

## **Electronic Supplementary Information for**

### **Antibacterial performance of polymer quaternary ammonium salt - capped silver nanoparticles on *Bacillus subtilis* in water**

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## Supplementary information captions:

**Fig. S1** The physicochemical properties of PVP-AgNPs. (a) UV-visible spectrum; (b) TEM image.

**Fig. S2** Inactivation efficiency of *B. subtilis* with silver ions corresponding to different release from 1.0 mg/L of PQAS-AgNPs or PVP-AgNPs. Reaction conditions: reaction time = 60 min, T = 25 °C, initial concentration of *B. subtilis*: 10<sup>6</sup> CFU/mL.

**Fig. S3** Inactivation efficiency of *B. subtilis* with silver ions corresponding to different pH values (pH = 4.9, 7.1, 8.9). Reaction conditions: reaction time = 60 min, T = 25 °C, initial concentration of *B. subtilis*: 10<sup>6</sup> CFU/mL.

**Fig. S4** Effect of Cl<sup>-</sup> on antibacterial efficacy to *B. subtilis* of PQAS. Reaction conditions: [PQAS] = 1.0 mg/L, contact time = 60 min, pH = 7.1, T = 25 °C, initial concentration of *B. subtilis*: 10<sup>6</sup> CFU/mL.

**Fig. S5** Effect of Cl<sup>-</sup> on antibacterial efficacy to *B. subtilis* of PVP-AgNPs. Reaction conditions: [AgNPs] = 10.0 mg/L, contact time = 60 min, pH = 7.1, T = 25 °C, initial concentration of *B. subtilis*: 10<sup>6</sup> CFU/mL.

**Fig. S6** Effect of HA on antibacterial efficacy to *B. subtilis* of PVP-AgNPs. Reaction conditions: [AgNPs] = 10.0 mg/L, contact time = 60 min, pH = 7.1, T = 25 °C, initial concentration of *B. subtilis*: 10<sup>6</sup> CFU/mL.

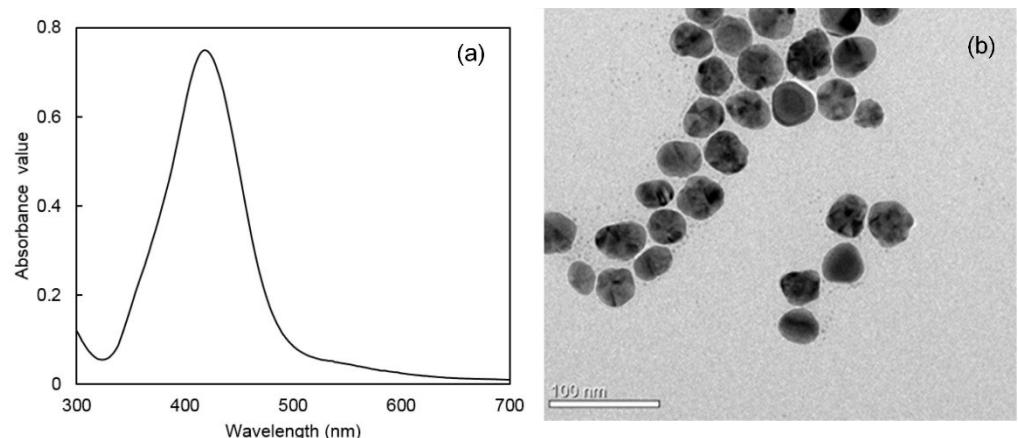
**Fig. S7** FCM results of *B. subtilis* after treated by PVP-AgNPs. Among them, (a) to (d) represent the concentration of PVP-AgNPs is 1.0, 2.0, 5.0, 10.0 mg/L, respectively. Reaction conditions: reaction time = 15 min, pH = 7.1, T = 25 °C, initial concentration of *B. subtilis*: 10<sup>6</sup> CFU/mL.

**Fig. S8** FCM results statistics of *B. subtilis* after treated by PQAS-AgNPs and PVP-AgNPs. Reaction conditions: reaction time = 15 min, pH = 7.1, T = 25 °C, initial concentration of *B. subtilis*: 10<sup>6</sup> CFU/mL.

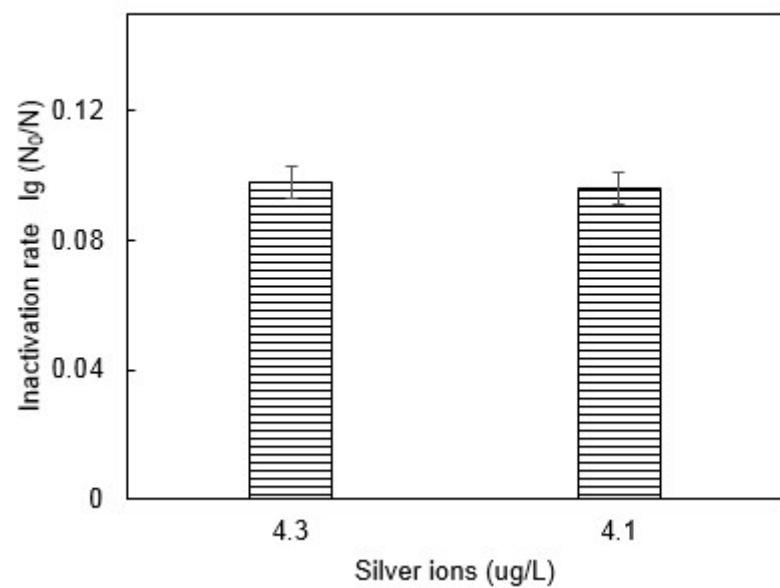
**Fig. S9** Changes of ATP of *B. subtilis* after treated by PVP-AgNPs. Reaction conditions: reaction time = 15 min, pH = 7.1, T = 25 °C, initial concentration of *B. subtilis*: 10<sup>6</sup> CFU/mL.

**Fig. S10** ATP results statistics of *B. subtilis* after treated by PQAS-AgNPs and PVP-AgNPs. Reaction conditions: reaction time = 15 min, pH = 7.1, T = 25 °C, initial concentration of *B. subtilis*: 10<sup>6</sup> CFU/mL.

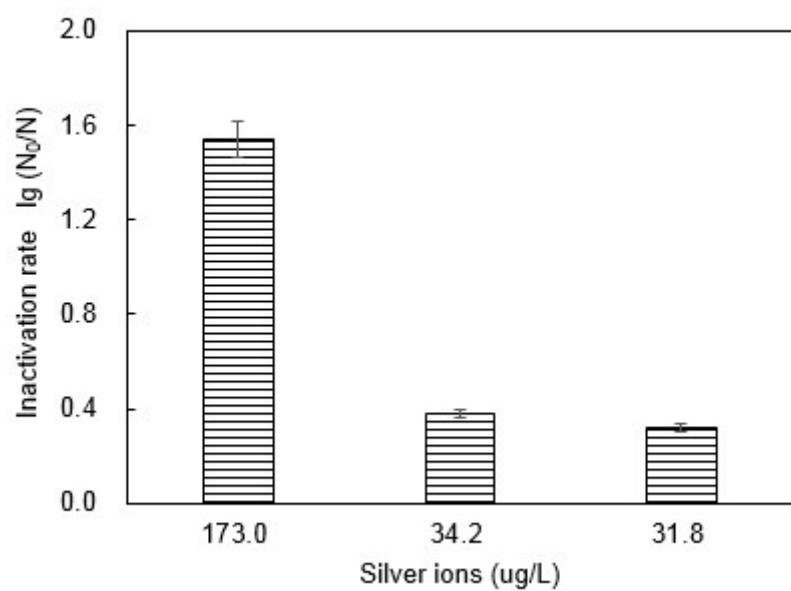
**Fig. S1**



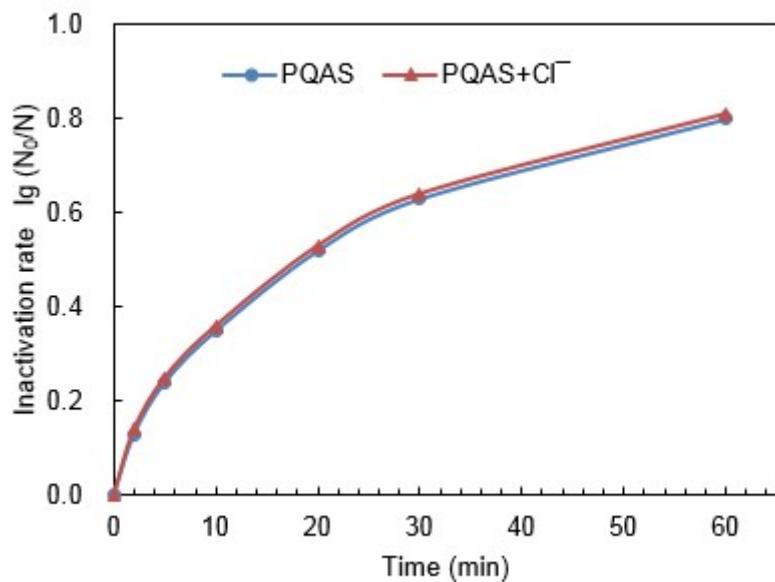
**Fig. S2**



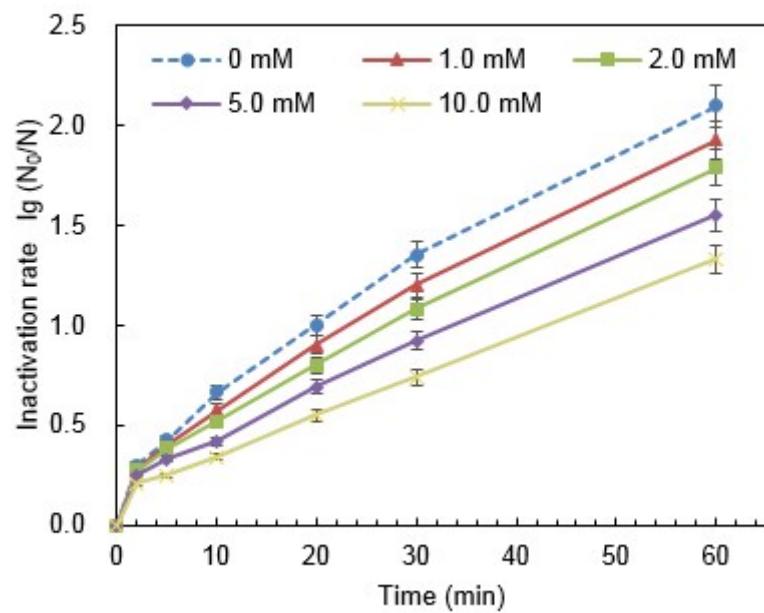
**Fig. S3**



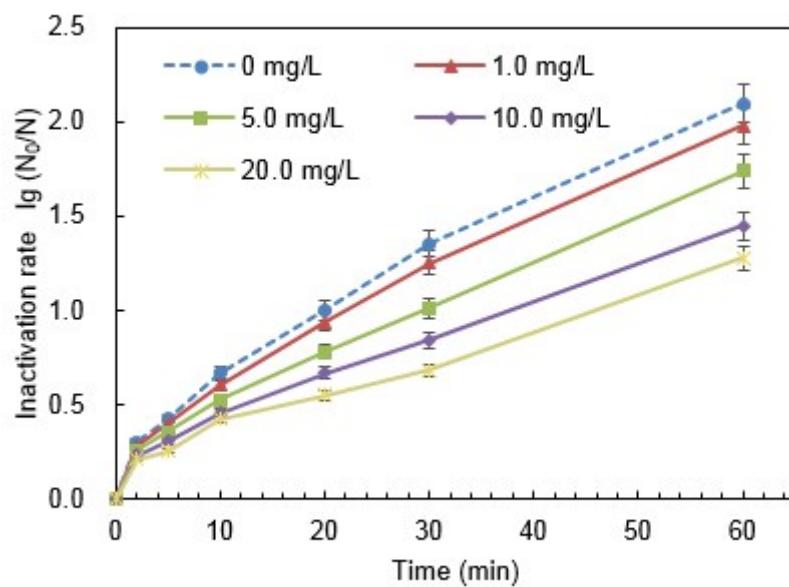
**Fig. S4**



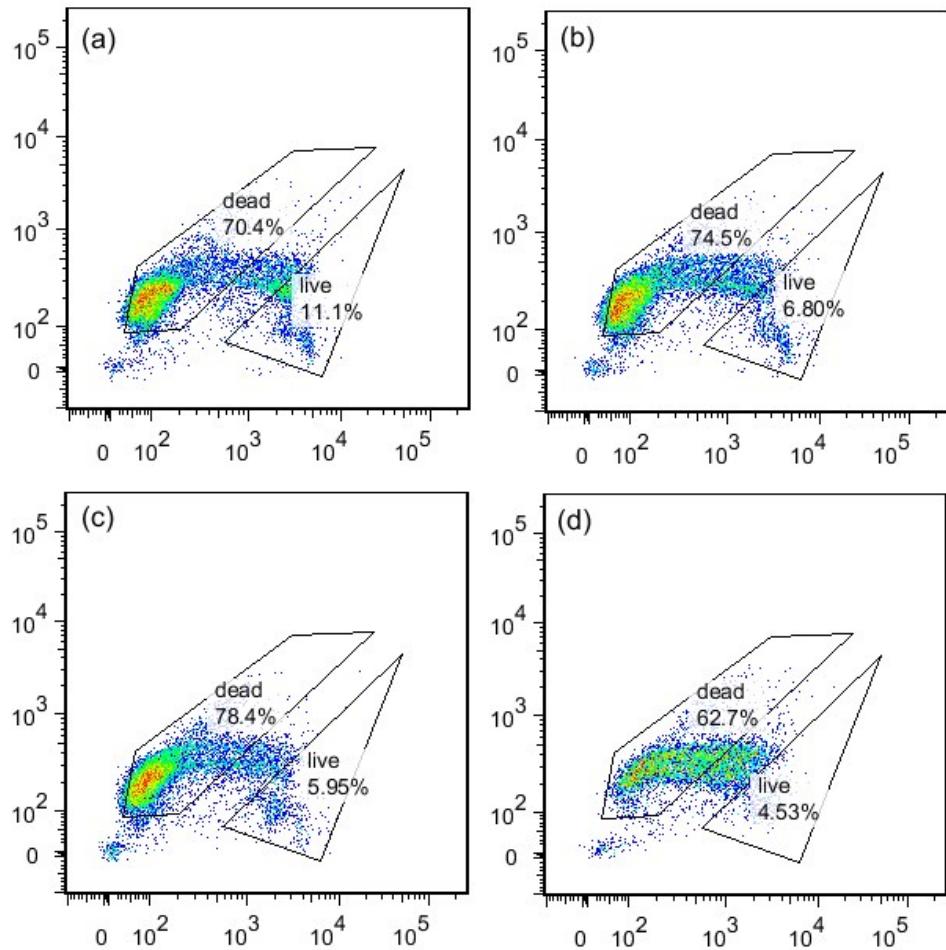
**Fig. S5**



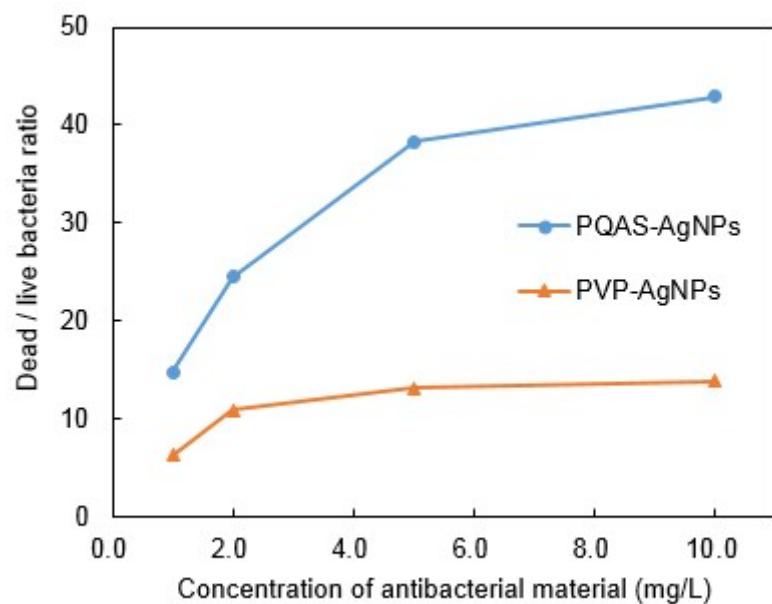
**Fig. S6**



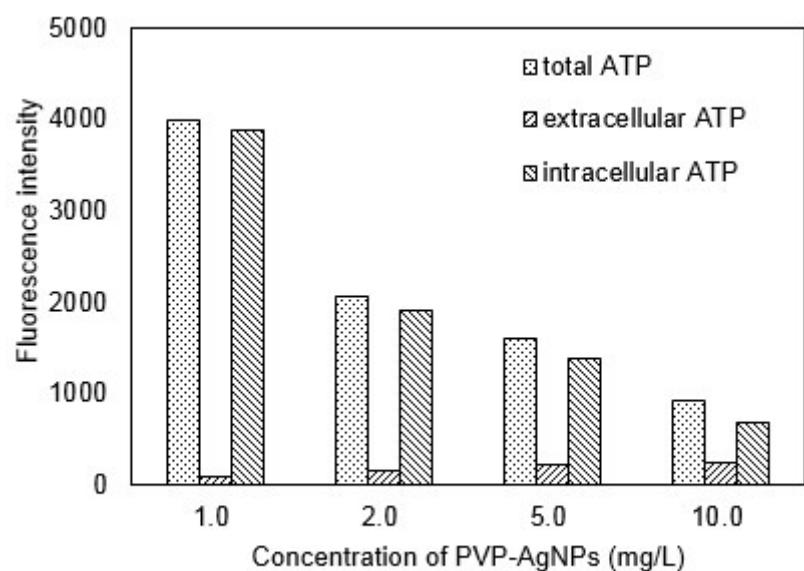
**Fig. S7**



**Fig. S8**



**Fig. S9**



**Fig. S10**

