

## Supporting Information

### **Formation of Nanosilver from Silver Sulfide Nanoparticles in Natural Waters by Photoinduced Fe(II, III) Redox Cycling**

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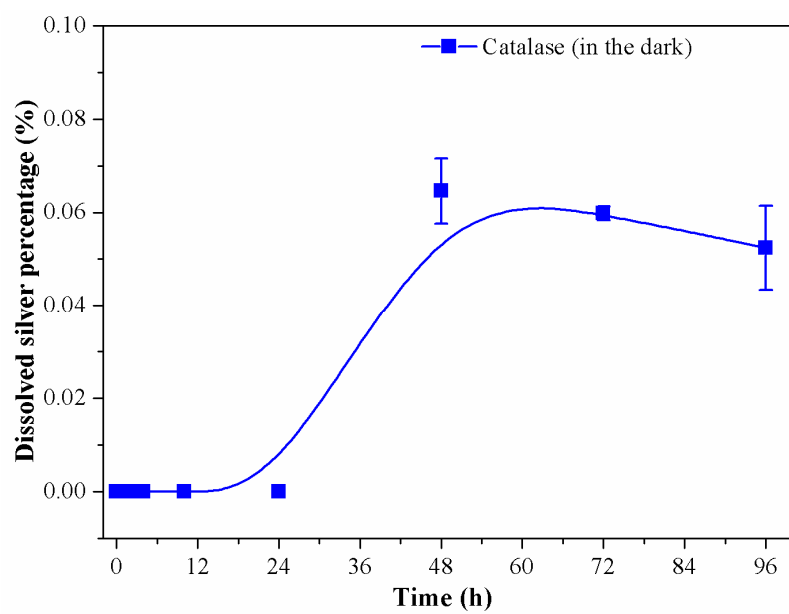
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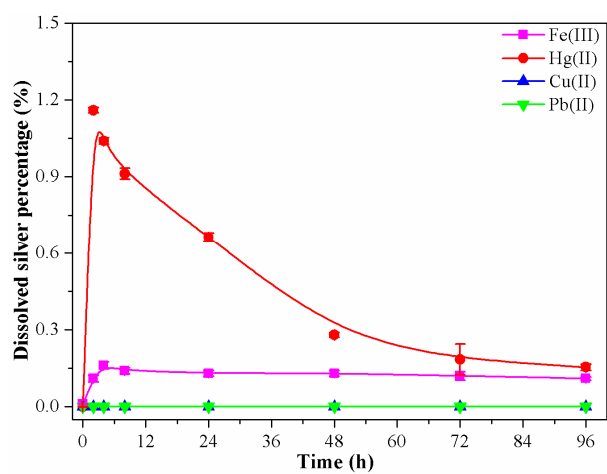
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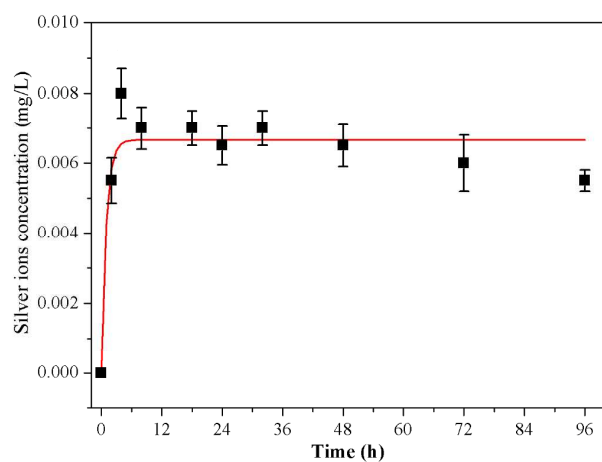
**11 Figures**



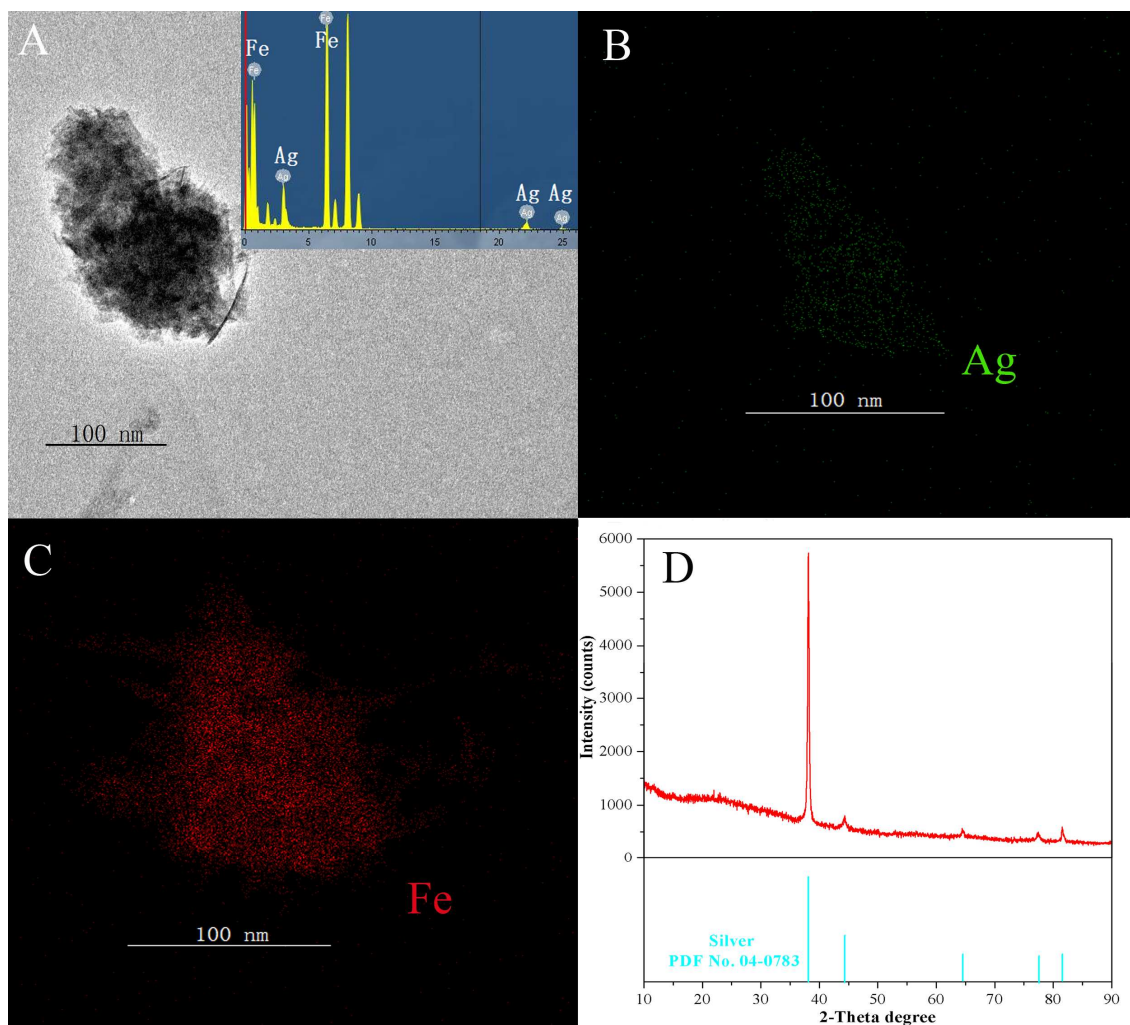
**Figure S1.** Effect of catalase on the dissolution kinetic of Ag<sub>2</sub>SNPs in the presence of Fe(III) under dark.



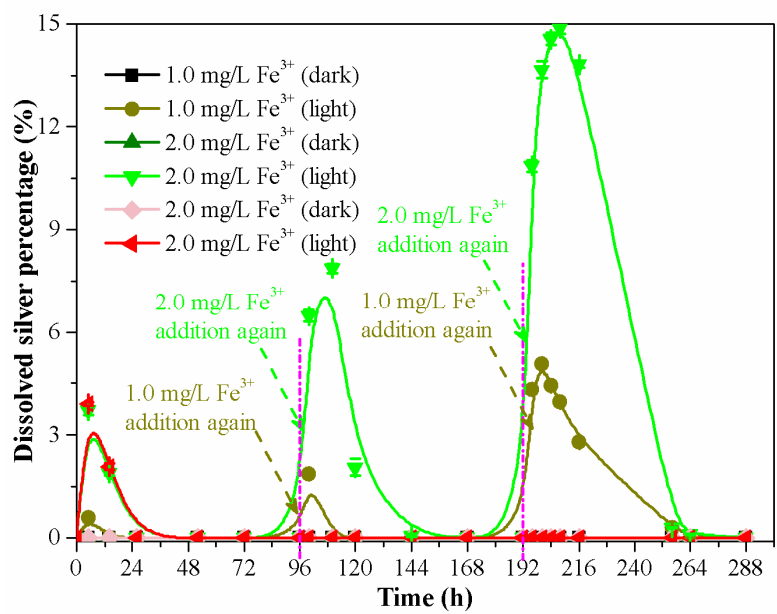
**Figure S2.** Kinetics of silver ions release from Ag<sub>2</sub>SNPs in borate solution with Fe(III) (2 mg/L), Hg(II) (2 mg/L), Cu(II) (2 mg/L) and Pb(II) (2 mg/L), respectively under light condition.



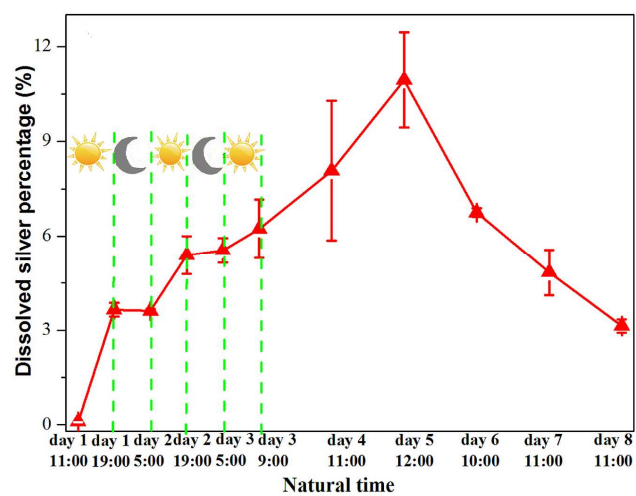
**Figure S3.** The pseudo-first-order reaction kinetics of  $\text{Ag}_2\text{SNPs}$  dissolution in the presence of an environmentally relevant concentration of  $\text{Fe(III)}$ , and its rate constant of  $1.06 \text{ h}^{-1}$ .



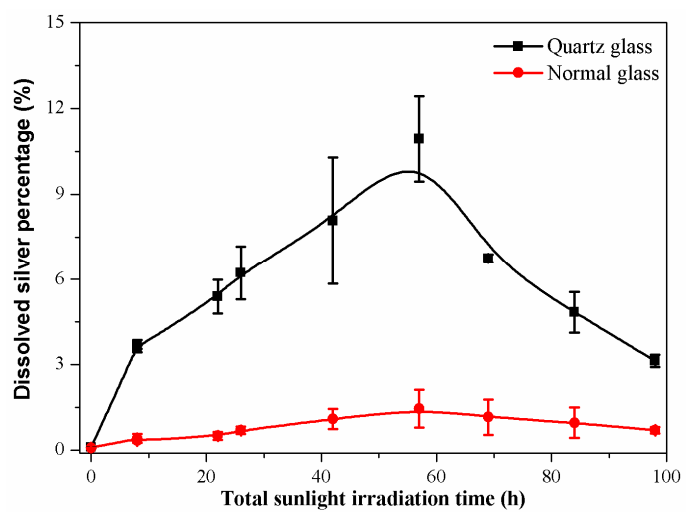
**Figure S4.** Characteristic of particles obtained from the reaction between  $\text{Ag}^+$  ( $\text{AgNO}_3$ , 100 mg/L) and  $\text{Fe}^{2+}$  ( $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ , 10 mg/L) solutions in the light for 48 h. This reaction was performed with high concentrations of  $\text{Ag}^+$  and  $\text{Fe}^{2+}$ , to evidently document our proposal that reaction between  $\text{Ag}^+$  and  $\text{Fe}^{2+}$  can form nAg in the light. (A) TEM image of particles, and inset is EDX spectrum of the particles. (B-C) Elemental mappings of the particles. (D) XRD spectrum of the particles.



**Figure S5.** The effect of Fe(III) on the transformation of Ag<sub>2</sub>SNPs in water. After 96 and 192 h, a second and third equivalent of Fe(III) was added.

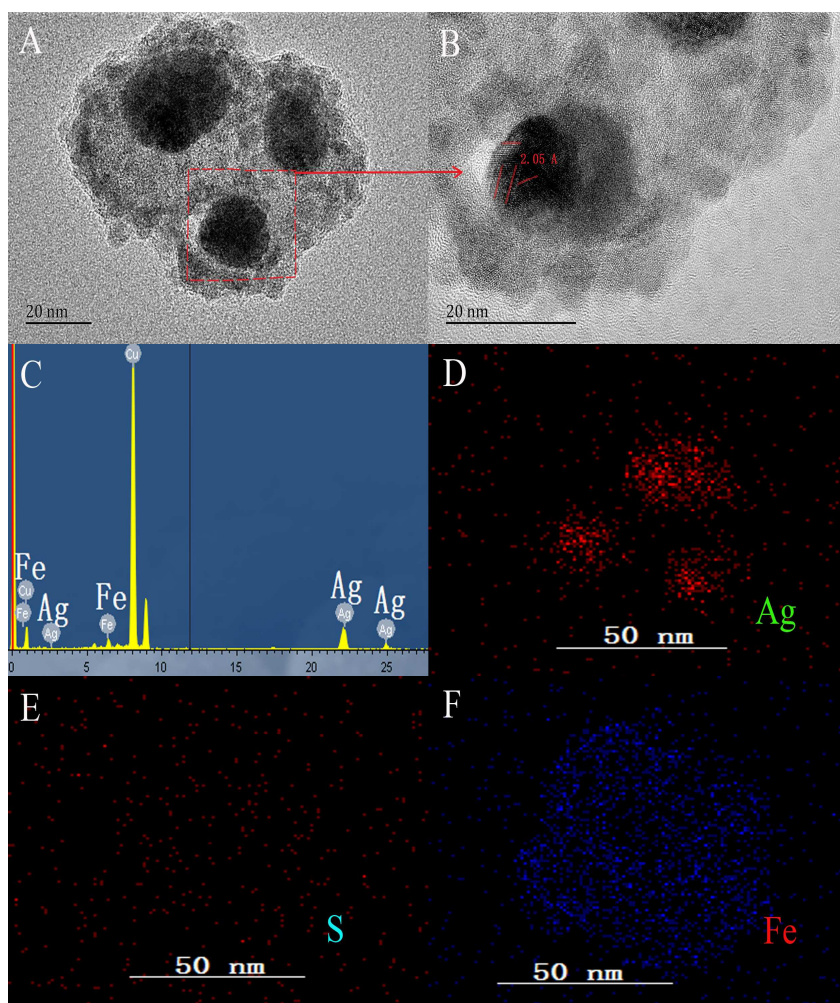


**Figure S6.** The dissolution kinetics of  $\text{Ag}_2\text{SNPs}$  in borate solution with an environmentally relevant concentration of  $\text{Fe(III)}$  under natural sunlight (July 1st - 8th , 2015, Beijing, China).

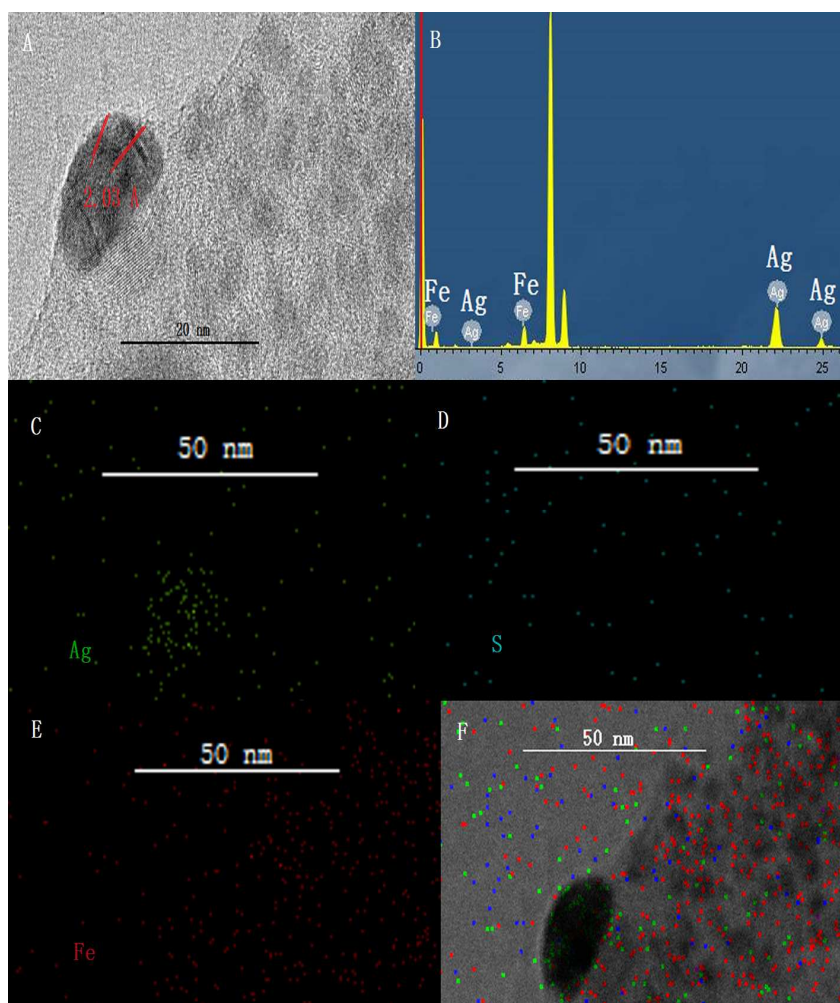


**Figure S7.** Effect of glass materials (quartz vs. normal) on the Ag<sub>2</sub>SNPs dissolution in the presence of Fe(III)

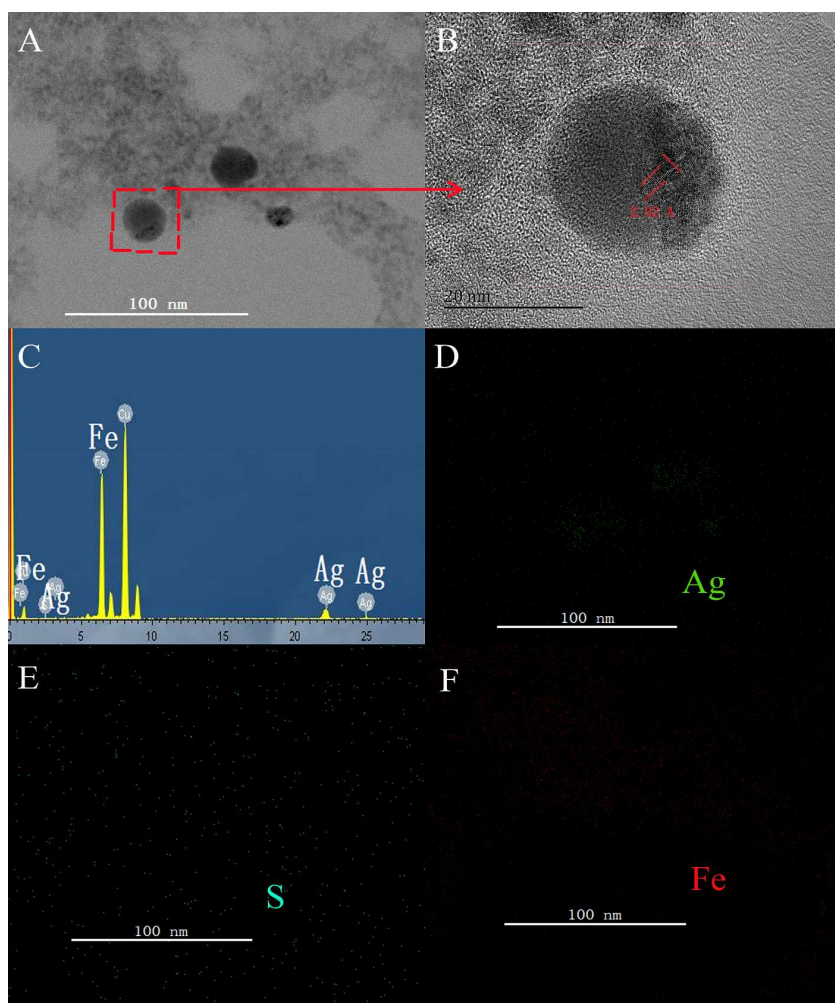
under natural sunlight.



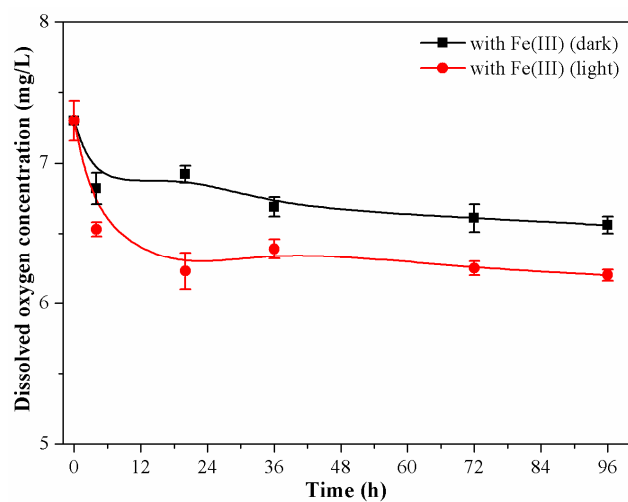
**Figure S8.** HRTEM images of NPs after transformations of Ag<sub>2</sub>SNPs in borate solution with an environmentally relevant concentration of Fe(III) under natural sunlight (July 1st - 8th, 2015, Beijing, China). (A) HRTEM image. (B) nAg with a lattice spacing of 2.05 Å. (C) EDS image of the nAg particle in (B). (D-F) EDS elemental mappings of the nAg shown in Figure S7B.



**Figure S9.** HRTEM images of NPs after transformation of Ag<sub>2</sub>SNPs in wastewater treatment plant effluent with Fe(III) under light condition. (A) HRTEM image with a lattice spacing of 2.03 Å. (B) EDX image of the particle of (A). (C-F) Elemental mappings of the NPs after transformation of Ag<sub>2</sub>SNPs.



**Figure S10.** HRTEM images of NPs after transformation of Ag<sub>2</sub>SNPs in river water with Fe(III) under light condition. (A) HRTEM image. (B) nAg particles with a lattice spacing of 2.02 Å. (C) EDX image of nAg particle in (B). (D-F) Elemental mappings of the NPs after transformation of Ag<sub>2</sub>SNPs.



**Figure S11.** Kinetics of dissolved oxygen in the  $\text{Ag}_2\text{SNPs}$  solution with an environmentally relevant concentration of  $\text{Fe(III)}$  under light and in the dark, respectively.