Electronic Supplementary Material (ESI) for RSC Advances.

Chemical Colorimetric Square Wave and its Derived Logic Gates Based on Tunable Growth of Plasmonic Gold Nanoparticles

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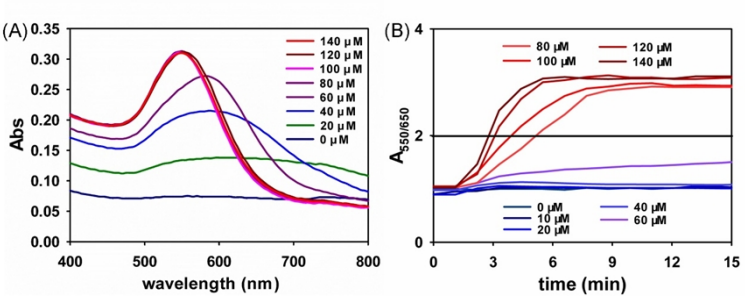

Figure S1. (A) The UV-Vis spectra of AuNPs solutions with different H_2O_2 concentrations. (B) Variation of the values of $A_{550/650}$ with time after adding different concentrations of H_2O_2 to the gold precursor solution.

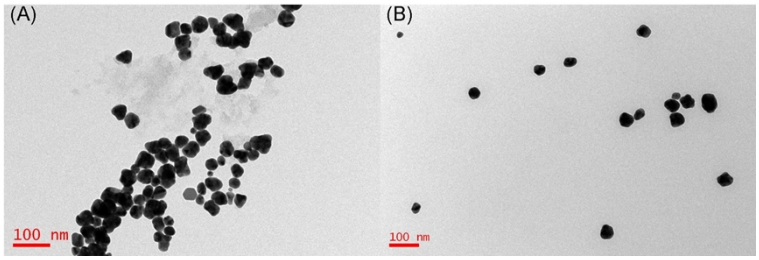

Figure S2. The TEM measurements performed to investigate the state of AuNPs obtained with different concentrations of H_2O_2. TEM images of AuNPs grown in the presence of (A) 60 μM H_2O_2 and (B) 80 μM H_2O_2.

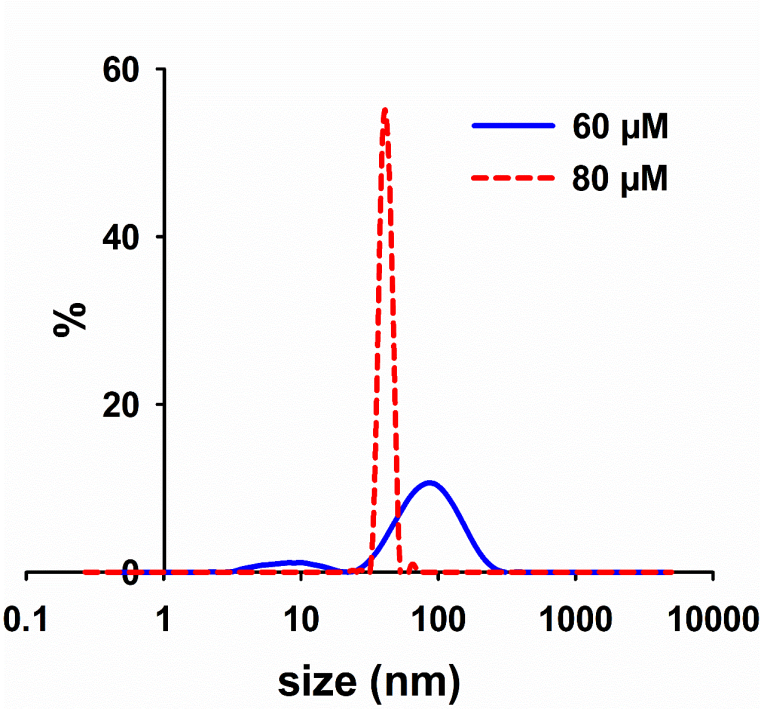

Figure S3. DLS analysis of AuNPs grown in the presence of $HAuCl_4$ (0.1 mM), 60 µM H_2O_2 or 80 µM H_2O_2.

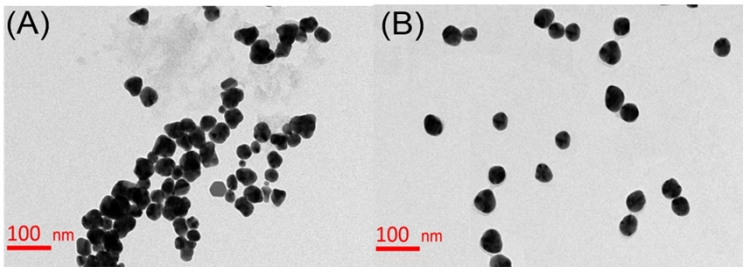

Figure S4. The TEM images of AuNPs obtained with or without $AgNO_3$. The reaction conditions: (A) H_2O_2 (60 μM) and $HAuCl_4$ (0.1 mM) in MES buffer (1 mM, pH 6.5); (B) H_2O_2 (60 μM), $HAuCl_4$ (0.1 mM) and $AgNO_3$ (1 μM) in MES buffer (1 mM, pH 6.5).

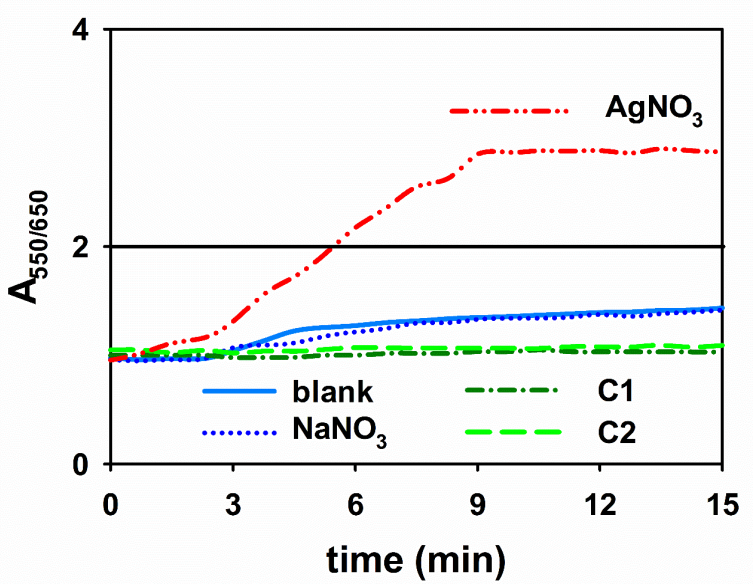

Figure S5. Variation of $A_{550/650}$ of solutions with time obtained under different reaction conditions: $AgNO_3$: $AgNO_3$ (1 μM), H_2O_2 (60 μM) and $HAuCl_4$ (0.1 mM); Blank: the control without $AgNO_3$; C1: the control without H_2O_2; C2: the control without $HAuCl_4$; $NaNO_3$: the control using $NaNO_3$ (1 μM) instead of $AgNO_3$.

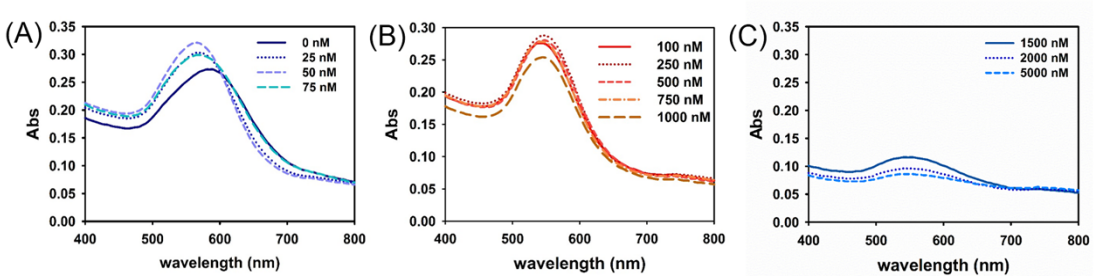

Figure S6. The UV-Vis spectra of AuNPs with 60 μM H_2O_2 and different concentrations of $AgNO_3$ (0 ~5 μM): (A) the first OFF interval of the Ag^+-CCSW (0 ~ 100 nM); (B) ON interval of the Ag^+-CCSW (100 nM ~ 1 μM); (C) the second OFF interval of the Ag^+-CCSW (1 μM ~ 5 μM).

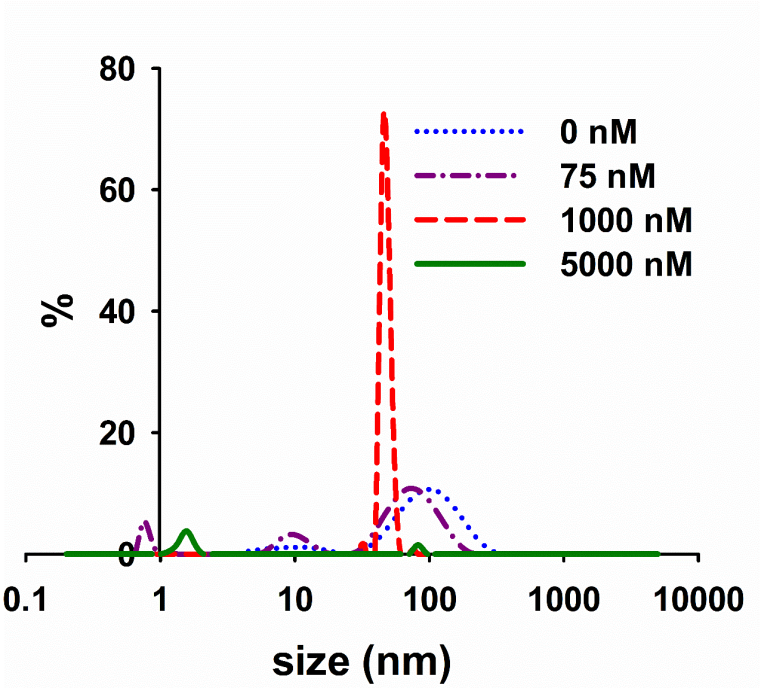

Figure S7. DLS analysis of AuNPs grown in the presence of $HAuCl_4$ (0.1 mM), 60 µM H_2O_2 and different concentrations of $AgNO_3$.

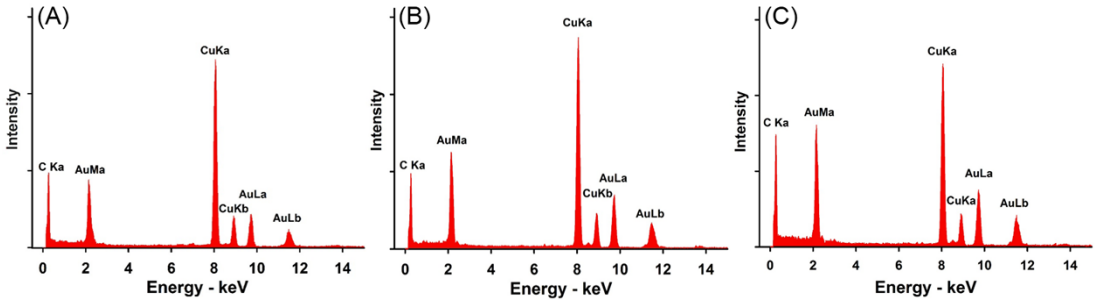

Figure S8. EDX analysis of AuNPs grown in the presence of different concentrations of $AgNO_3$ (A: 0.075 µM, B: 1 µM and C: 5 µM) with $HAuCl_4$ (0.1 mM) and H_2O_2 (60 µM).

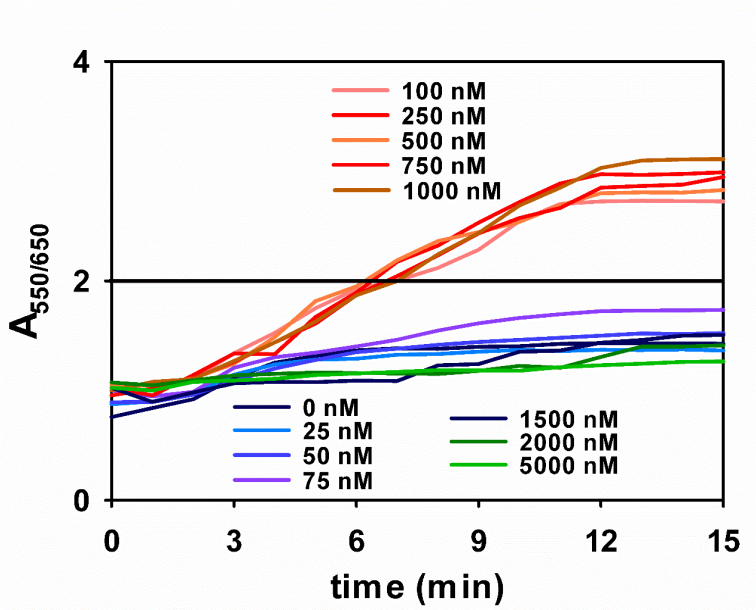

Figure S9. The variation of $A_{550/650}$ of solutions with time obtained under different concentrations of Ag^+. The AuNPs formed under the following conditions: H_2O_2 (60 μM), $HAuCl_4$ (0.1 mM) and different concentrations of Ag^+ (0 ~ 5 μM) in MES buffer (50 mM, pH 6.5). Only the solutions with the concentration of $AgNO_3$ located in the ON interval of the Ag^+-CCSW (100 ~ 1000 nM) would lead to the $A_{550/650}$ surpassing 2, otherwise the $A_{550/650}$ below 2 was obtained with Ag^+ concentration within the first OFF interval (0 ~ 100 nM) or the second OFF interval (1 μM ~ 5 μM).

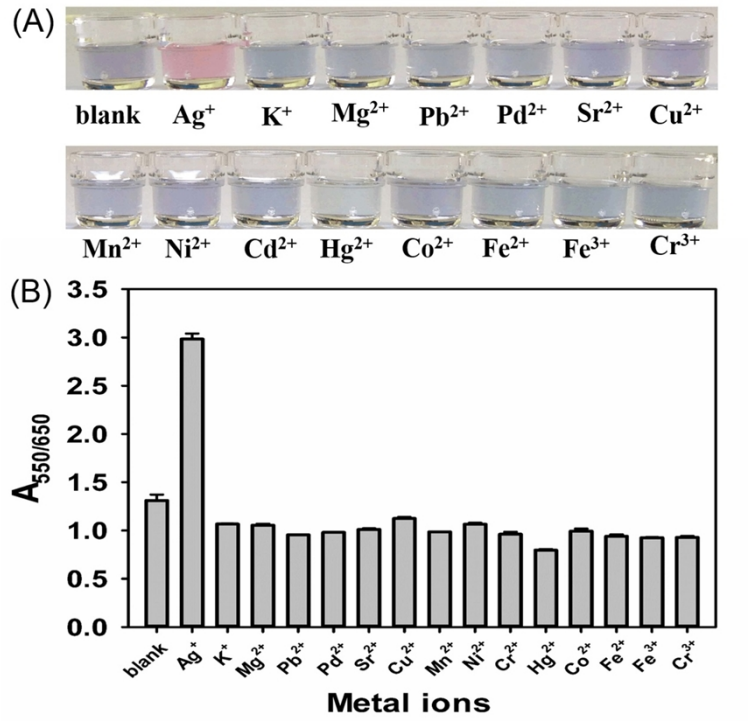

Figure S10. The selectivity of the metal ions for assisting the growth of AuNPs and constructing the CCSW. (A) Different color and (B) the absorption ratio value ($A_{550/650}$) of AuNPs solution obtained with 60 μM H_2O_2 and in the presence of 1 μM Ag^+ and 1 μM other metal ions, respectively.

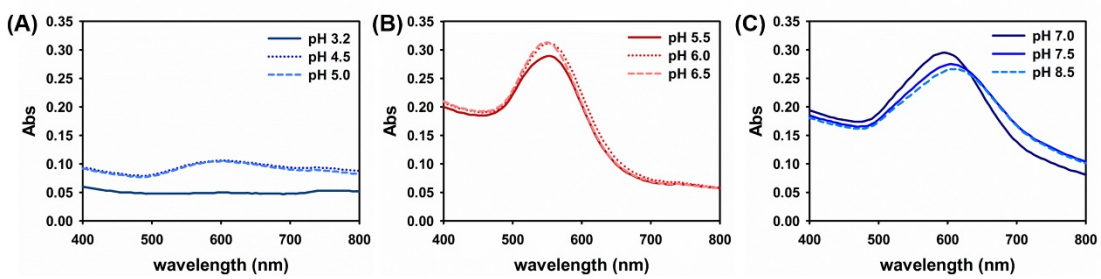

Figure S11. The UV-Vis spectra of AuNPs with 60 μM H_2O_2 and 1 μM of $AgNO_3$ in MES buffer with different pH (pH 3.2 ~ 8.5): (A) the first OFF interval of the pH-CCSW (3.2 ~ 5.0); (B) ON interval of the pH-CCSW (5.5 ~ 6.5); (C) the second OFF interval of the pH-CCSW (7.0 ~ 8.5).

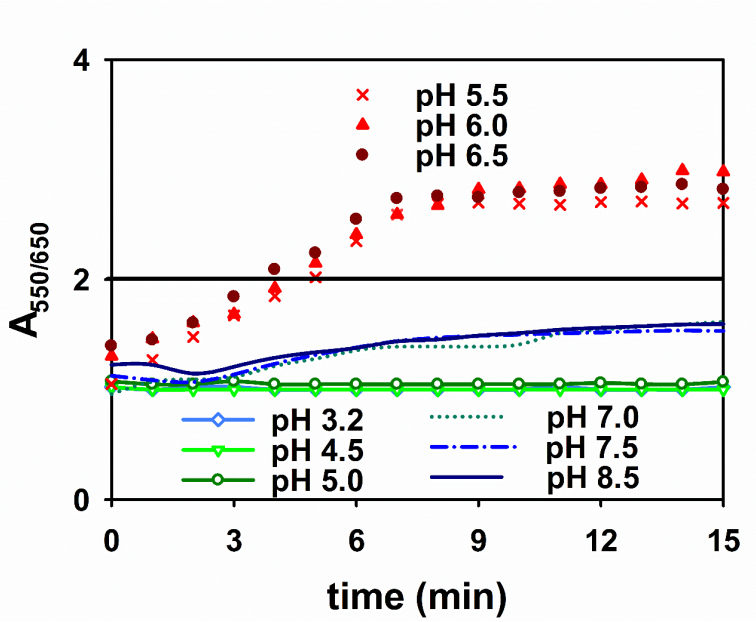

Figure S12. The variation of $A_{550/650}$ of solutions with time obtained at different pH. The AuNPs formed under the following condition: H_2O_2 (60 μM), $HAuCl_4$ (0.1 mM) and Ag^+ (1 μM) in MES buffer with different pH (50 mM, pH 3.2 ~ 8.5). Only the solutions with the pH located in the ON interval of pH-CCSW (pH 5.5 ~ 6.5) would lead to the $A_{550/650}$ surpassing 2, otherwise the $A_{550/650}$ below 2 was obtained with the pH within the first OFF interval (3.2 ~ 5.0) or the second OFF interval (7.0 ~ 8.5).

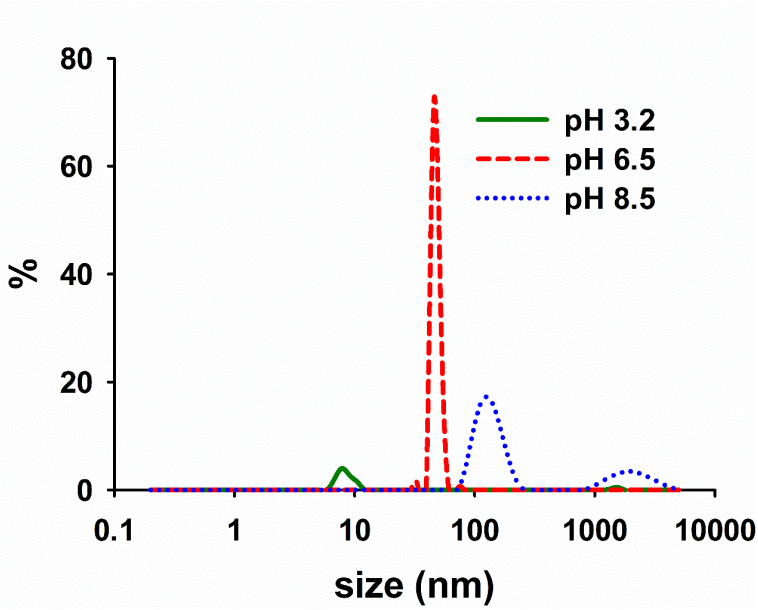

Figure S13. DLS analysis of AuNPs grown in the presence of $HAuCl_4$ (0.1 mM), 60 μM H_2O_2 in MES buffer with different pH values.