Electronic Supplementary Information

UV and Visible Lights Synergetic Photodegradation Using Rutile TiO_2 Nanorod Arrays Based on a p-n Junction

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Part I: Reaction Equation

The reaction mechanism can be described as the following steps,

$$TiO_2 + hv(\lambda < 415nm) \rightarrow e^- + h^+ \quad \text{(S1)}$$

$$h^+ + H_2O \rightarrow \cdot OH + H^+$$
$$h^+ + OH^- \rightarrow \cdot OH \quad \text{(S2)}$$

The part of Sunlight with wavelength less than 415 nm generated electron-hole pairs in the TiO_2 (Eq. (1)), most of the other light would produce photovoltaic (PV) voltage at the PN junction. Because of the applied PV voltage by PN junction, photo-generated holes were left on the surface of TiO_2@PN. And the holes (h^+) produced hydroxyl radicals (•OH).

The photocatalytic activity (PCA) could be reflected from the following equation:

$$PCA = \frac{m_P}{m_C} \cdot \frac{1}{t} \quad \text{(S3)}$$

Where m_P is the quality of the degraded model pollutant (MO, MB or Rhodamine B), m_C is the quality of the catalyst used, t is the time of degradation to 90%.

Part II: Supplementary Figures

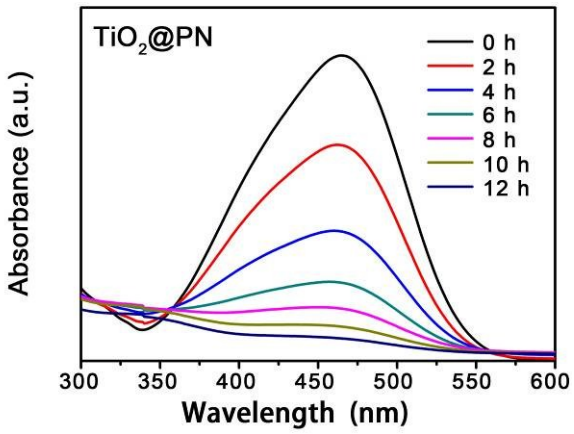


Figure S1 The time evolution of absorption spectra upon photodecomposition of MO over TiO_2@PN under 300 W Xe lamp.

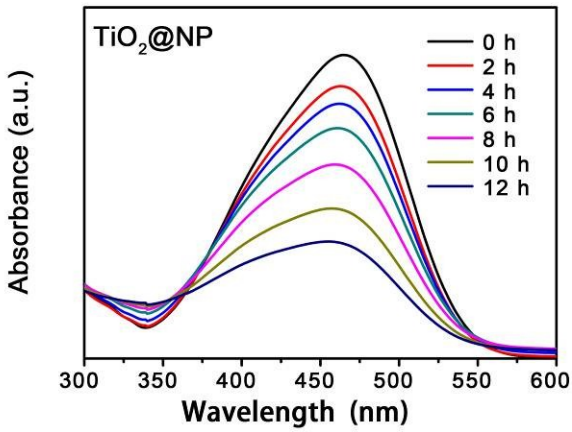


Figure S2 The time evolution of absorption spectra upon photodecomposition of MO over TiO_2@NP under 300 W Xe lamp.

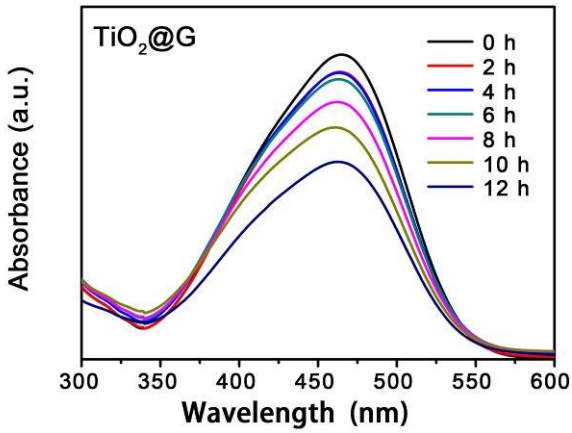


Figure S3 The time evolution of absorption spectra upon photodecomposition of MO over TiO_2@G under 300 W Xe lamp.

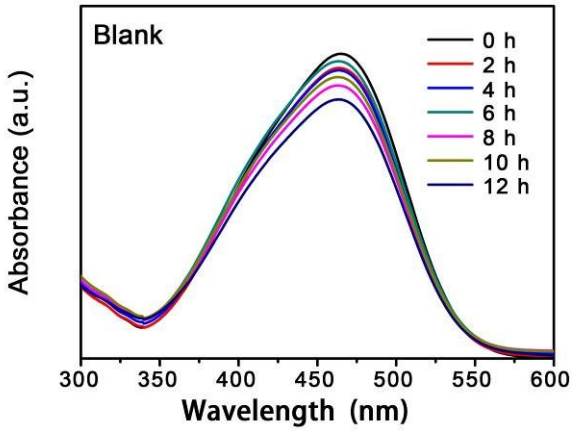


Figure S4 The time evolution of absorption spectra upon photodecomposition of MO over blank under 300 W Xe lamp.

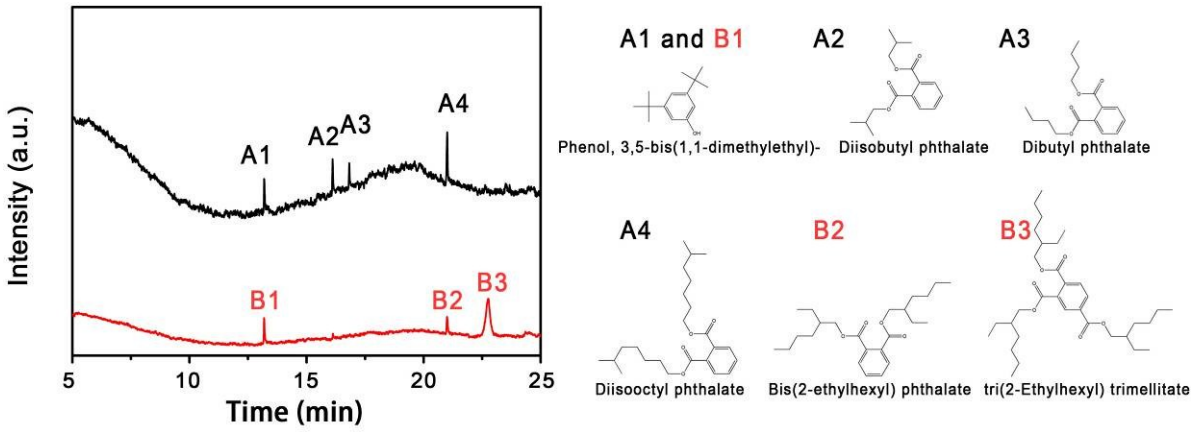
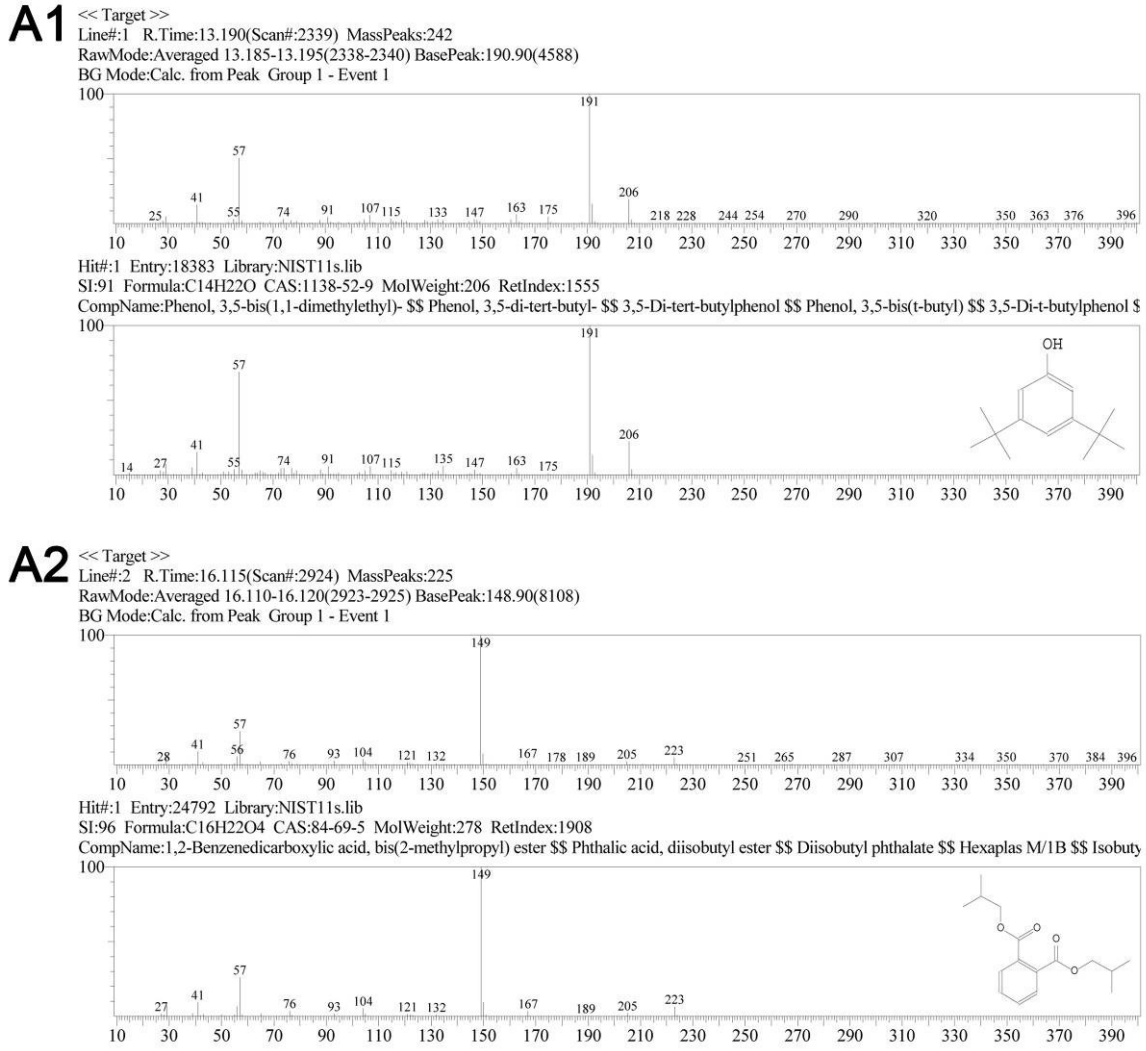
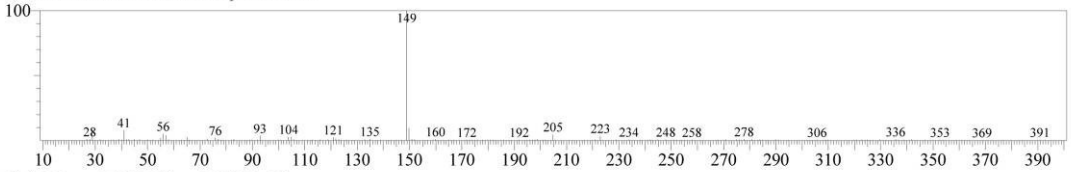


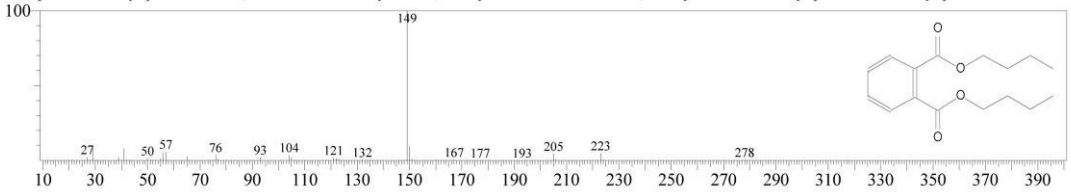
Figure S5 The liquid chromatography scheme of the decolorization products: MO solution degraded by TiO_2@PN for 12 hours (black), the red one was degraded by TiO_2@NP for 12 hours.



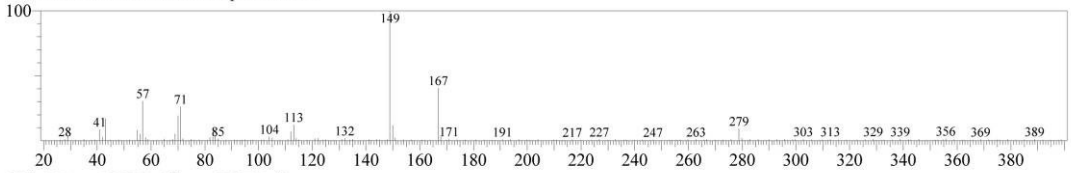
A3 << Target >>
Line#:3 R.Time:16.825(Scan#:3066) MassPeaks:239
RawMode:Averaged 16.820-16.830(3065-3067) BasePeak:148.90(4805)
BG Mode:Calc. from Peak Group 1 - Event 1



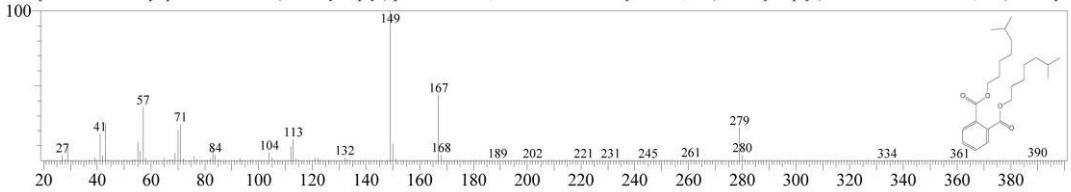
Hit#:1 Entry:24795 Library:NIST11s.lib
SI:92 Formula:C16H22O4 CAS:84-74-2 MolWeight:278 RetIndex:2037
CompName:Dibutyl phthalate $$ 1,2-Benzenedicarboxylic acid, dibutyl ester $$ Phthalic acid, dibutyl ester $$ n-Butyl phthalate $$ Butyl phthalate $$ Cellu



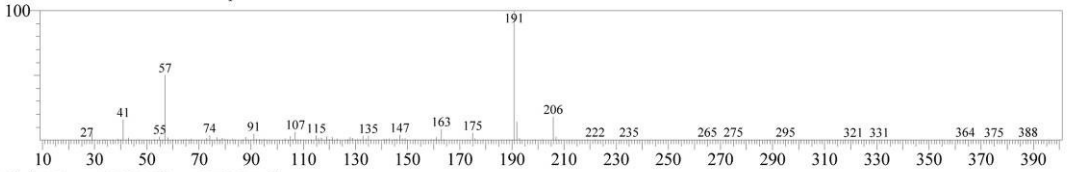
A4 << Target >>
Line#:4 R.Time:21.010(Scan#:3903) MassPeaks:234
RawMode:Averaged 21.005-21.015(3902-3904) BasePeak:148.90(6244)
BG Mode:Calc. from Peak Group 1 - Event 1



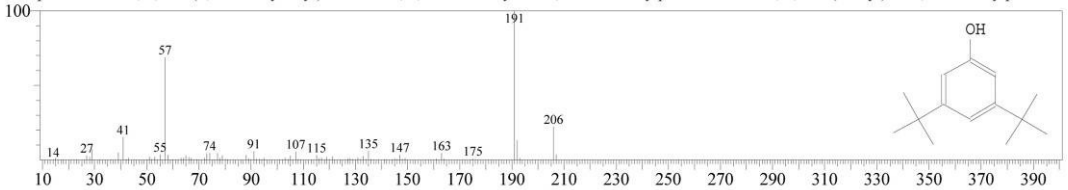
Hit#:1 Entry:178252 Library:NIST11.lib
SI:91 Formula:C24H38O4 CAS:131-20-4 MolWeight:390 RetIndex:2704
CompName:Diisooctyl phthalate $$ Bis(6-methylheptyl) phthalate $$ 1,2-Benzenedicarboxylic acid, bis(6-methylheptyl) ester $$ Phthalic acid, bis(6-methyl



B1 << Target >>
Line#:1 R.Time:13.190(Scan#:2339) MassPeaks:235
RawMode:Averaged 13.185-13.195(2338-2340) BasePeak:190.90(10775)
BG Mode:Calc. from Peak Group 1 - Event 1



Hit#:1 Entry:18383 Library:NIST11s.lib
SI:91 Formula:C14H22O CAS:1138-52-9 MolWeight:206 RetIndex:1555
CompName:Phenol, 3,5-bis(1,1-dimethylethyl)- $$ Phenol, 3,5-di-tert-butyl- $$ 3,5-Di-tert-butylphenol $$ Phenol, 3,5-bis(t-butyl) $$ 3,5-Di-t-butylphenol $



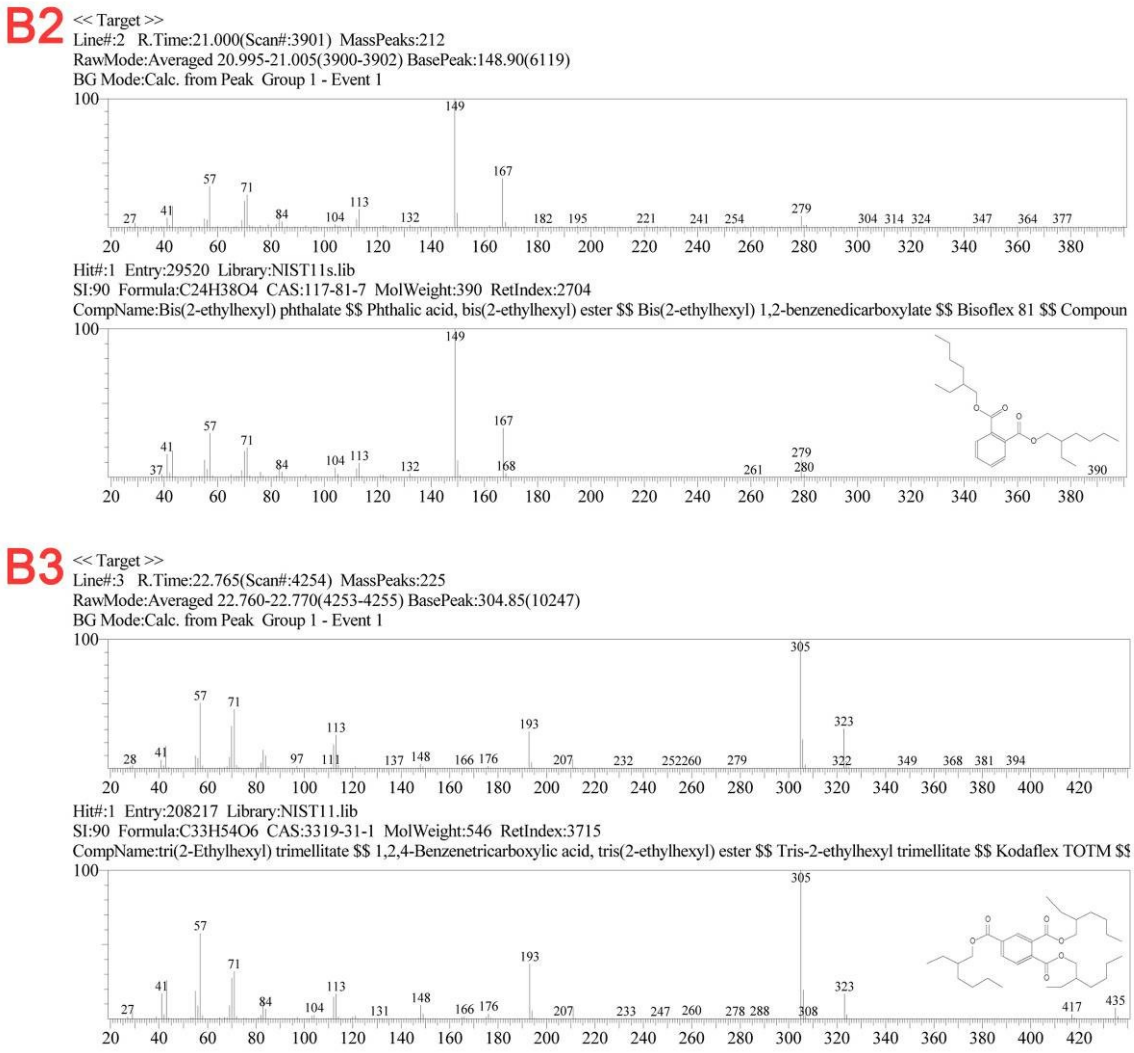


Figure S6 The mass spectra of A1, A2, A3, A4 and B1, B2, B3 in Fig. S5.