Electronic Supplementary Information

Rational Design and Synthesis of Highly Oriented Copper-Zinc Ferrite QDs/Titania NAEs Nano-Heterojuncted Composites with Novel Photoelectrochemical and Photoelectrocatalytic Behavior

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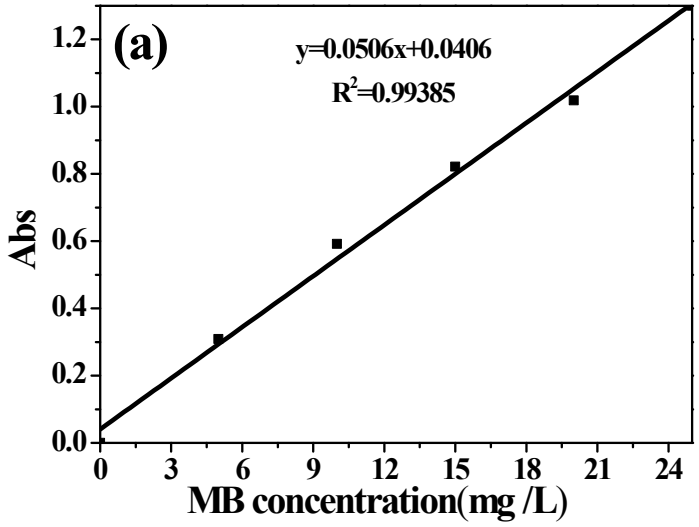
The supporting information contains a total of 12 figures.



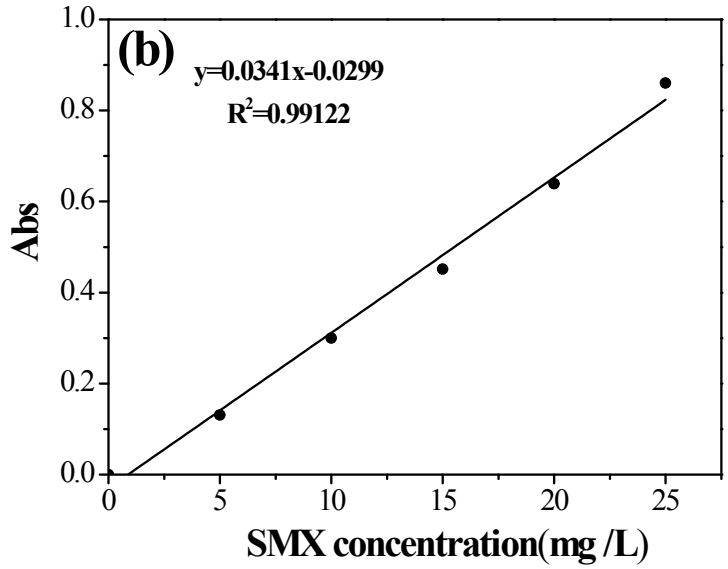


Fig.S1 Standard curve of Methylene Blue (a) and Sulfamethoxazole (b)

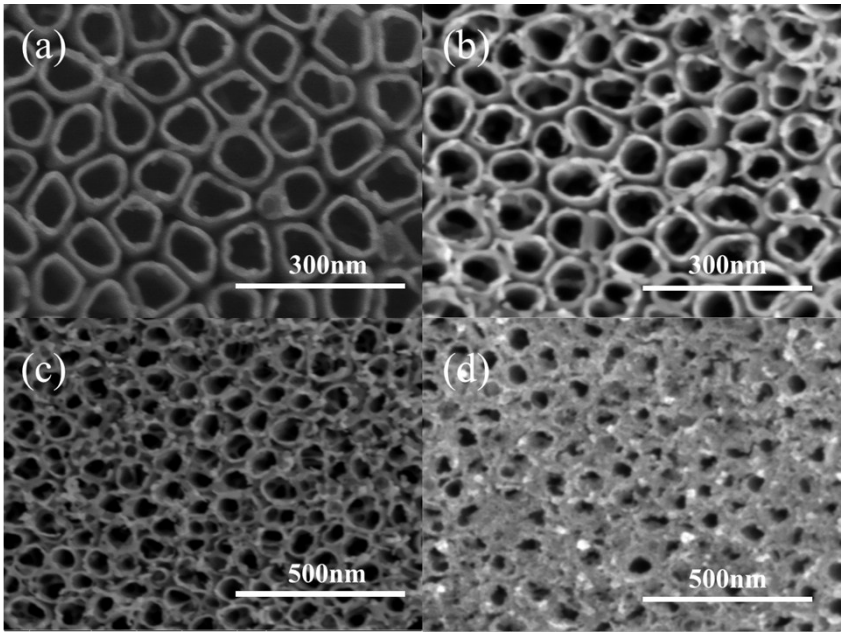


Fig. S2 SEM images of the $Cu_{0.5}Zn_{0.5}Fe_2O_4$ QDs/TiO_2 composite NAEs prepared by different concentration of precursor. (a) 0 M (b) 0.06M (c) 0.1M (d) 0.14M. (Experimental parameters: impregnation time = 10 min, vacuum pressure= 1×10^{-3} Pa, cycles = 10 repetitions, pH=9)

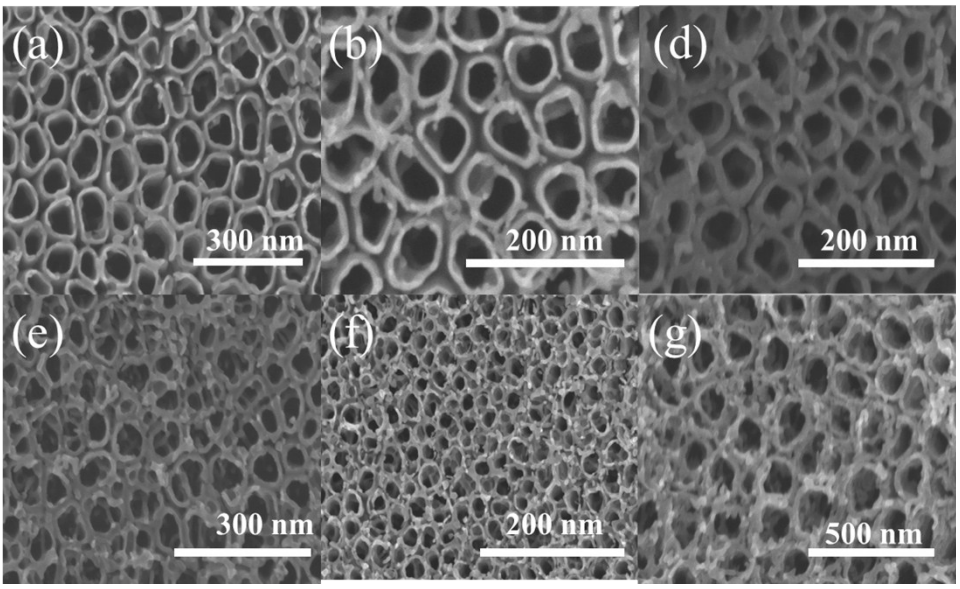


Fig. S3 SEM images of the $Cu_{0.5}Zn_{0.5}Fe_2O_4$ QDs/TiO_2 NAEs nanocomposites prepared by different pH of precursor. (a) pH=0 (b) pH=3 (c) pH=5 (d) pH=7 (e) pH=9 (f) pH=11. (Experimental parameters: impregnation time = 10 min, vacuum pressure= 1×10^{-3} Pa, concentration = 0.05 M $Cu(NO_3)_2\cdot6H_2O$, 0.05 M $Zn(NO_3)_2\cdot6H_2O$ and 0.2 M $Fe(NO_3)_3\cdot9H_2O$, cycles = 5 repetitions)

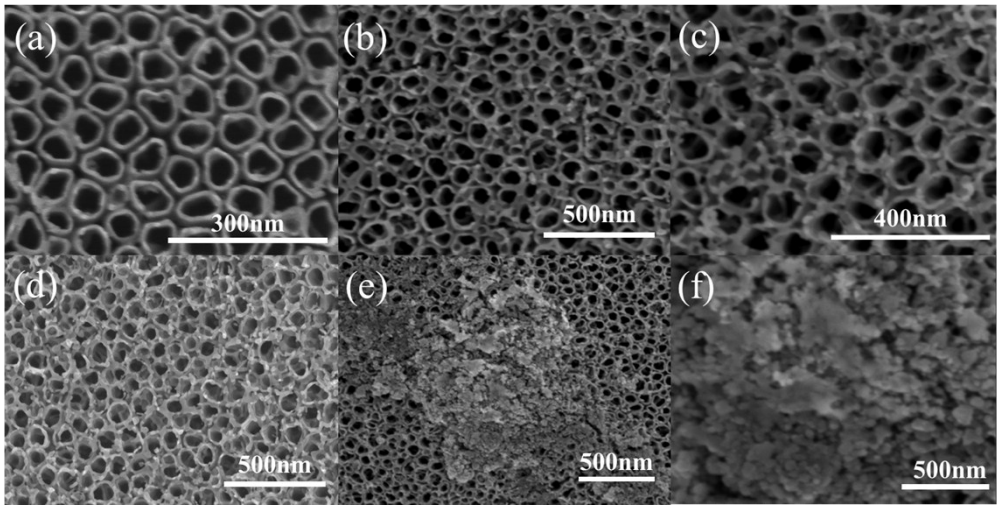


Fig. S4 SEM images of the $Cu_{0.5}Zn_{0.5}Fe_2O_4$ QDs/TiO_2 NAEs nanocomposites prepared by different deposition cycles. (a) 0 repetitions, (b) 1 repetitions, (c) 3 repetitions, (d) 5 repetitions, (d) 7 repetitions, (d) 9 repetitions. (Experimental parameters: impregnation time = 10 min, vacuum pressure= 1×10^{-3} Pa, concentration = 0.05 M $Cu(NO_3)_2\cdot6H_2O$, 0.05 M $Zn(NO_3)_2\cdot6H_2O$ and 0.2 M $Fe(NO_3)_3\cdot9H_2O$, pH = 9)

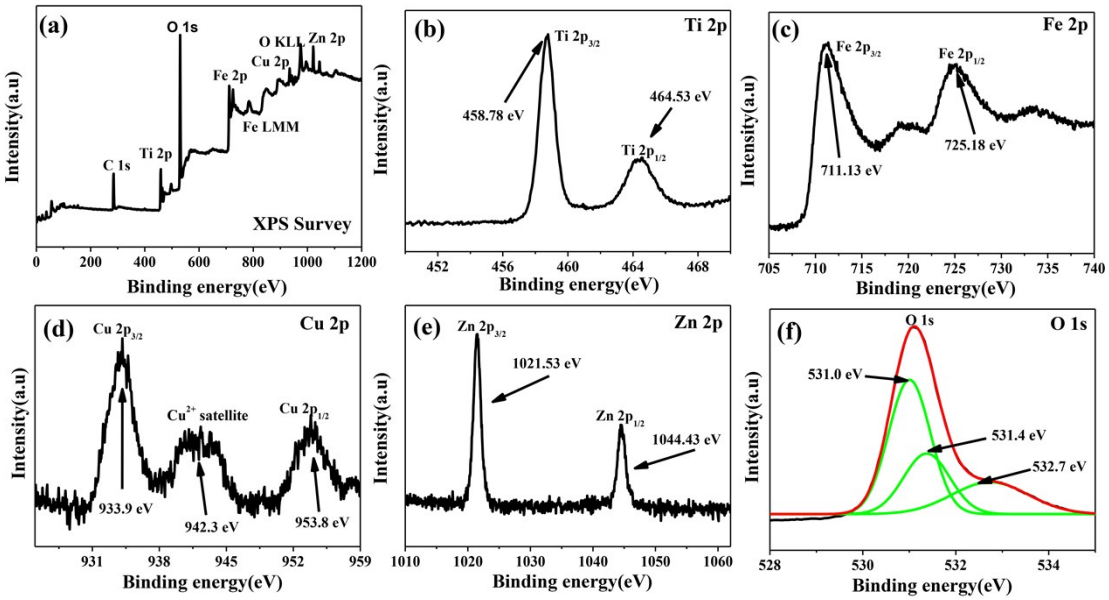


Fig. S5 XPS survey spectrum (a) and high-resolution XPS spectra of Ti 2p (b), Fe 2P (c), Cu 2p (d), Zn 2p (E) and O 1s (f) for $Cu_{0.5}Zn_{0.5}Fe_2O_4$ QDs/TiO_2-NAEs nanocomposites

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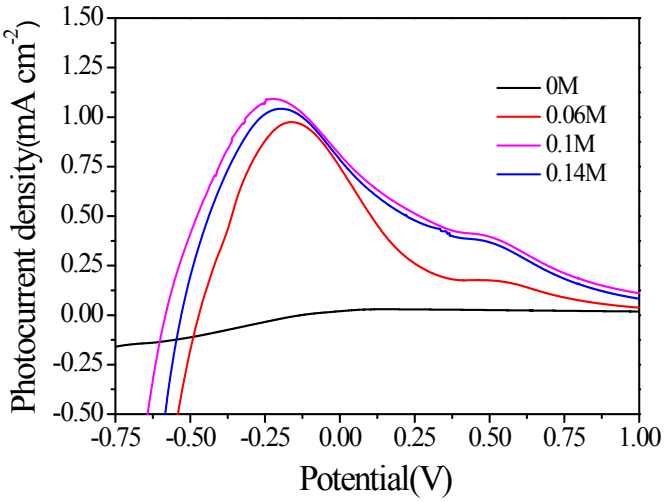

Fig. S6 Photocurrent density *vs*. applied potential (*vs*. SCE) of $Cu_{0.5}Zn_{0.5}Fe_2O_4$ QDs/TiO_2-NAEs nanocomposites under visible light irradiation with different concentration of precursor. (black: 0 M, red: 0.06M, pink: 0.1M, blue: 0.14M).

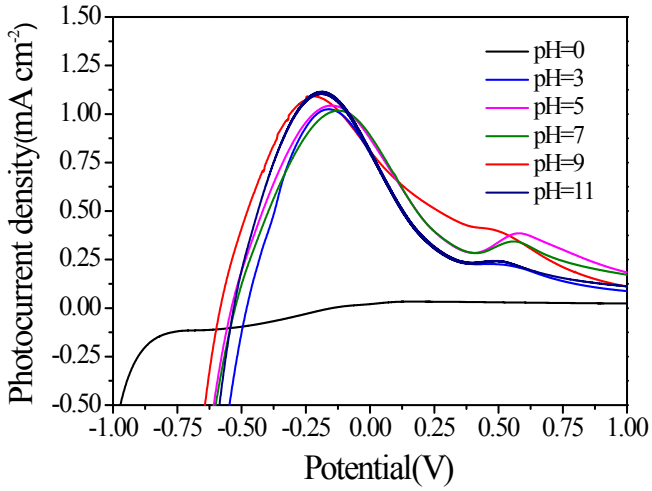

Fig. S7 Photocurrent density *vs*. applied potential (*vs*. SCE) of $Cu_{0.5}Zn_{0.5}Fe_2O_4$ QDs/TiO_2-NAEs under visible light irradiation with different pH values. (black: pH=0, blue: pH=3, pink: pH=5, green: pH=7, red: pH=9, dark blue: pH=11).

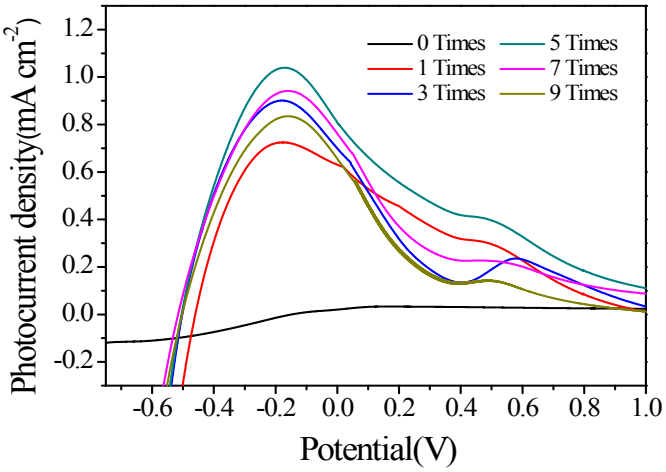

Fig. S8 Photocurrent density *vs*. applied potential (*vs*. SCE) of $Cu_{0.5}Zn_{0.5}Fe_2O_4$ QDs/TiO_2-NAEs nanocomposites under visible light irradiation with different deposition cycles. (black: 0 times, red: 1 times, blue: 3 times, green: 5 times, pink: 7 times, brown: 9 times)

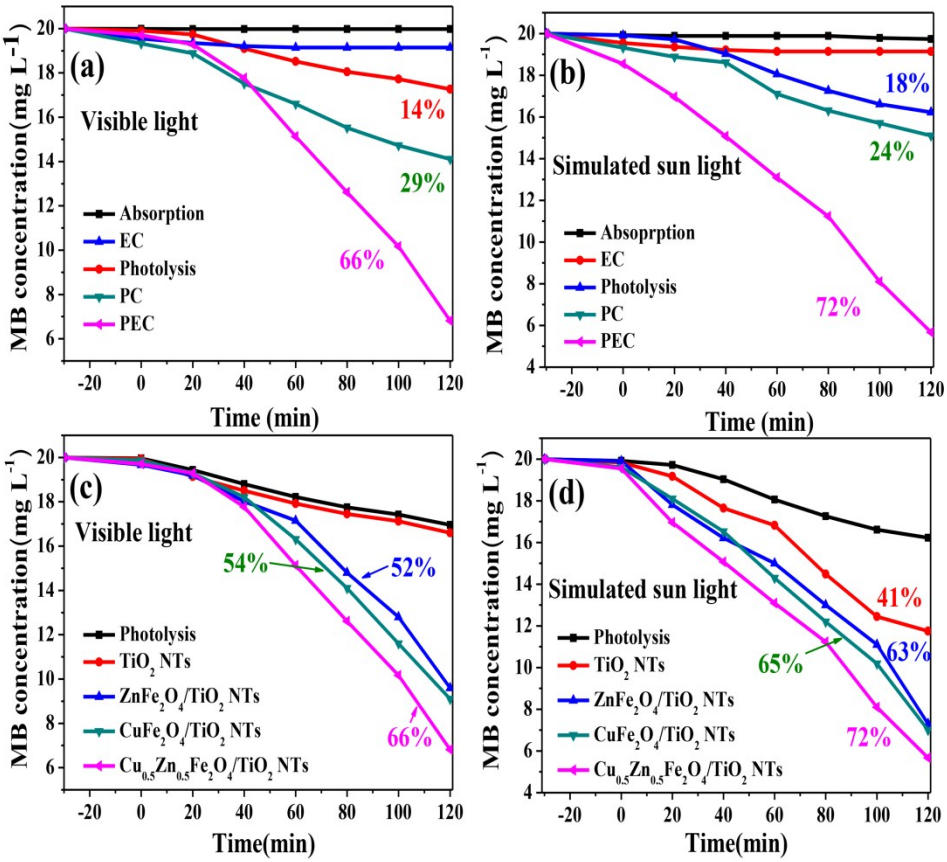

Fig. S9 The concentration vs. time plotted for photoelectrocatalytic degradation of MB by TiO_2 NAEs and $Cu_{0.5}Zn_{0.5}Fe_2O_4$ QDs/TiO_2 NAEs in different processes under visible light irradiation: (a), (c) (I_0 = 30 mW cm^{-2}, 0.6 V vs. SCE, C_0 = 20 mg L^{-1}) and simulated sunlight irradiation (b), (d) (I_0 = 33 mW cm^{-2}, 0.6 V vs. SCE, C_0 = 20 mg L^{-1}).

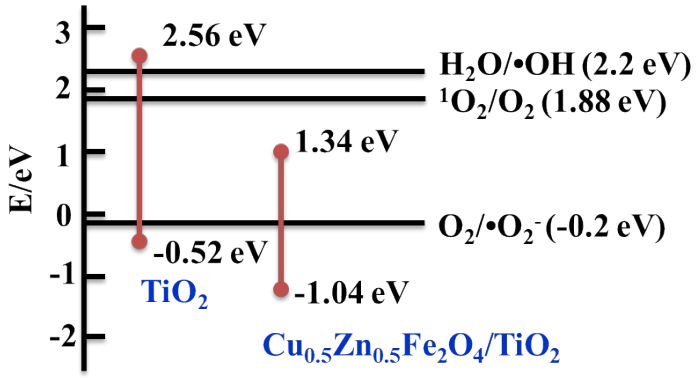

Fig. S10 Band structures of TiO_2 and $Cu_{0.5}Zn_{0.5}Fe_2O_4/TiO_2$, and the redox potential of each ROS

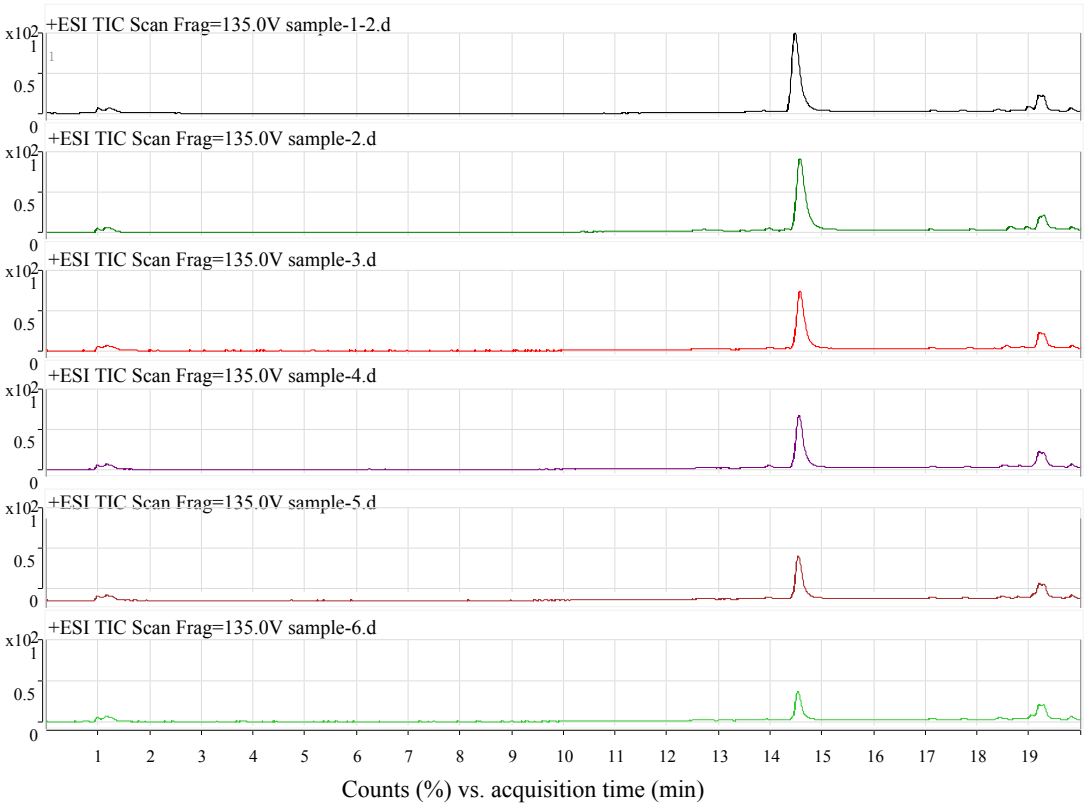

Fig. S11 HPLC graphs of the MB solution at different reaction times. Conditions: MB, 20 mg L^{-1} (initial concentration).

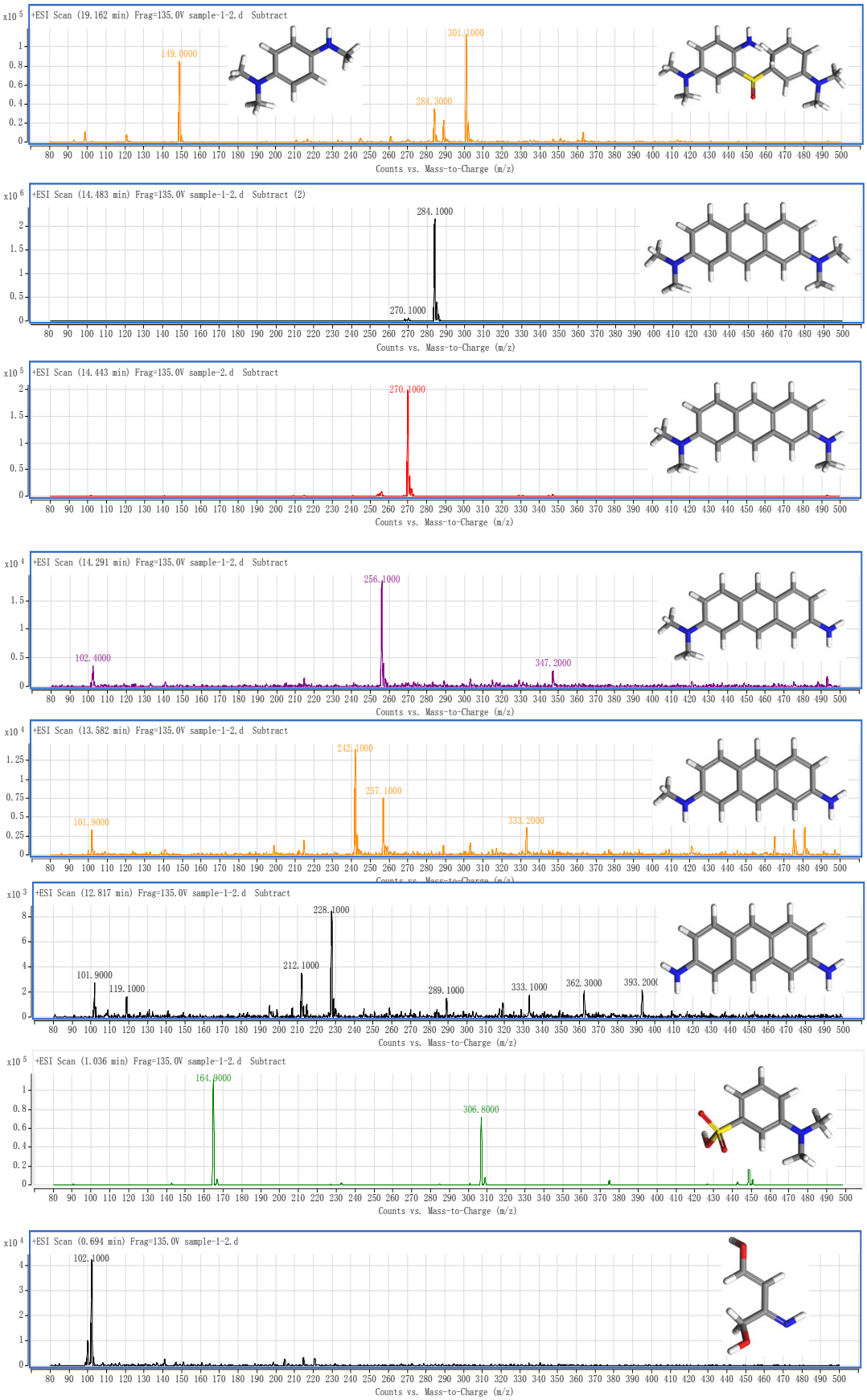

Fig. S12 MS-MS graphs in the positive ion mode for monitoring the degradation of the MB solutions.