Electronic Supplementary Information for:

Enhanced photochemical activity and stability of ZnS by a simple alkaline treatment approach

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Table S1

Physiochemical properties of the as-synthesized samples

Samples	[a] Crystallite size (nm)	[b] S_{BET} (m^2g^{-1})	Zeta potential (mV)	Absorption edge (nm)	Band gap (eV)	
					[c]KM method	[d]DFT calculation
ZnS	4.52	27.61	-29.6	375	3.26	3.12
1M-ZnS	9.52	60.99	/	370	3.35	/
3M-ZnS	13.18	51.18	+18.0	355	3.50	3.30
5M-ZnS	17.14	37.48	/	358	3.46	/
10M-ZnS	17.13	11.02	/	365	3.43	/

[a] by Debye Scherer equation for the (111) peaks of ZnS; [b] calculated by Brunauer-Emmett-Teller (BET) method; [c] by Kubelka-Munk function from UV–DRS; [d] calculated by density functional theory (DFT)

Table S2

FT-IR analysis for ZnS

Peaks	Wavenumber (cm^{-1})	Peak intensity	Interpretation
1	1397	Small, weak	C-H bending
2	1552	Sharp, broad	O-H bending (adsorbed water)
3	3331	Broad	Associated O-H (adsorbed water)

Table S3

FT-IR analysis for 3M-ZnS

Peaks	Wavenumber (cm^{-1})	Peak intensity	Interpretation
1	1383	Small, weak	C-H bending
2	1625	Sharp, broad	O-H bending (adsorbed water)
4	3419	Broad	Associated O-H (adsorbed water)

Table S4

Apparent reaction kinetic constants for the degradation of MB under UV light irradiation ($\lambda \leq 420$ nm)

Samples	**ZnS**	**1M-ZnS**	**3M-ZnS**	**5M-ZnS**	**10M-ZnS**
***k* (g mg^{-1} min^{-1})**	0.0262	0.0312	0.0405	0.0335	0.0234
R^2	0.94	0.96	0.93	0.98	0.98

Fig. S1

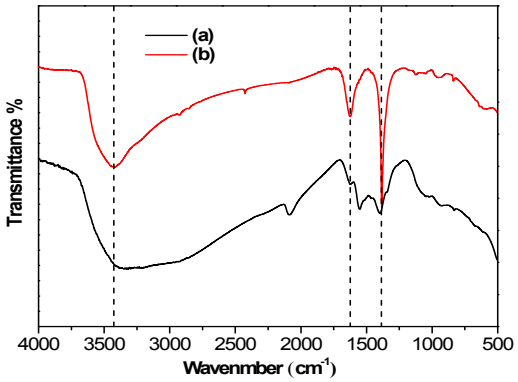

Fig. S1 FT-IR spectra of the samples; **(a)** ZnS; **(b)** 3M-ZnS

Fig. S2

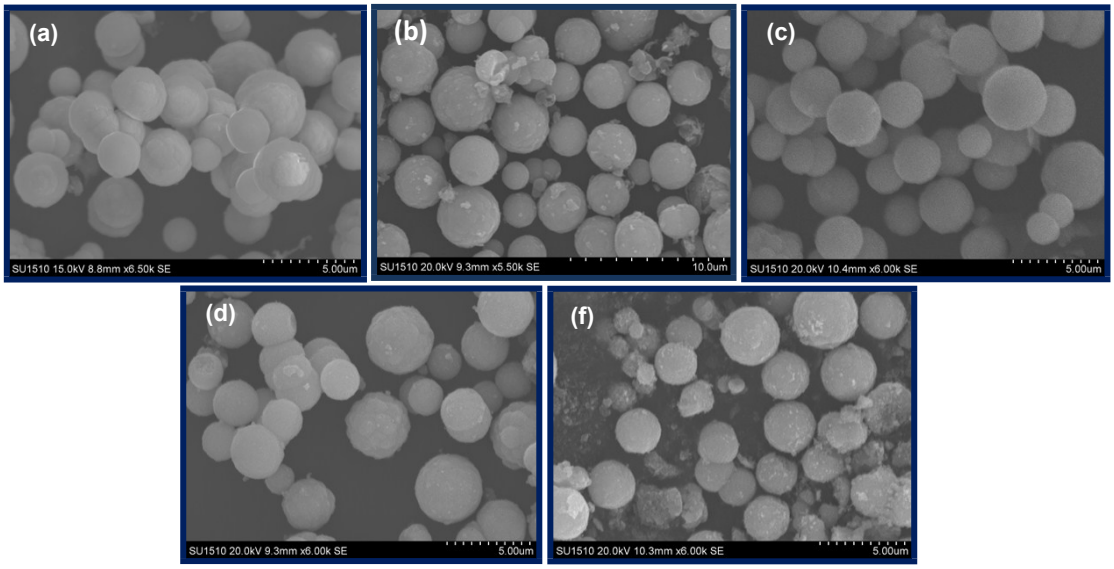

Fig. S2 SEM images of the samples; **(a)** ZnS; **(b)** 1M-ZnS **(c)** 3M-ZnS; **(d)** 5M-ZnS; and **(e)** 10M-ZnS

Fig. S3

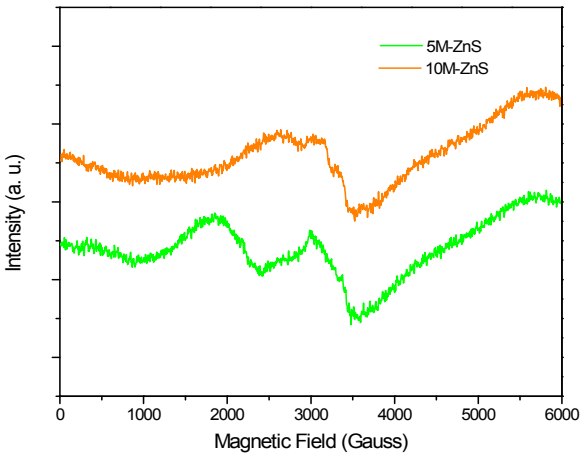

Fig. S3 EPR of the samples

Fig. S4

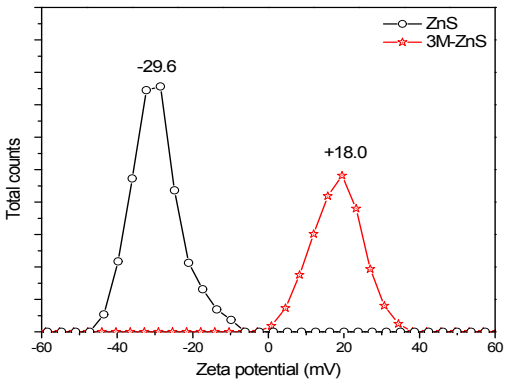

Fig. S4 Zeta potentials of ZnS and 3M-ZnS

Fig. S5

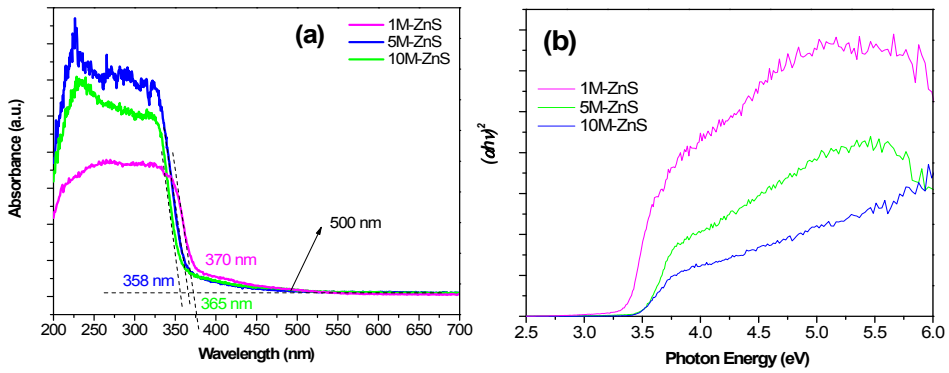

Fig. S5 (a) UV-DRS and **(b)** Tauc plots of the samples

Fig. S6

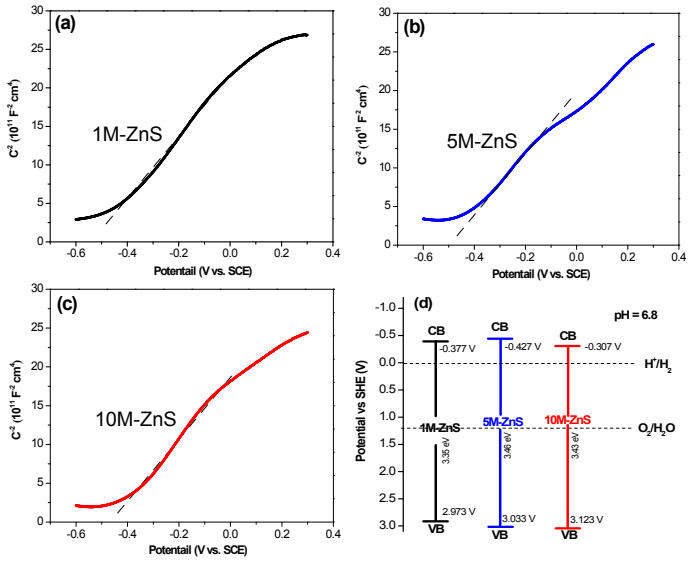

Fig. S6 (a-d) Mott–Schottky plots at fixed frequency of 1 kHz in 0.5 M Na_2SO_4 (pH = 6.8);

(d) CB and VB potentials

Fig. S7

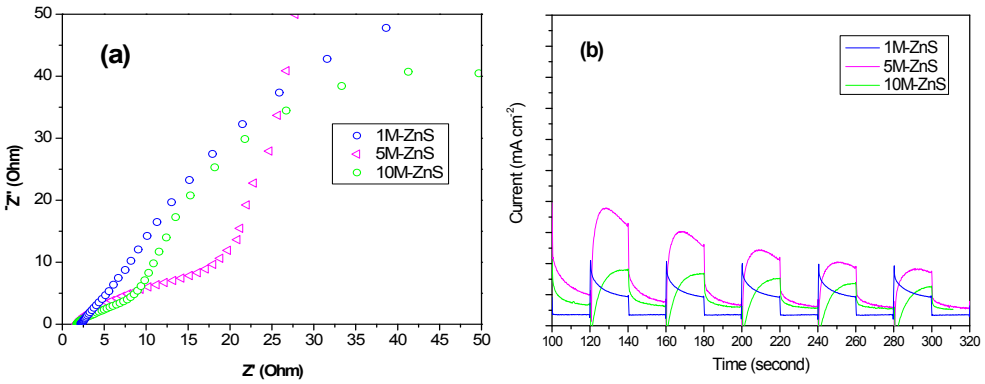

Fig. S7 (a) EIS and **(b)** photocurrent spectra under UV-light irradiation ($\lambda \leq 420$ nm)

Fig. S8

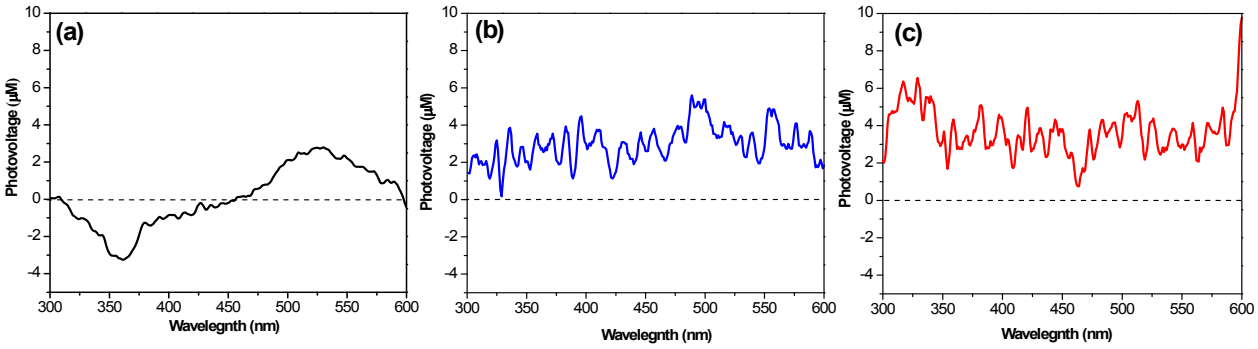

Fig. S8 SPV of **(a)** 1M-ZnS; **(b)** 5M-ZnS and **(c)** 10M-ZnS.

Fig. S9

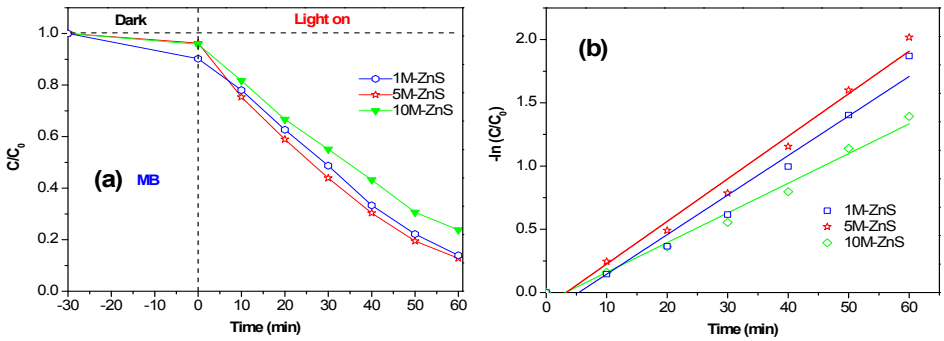

Fig. S9 (a) Degradation curves and **(b)** reaction kinetic curves of Methylene Blue (MB) solution under UV-light irradiation ($\lambda \leq 420$ nm)