

## Supporting Information

### **A Novel Full Solar Light Spectrum Responsive Antimicrobial Agent by WS<sub>2</sub> Quantum Dots for Photocatalytic Wound Healing Therapy**

Huan Wang<sup>1,2#</sup>, Fanghan Li<sup>3#</sup>, Yuan Yong<sup>1,2\*</sup>, Mingzhu Lv<sup>1,2</sup>, Chenghui Liu<sup>1,2</sup>, Qiqi Xu<sup>1,2</sup>, Guobo Du<sup>5</sup>, Jiani Xie<sup>6</sup>, Yong You<sup>1,2</sup>, Jiangwei Xiao<sup>3\*</sup>, Guohui Jiang<sup>4\*</sup>

1. Key Laboratory of Pollution Control Chemistry and Environmental Functional Materials for Qinghai-Tibet Plateau of the National Ethnic Affairs Commission, School of Chemistry and Environment, Southwest Minzu University, Chengdu 610041, China.

2. Key Laboratory of General Chemistry of the National Ethnic Affairs Commission, School of Chemistry and Environment, Southwest Minzu University, Chengdu 610041, China.

3. The Department of Gastrointestinal Surgery, The First Affiliated Hospital of Chengdu Medical College, Faculty of medicine, Chengdu, 610500, China.

4. Department of Neurology, Affiliated Hospital of North Sichuan Medical College, Institute of neurological diseases, North Sichuan Medical College, Nanchong, 637000, China.

5. Department of Oncology, Affiliated Hospital of North Sichuan Medical College, Nanchong, 637000, China.

6. College of Pharmacy and Biological Engineering, Chengdu University, Chengdu, 610106, China.

# These authors contributed equally.

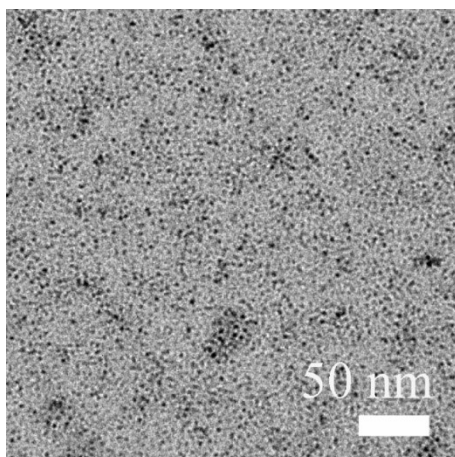
Corresponding Authors:

\*E-mail: [yongy1816@163.com](mailto:yongy1816@163.com); [xiaojiangwei@126.com](mailto:xiaojiangwei@126.com); [neurodoctor@163.com](mailto:neurodoctor@163.com)

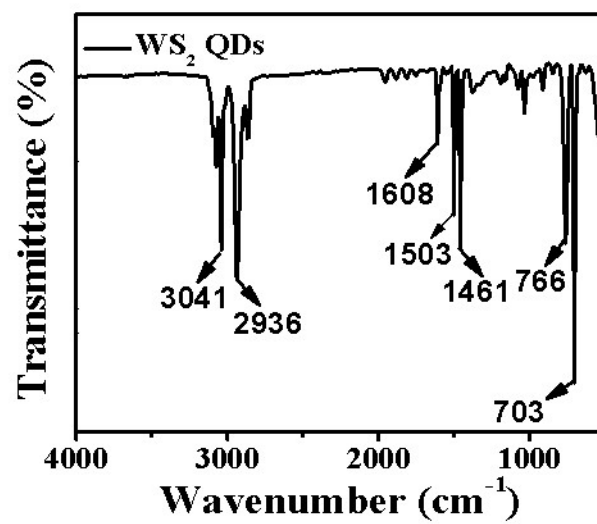
## **EXPERIMENTAL SECTION**

### **Materials and chemicals**

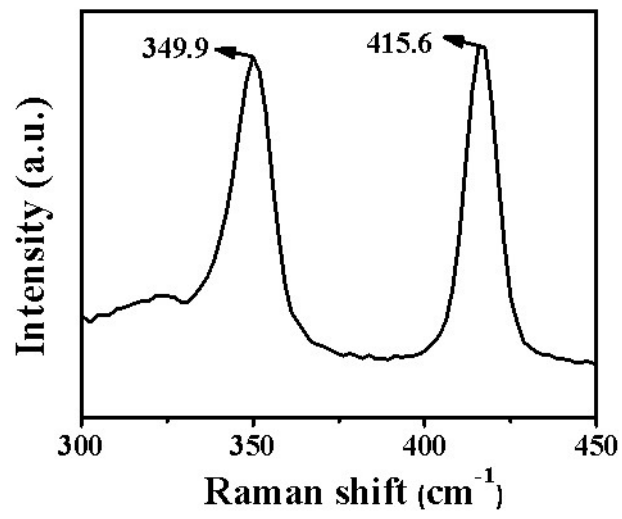
Commercial WS<sub>2</sub> (99.8 %) was obtained from Alfa Aesar and used without further purification. H<sub>2</sub>SO<sub>4</sub> (95.0 %-98.0 %, analytical reagent), methyl orange (MO), Tris(hydroxymethyl)methyl aminomethane THAM (Tris) and Potassium bromide (KBr) were obtained from Chron Chemical Co. Ltd. (Chengdu, China). Rhodamine B (RhB), 2, 2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt (ABTS), 3,3',5,5'-tetramethylbenzidine (TMB), o-phenylenediamine (OPD), 3, 3'-diaminobenzidine (DAB) and 5,5'-dithiobis (2-nitrobenzoic acid) (DTNB) were obtained from Aladdin Company (China, Shanghai). hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>, 30 %) was procured from Jinshan Chemical Reagent Co. Ltd. (Chengdu, China). Reduced glutathione (GSH) was sourced from Nanjing Jiancheng Institute of Biological Engineering. Crystal violet staining solution was purchased from Scientific Phygene (Shanghai, China). Acridine orange and Ethidium bromide (AO-EB) staining kit was acquired from Shanghai Yuanye Bio-Technology Co. Ltd. (China). Sprague Dawley rats. Deionized (DI) water was used in the whole process.



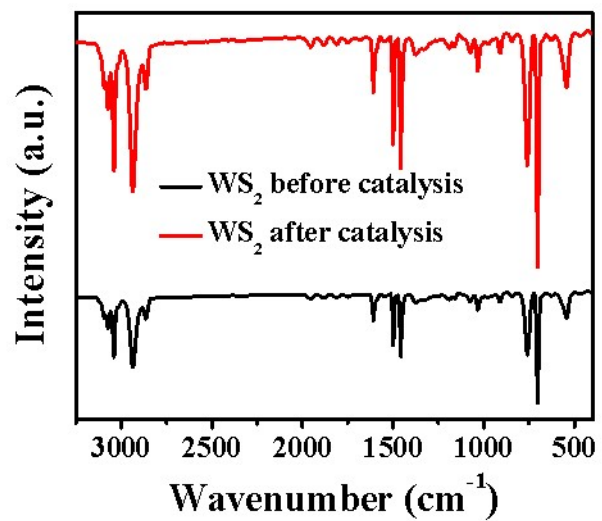
**Fig. S1** TEM of WS<sub>2</sub> QDs. (Scale bar = 50 nm)



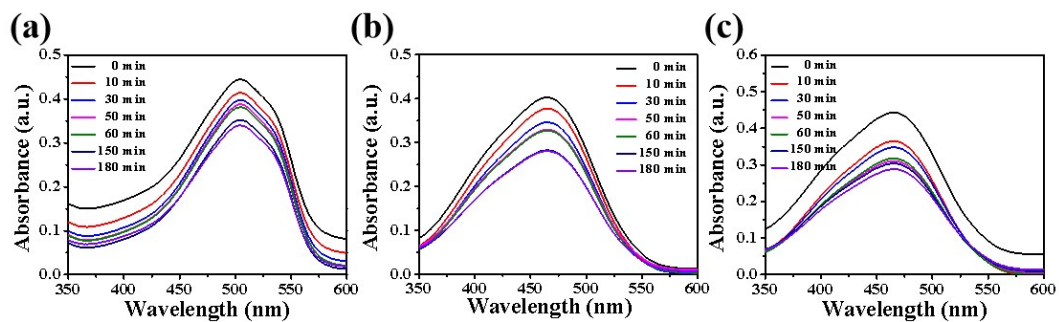
**Fig. S2** FT-IR spectra of the WS<sub>2</sub> QDs.



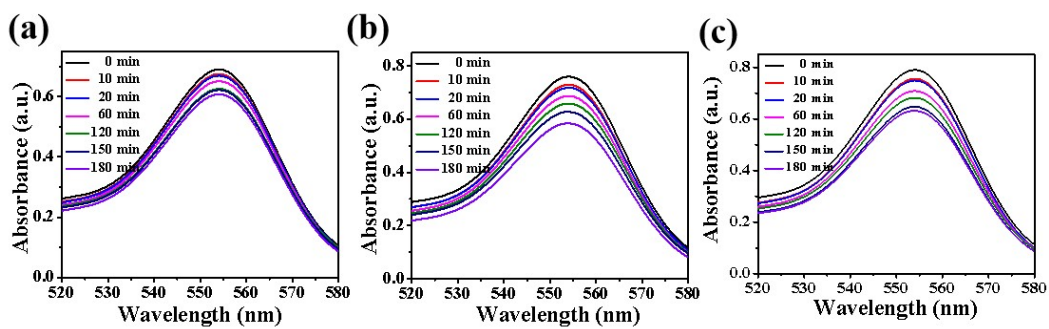
**Fig. S3** Raman spectra of the WS<sub>2</sub> QDs.



**Fig. S4** FT-IR spectra of WS<sub>2</sub> QDs.

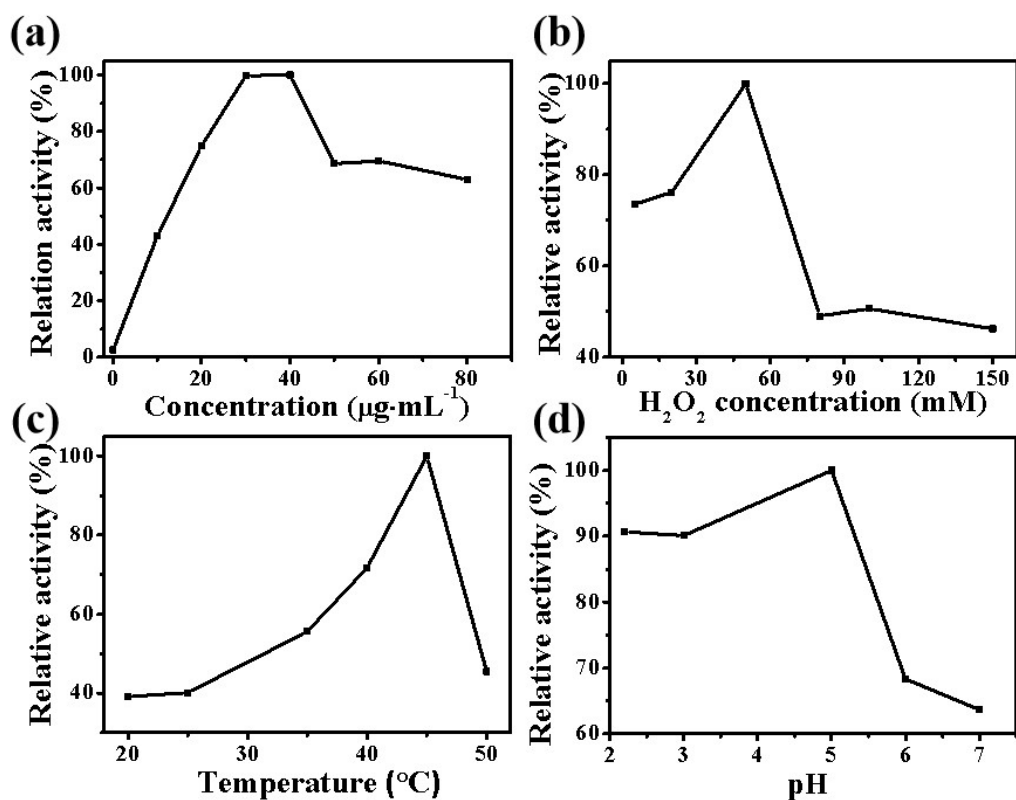


**Fig. S5** UV-vis absorption spectra of MO ( $10 \mu\text{g}\cdot\text{mL}^{-1}$ ) with WS<sub>2</sub> QDs ( $500 \mu\text{g}\cdot\text{mL}^{-1}$ ) under UV, Nis and NIR light irradiation at different time (0-180 min).

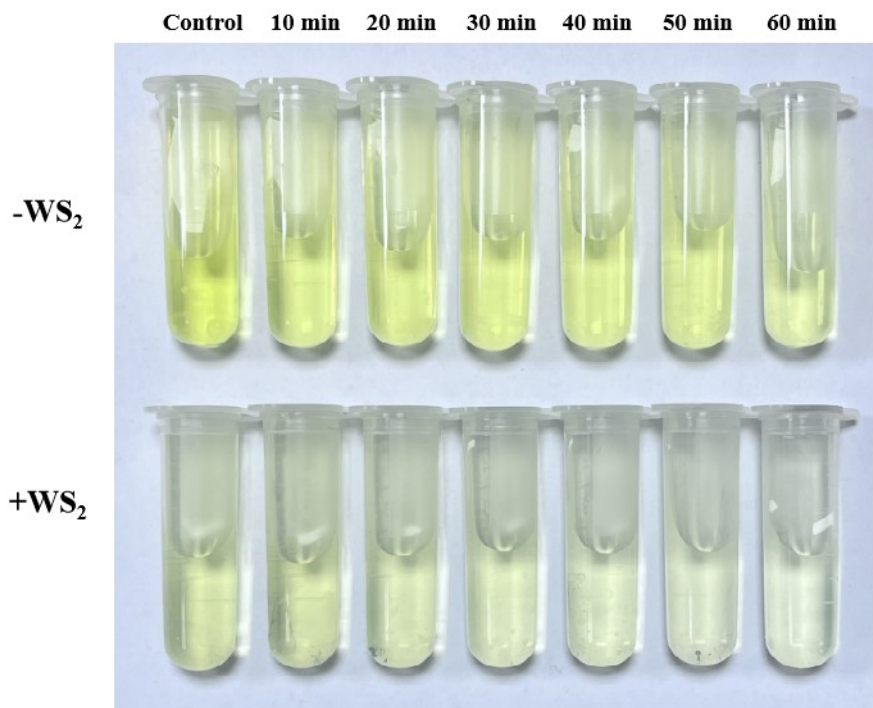


**Fig. S6** UV-vis absorption spectra of RhB ( $10 \mu\text{g}\cdot\text{mL}^{-1}$ ) with  $\text{WS}_2$  QDs ( $500 \mu\text{g}\cdot\text{mL}^{-1}$ ) under UV, Nis and NIR light irradiation at different time (0-180 min).

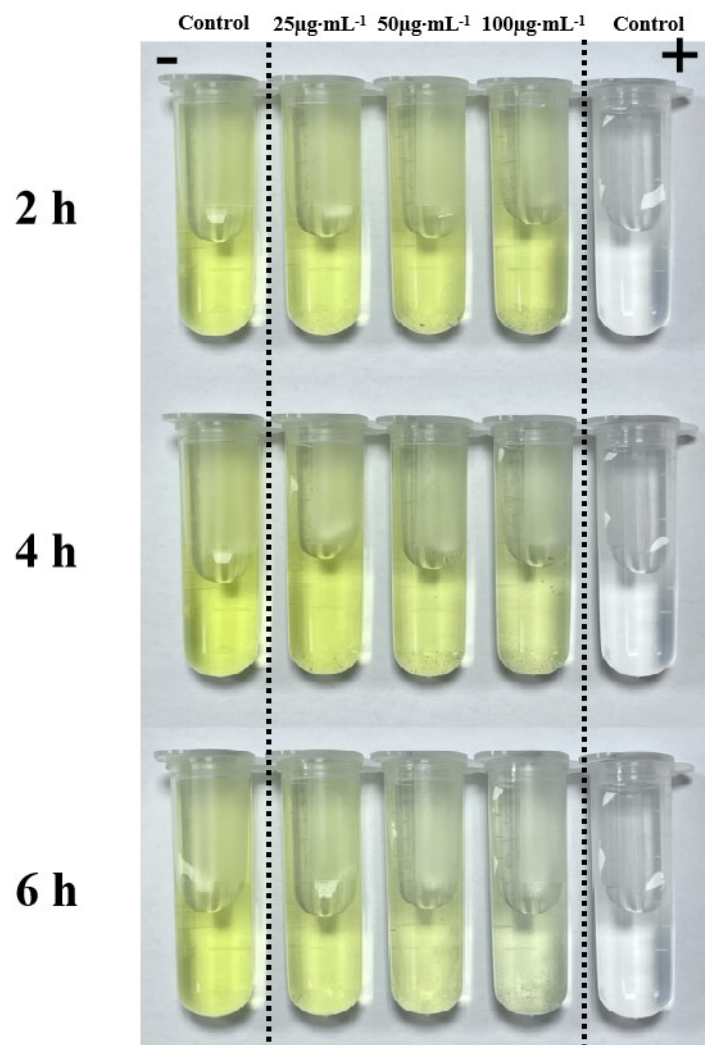




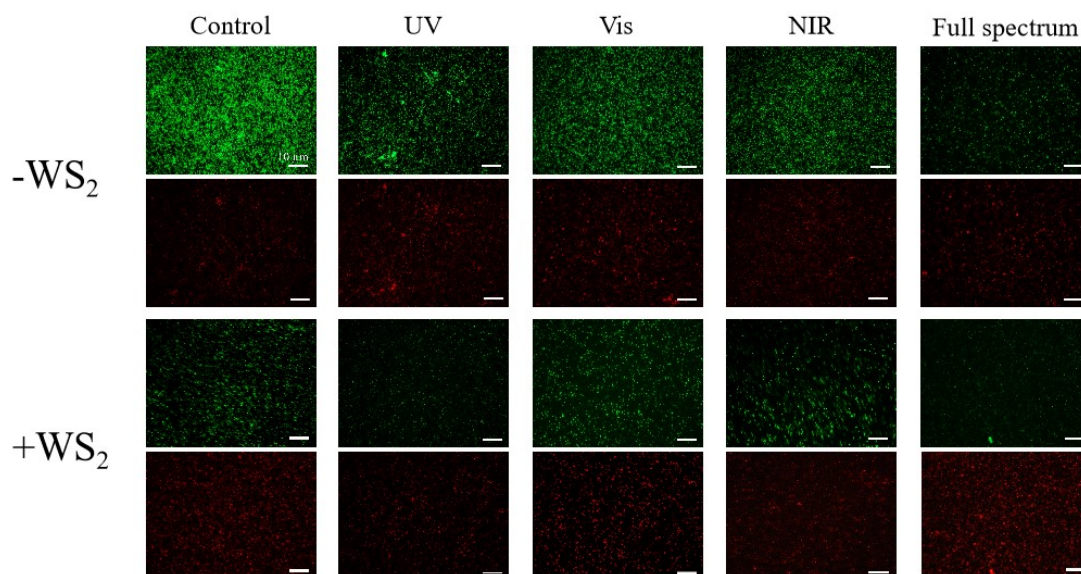
**Fig. S7** Peroxidase-like activity of reduced WS<sub>2</sub> QDs is dependent on concentrations (a), H<sub>2</sub>O<sub>2</sub> (b), temperature (c), and pH (d). WS<sub>2</sub> QDs show an optimal pH of 4.0-5.0 and optimal temperature around 25-30°C. The insets show the fluorescence spectra of the corresponding reduced WS<sub>2</sub> QDs reaction system.



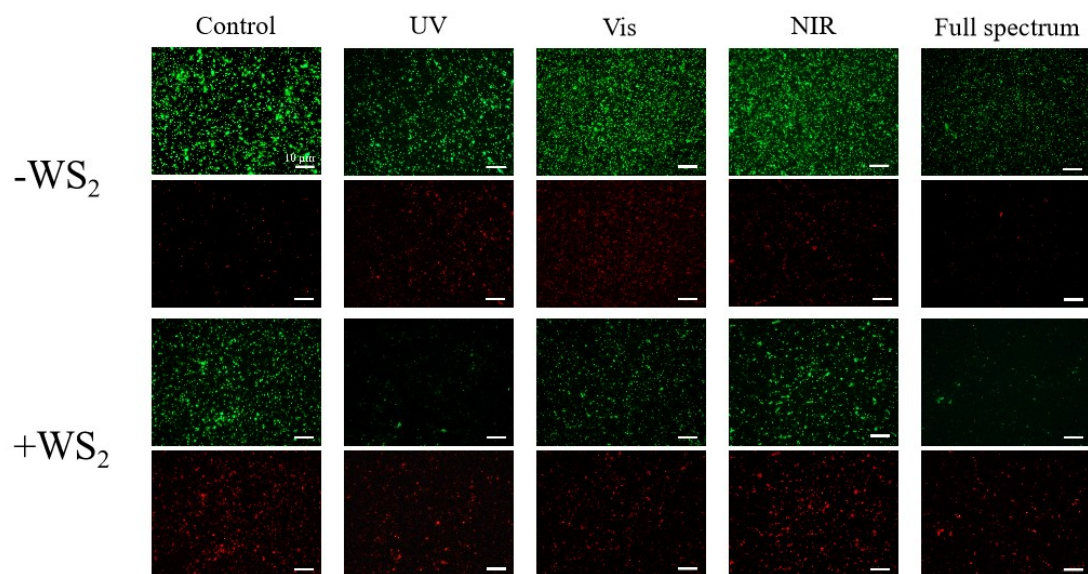
**Fig. S8** Photographs of color changes after GSH treatment at different full spectrum light intervals were determined by Ellman's assay in the absence and presence of WS<sub>2</sub> QDs. The concentration of WS<sub>2</sub> QDs was 50  $\mu\text{g}\cdot\text{mL}^{-1}$ . GSH without WS<sub>2</sub> QDs as a control showed a significant reduction in color after 60 minutes of light.



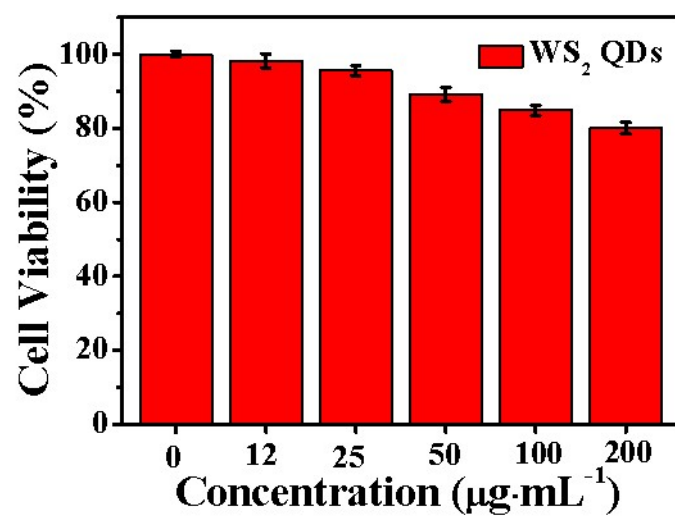
**Fig. S9** Photographs for the color change after GSH oxidation with different concentrations of WS<sub>2</sub> QDs at different time intervals determined by Ellman's assay.



**Fig. S10** Fluorescent staining photograph of *E. coli* treated after exposed (I) Control, (II) UV, (III) Vis, (IV) NIR, (V) Full spectrum, (VI) WS<sub>2</sub> QDs (50  $\mu\text{g}\cdot\text{mL}^{-1}$ ), (VII) WS<sub>2</sub> QDs + UV, (VIII) WS<sub>2</sub> QDs + Vis, (IX) WS<sub>2</sub> QDs + NIR, (X) WS<sub>2</sub> QDs + Full spectrum.



**Fig. S11** Fluorescent staining photograph of *S. aureus* treated after exposed (I) Control, (II) UV, (III) Vis, (IV) NIR, (V) Full spectrum, (VI) WS<sub>2</sub> QDs (50 μg·mL<sup>-1</sup>), (VII) WS<sub>2</sub> QDs + UV, (VIII) WS<sub>2</sub> QDs + Vis, (IX) WS<sub>2</sub> QDs + NIR, (X) WS<sub>2</sub> QDs + Full spectrum.



**Fig. S12** Toxicity experiments with different concentrations of WS<sub>2</sub> QDs for 24 h.