg/L respectively, P25 dosage=200 mg/L, and pH=7.

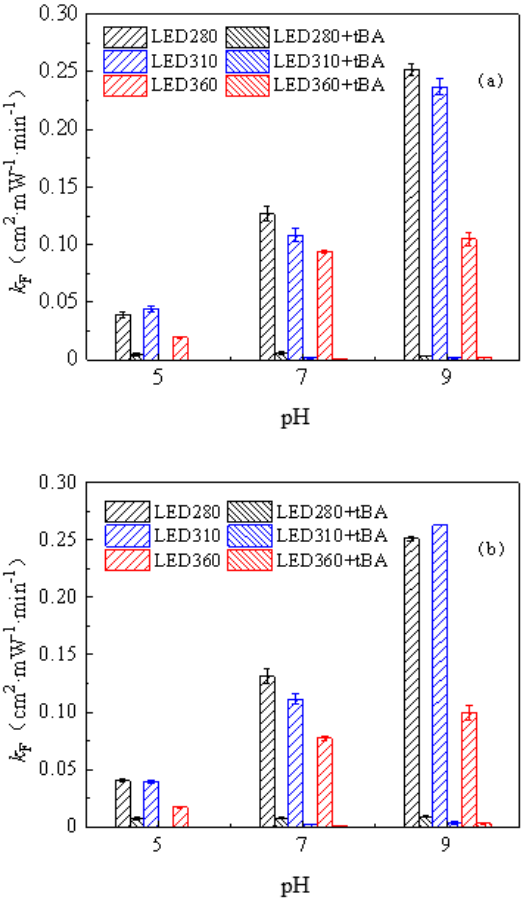

Fig. S2. Effect of tBA addition on the light dose-based first-order kinetics rate constant of CMIT (a) and MIT (b) in photocatalytic degradation over P25 under illuminations of LED280, LED310, and LED360. Initial CMIT and MIT concentration were 1 mg/L and 0.33 mg/L respectively, P25 dosage=50 mg/L, and tBA concentration was 10 mmol/L.

References

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