Supporting Information

Increasing power density and dye decolorization of X-3B-fed microbial fuel cell via prior TiO_2 photocatalysis

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Table S1

Degradation of azo dyes based on MFC/BES or TiO_2 photocatalysis (Selected research)

References	Dye Concentration (mg/L)	Degradation rate	Power density (mW/m^2)	Strategy
Guo, W. (2014)[1]	300	92% (vs. 80%)*	368 (vs. 182)	graphene-based anode modification (vs. Un-modified anode)
Cui, D. (2014)[2]	200	95.1%	-	series ABR–BES with external voltages
Yadav, A. K. (2012)[3]	500-2000 (best at 500)	93.15%	15.73	constructed wetland-MFC
Sun, J. (2013)[4]	300	100% (vs.43%)	100 (vs. 53.1)	add additional redox mediator (vs. None redox mediator)
Fernando, E. (2013)[5]	360	90%	25.6 (vs. 13.22)	dye acclimated microbial cultures (vs. none acclimated MFCs)
Khanna, A.(2013)[6]	10	100%	-	Ag@TiO_2 under solar light
Ilinoiu, E. C. (2013)[7]	25	89.62%	-	nitrogen-doped TiO_2 photocatalyst under UV light
Wang, X. (2015)[8]	80	97%	-	photocatalysis combined with electrolysis and water jet cavitation
This research	**200**	**56.5% (vs. 42%)**	**392 (vs. 276)**	**photocatalysis pretreatment (vs. without pretreatment)**

* Control group data in the brackets

Synthesis of photocatalyst

The photocatalyst was synthesized according to our previous researches [9]. In short, F-doped nano-TiO_2 sol and magnetic activated carbon powder fabricated by the adsorption of ACG with Fe_3O_4-sol were mixed under magnetic stirring for 1 hour, then rotary evaporation at 75℃ to obtain the composite particles. After washing with ultra-pure water for three times, drying and grinding in a corundum mortar, the composite could be used as the photocatalyst. The F doping enables the catalyst having a visible light activity, while Fe_3O_4 confers the ability to separate the catalyst powders from reaction solution via magnetic field. From a practical point of view, these characters will bring people great convenience for isolating and reusing the catalyst, as well as realizing an energy-saving pretreatment of X-3B by solar energy.

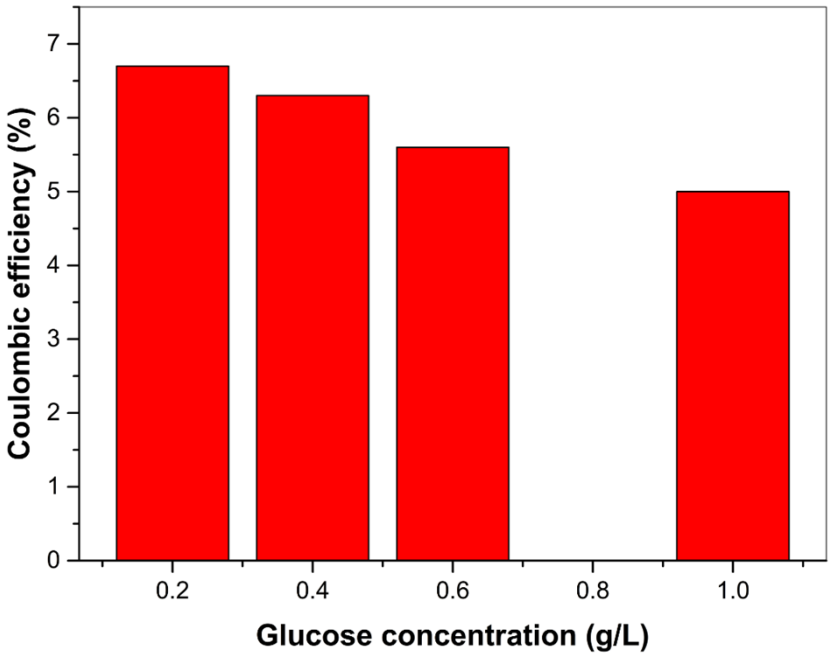

Fig.S1 Histogram of coulombic efficiency for MFC supplied with different concentrations of glucose mixing with 100 mg/L X-3B in substrates. The Coulombic efficiency was calculated as $CE = C_P/C_T \times 100\%$, where C_P is the total coulombs calculated by integrating the current over time. C_T is the theoretical amount of coulombs that can be produced from substrate, calculated as $C_T = Fb_{es}V_{An}\Delta C/M_s$, where F is Faraday's constant (96 485 C/mol electrons), b_{es} is the number of moles of electrons produced per mol of substrate, V_{An} is the liquid volume of anode chamber, ΔC is the substrate concentration variation before and after one cycle operation, and M_s is the molecular weight of glucose.

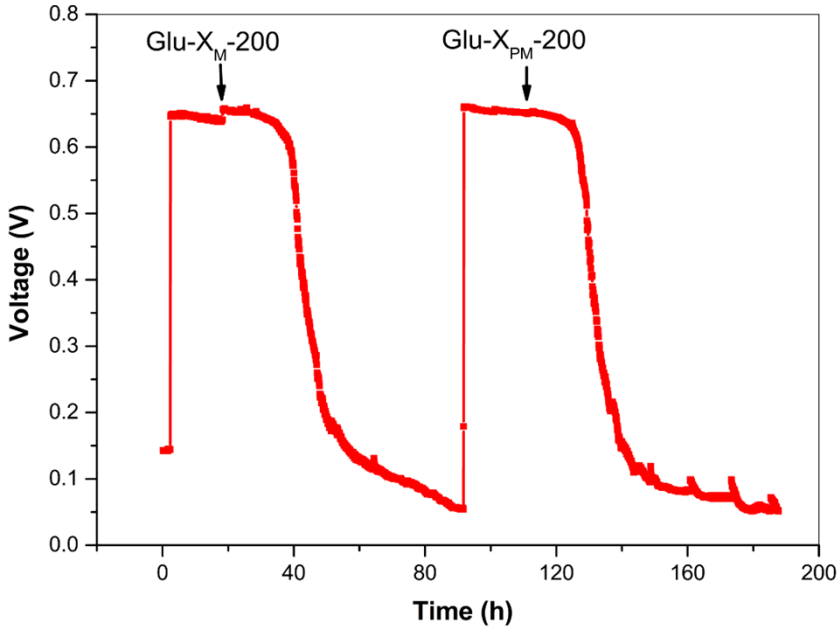

Fig.S2 Output voltage - time curve of the MFC supplied with **Glu-X_M-200** and **Glu-X_{PM}-200** in two consecutive running respectively.

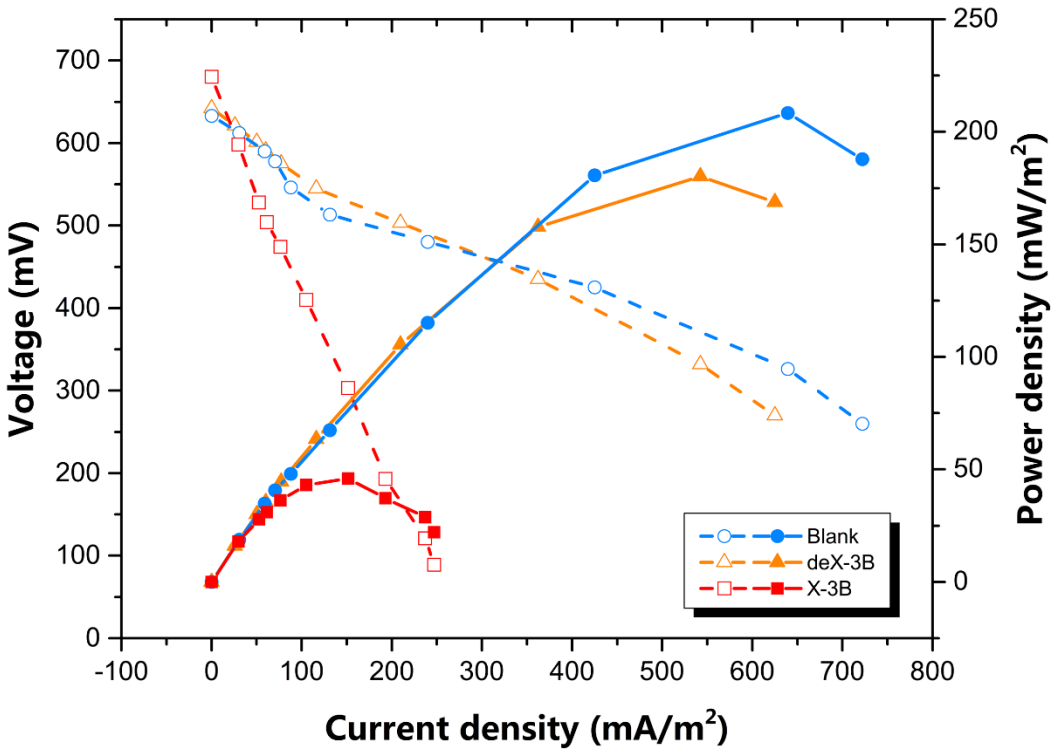

Fig.S3 The power density and polarization curve of the *Shewanella* PV-4 incubated MFC operated under different substrates. **Blank** stands for the normal medium solution containing 100 mM PBS buffer and 10 mM sodium lactate, **X-3B** indicates the substrate containing normal medium plus 200 mg/L X-3B dye, while **deX-3B** represents the substrate containing normal medium plus pretreated X-3B (200 mg/L) by TiO_2 photocatalysis. Most of power density was recovered when X-3B was treated by photocatalysis prior to its use in substrate.

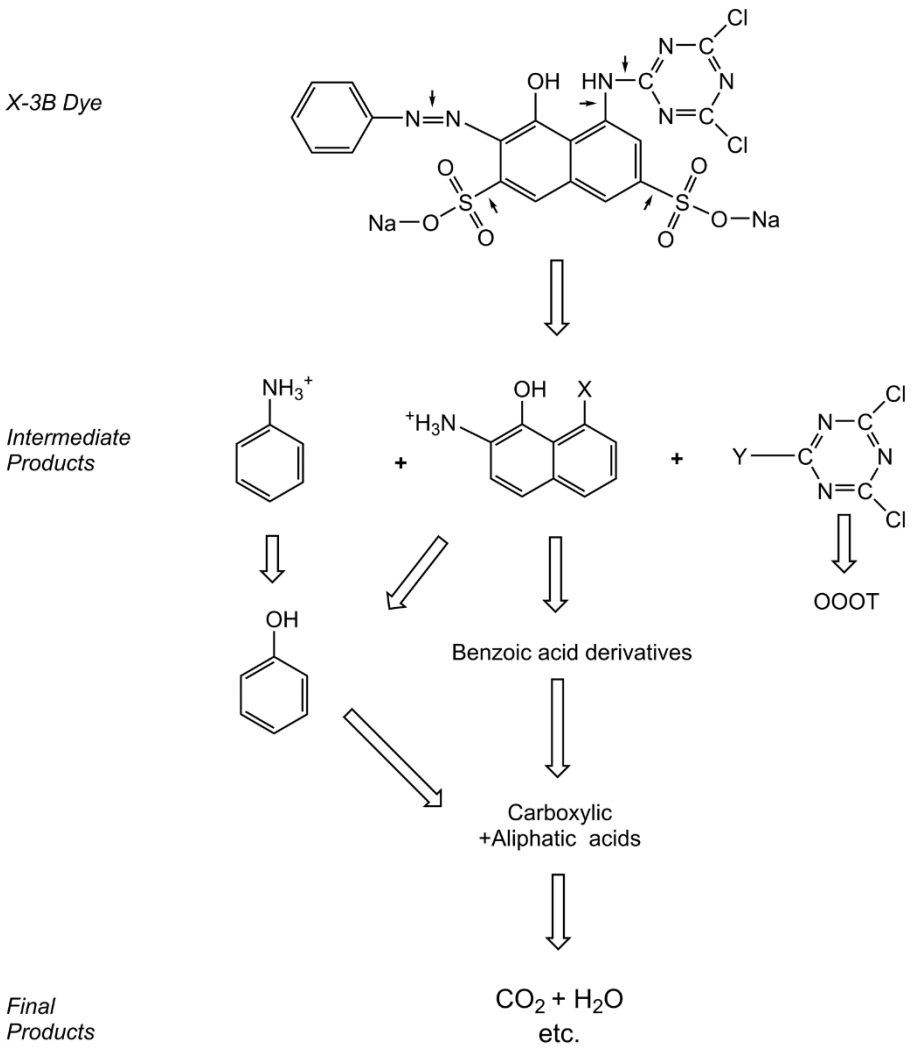

Fig.S4 Simplified degradation pathway of X-3B during photocatalysis by nano-TiO_2 based on references [10, 11].

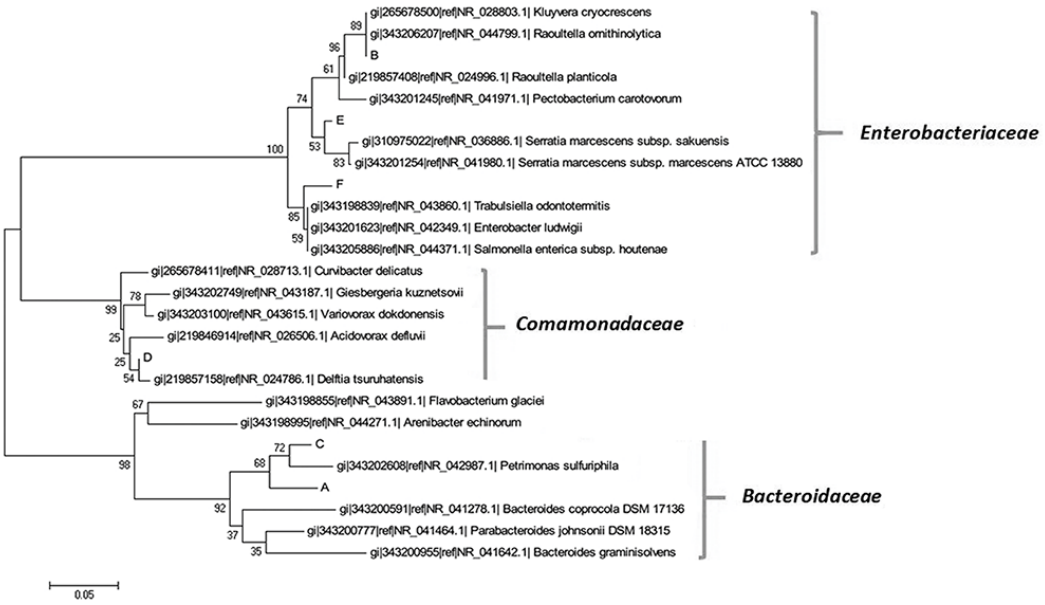

Fig.S5 Neighbor-joining trees (MEGA5，neighbor-joining method) showing phylogenetic relationships of 16S rDNA sequences clones of identified gel bands. Capital letter A to F refer to the strains corresponsing to DGGE bands of 3, 7, 9, 11, 12, 13 in Fig.6A in the text.

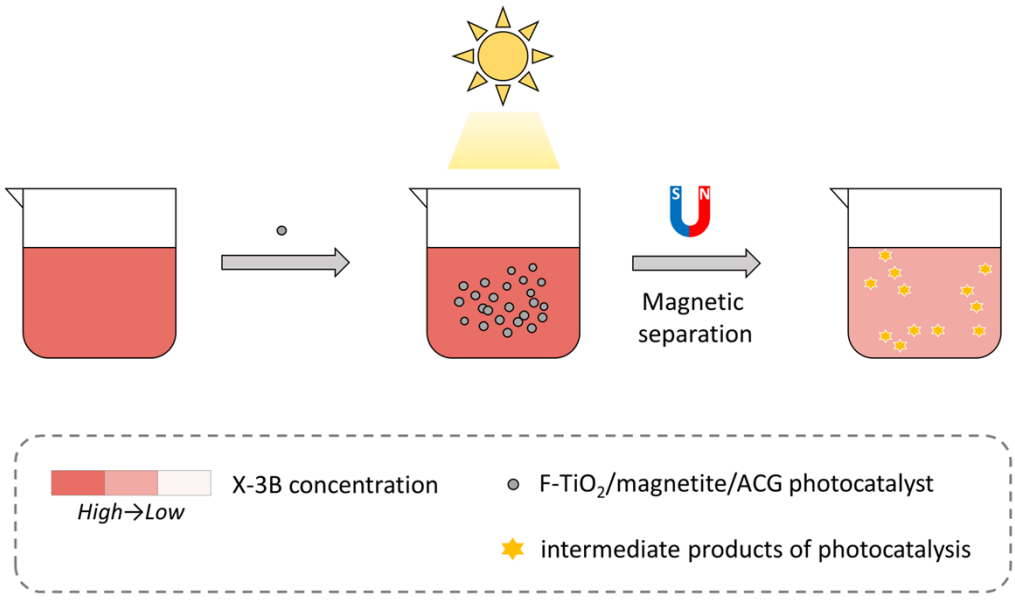

Fig.S6 The schematic process of the photocatalysis pretreatment of X-3B using as prepared photocatalyst. After photocatalysis, the catalyst was easily seperated from solution by magnetic field.

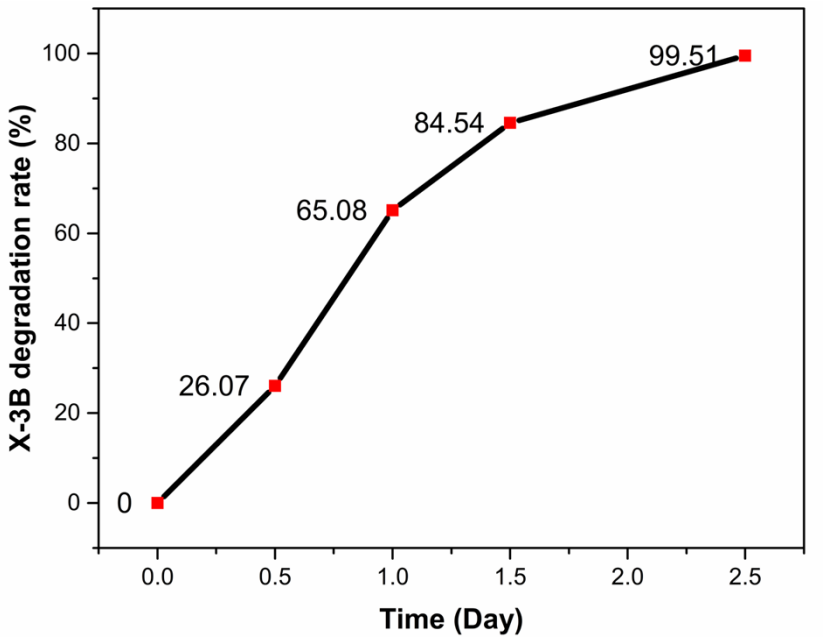

Fig.S7 The degradation curve of X-3B under solar light photocatalysis using as prepared photocatalyst (October, Nanjing, China).

References:

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