Supporting Information

In Situ Functionalization of Silver Nanoparticles by Gallic Acid as a Colorimetric Sensor for Simple Sensitive Determination of Melamine in Milk

Xuexia Liu[1], Juan Wang[1], Yinfeng Wang[1], Chunfang Huang[1], Zhijun Wang[1,*], and Limin Liu[1,*]

[1] School of Chemistry and Chemical Engineering, Jinggangshan University, Ji'an 343009, China

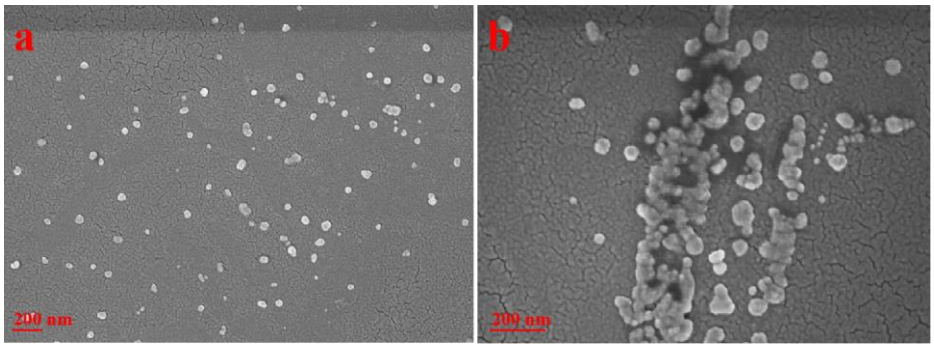

Figure S1. The FESEM of AgNPs (a) absence and (b) presence of melamine

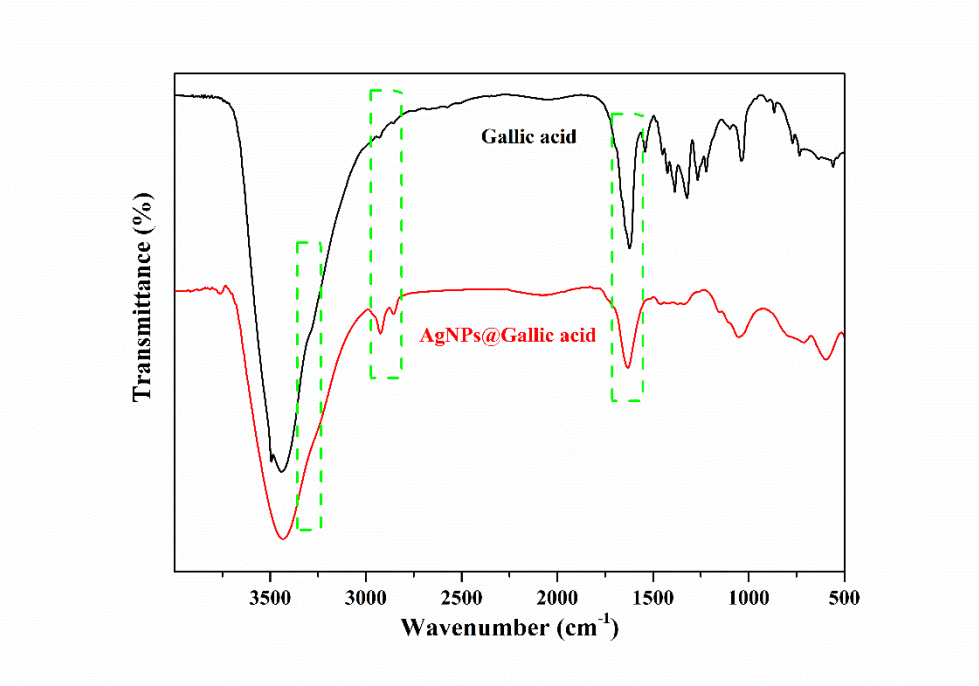

Figure S2. FTIR spectra of Gallic acid and AgNPs@Gallic acid.

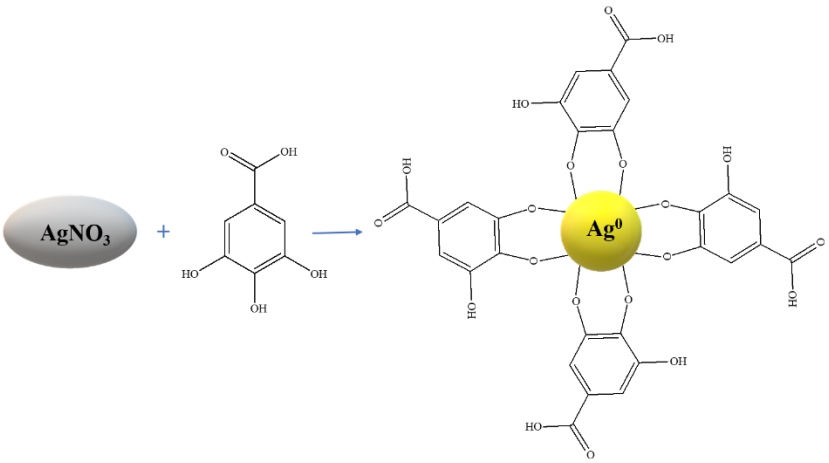

Figure S3. Schematic illustration of formation of AgNPs@Gallic acid.

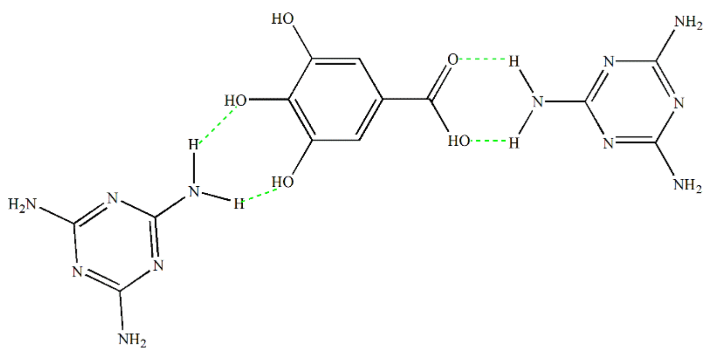

Figure S4. Schematic illustration of hydrogen-bonding interaction between melamine and Gallic acid.

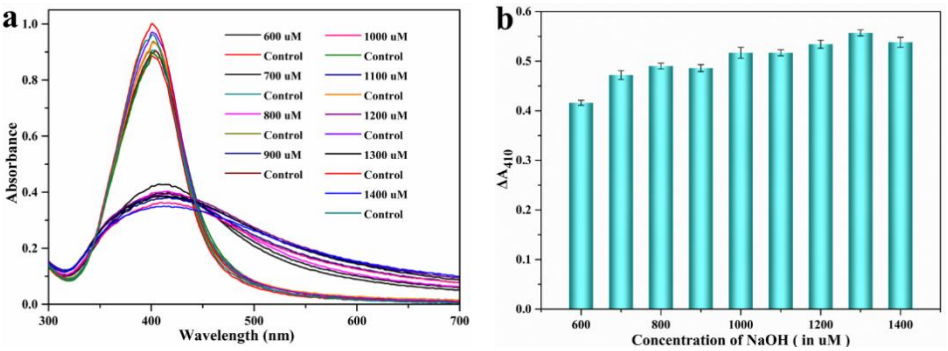

Figure S5. The effect of NaOH concentration towards the gallic acid functionalized AgNPs. (a) UV-Vis spectra and (b) ΔA_{410} of the AgNPs@Gallic acid assays.

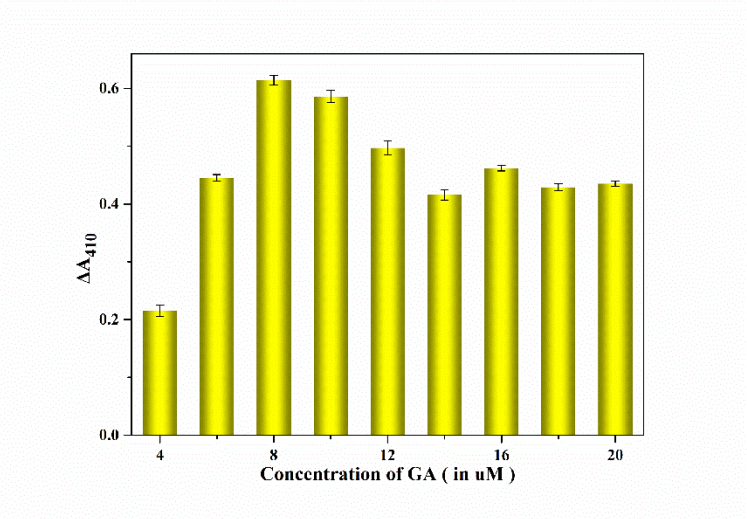

Figure S6. Effect of concentrations of gallic acid on ΔA_{410} of AgNPs@Gallic acid assays.

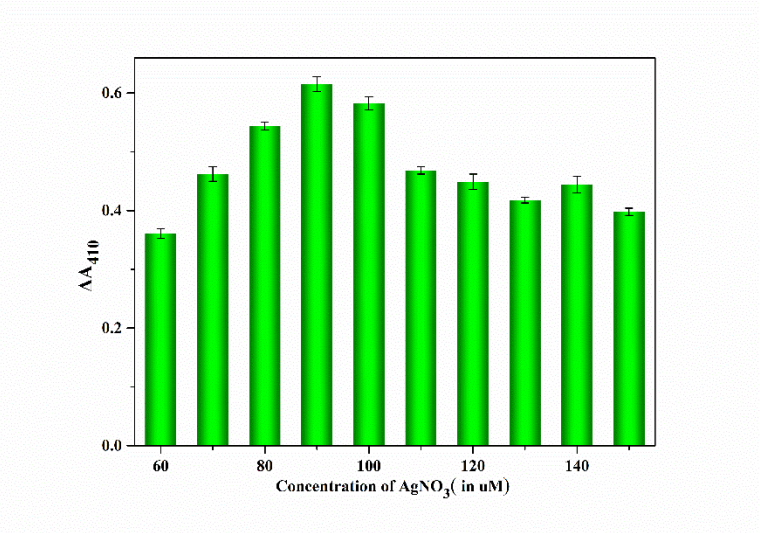

Figure S7. Effect of $AgNO_3$ concentration on ΔA_{410} of AgNPs@Gallic acid assays.

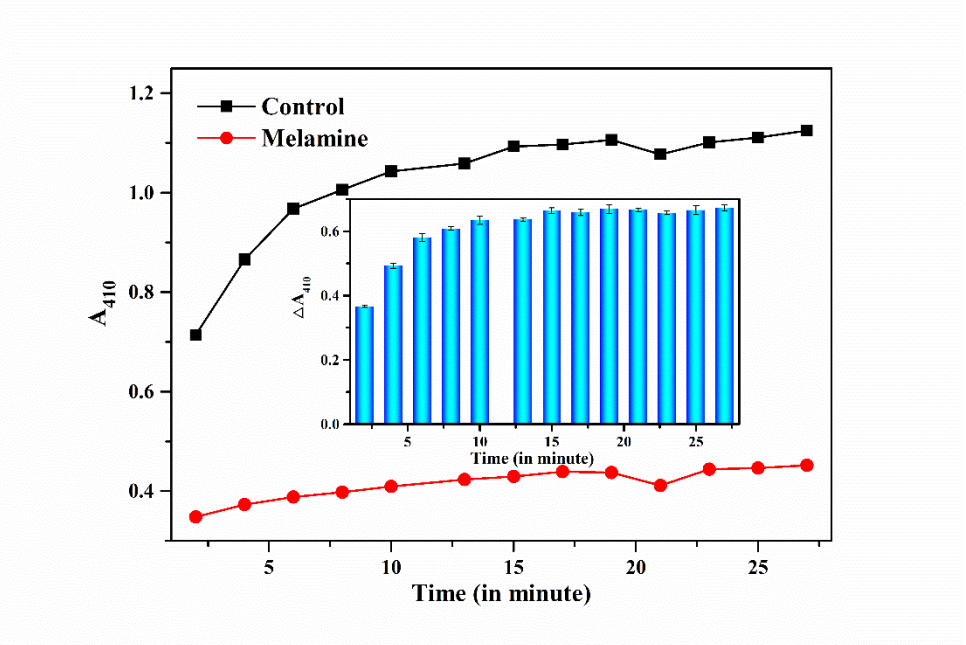

Figure S8. A_{410} versus reaction time for oxidization reaction of AgNPs@Gallic acid assays. Inset: the ΔA_{410} in presence and absence of melamine with the increase of reaction time.

Figure S9. Photographs of AgNPs@Gallic acid solution in the absence and presence of different concentrations of melamine.

Table S1. Comparison of various colorimetry sensing assays for melamine

Sensing Material	Detection Limit	Reference
Ascorbic acid-AgNPs	0.1 ppm	1
Sodium D-gluconate-AgNPs	0.06 ppm	2
B-cyclodextrin-AgNPs	4.98×10^{-6} M	3
pNA-AgNPs	0.1 ppm	4
Ag-Rutin	0.1 ppm	5
AgNPs/dopamine	0.01 ppm	6
Chitosan-AuNPs	6×10^{-6} g L^{-1}	7
AgNPs	0.07 mg L^{-1}	8
AgNPs	0.5 μm	9
AgNPs	0.79 μm	10
AgNPs	0.01 μm	11
AgNPs	3.609 nM	12
AgNPs@Gallic acid	0.012 ppm	**This Work**

(1) Varun S.; Kiruba Daniel S. C. G.; Gorthi S. S. Rapid sensing of melamine in milk by interference green synthesis of silver nanoparticles. *Mat. Sci. Eng. C-Mater.* **2017**, 74, 253-258.

(2) Kaleeswaran P.; Nandhini T.; Pitchumani K. Naked eye sensing of melamine: aggregation induced recognition by sodium D-gluconate stabilised silver nanoparticles. *New J. Chem.* **2016**, 40, 3869-3874.

(3) Xavier S. S. J.; Karthikeyan C.; kumar G. G.; Kim A. R.; Yoo D. J. Colorimetric detection of melamine using β-cyclodextrin-functionalized silver nanoparticles. *Anal. Methods* **2014**, 6, 8165-8172.

(4) Han C. P.; Li H. B. Visual detection of melamine in infant formula at 0.1 ppm level based on silver nanoparticles. *Analyst* **2010**, 135, 583-588.

(5) Jigyasa; Rajput J. K. Bio-polyphenols promoted green synthesis of silver nanoparticles for facile and ultra-sensitive colorimetric detection of melamine in milk.

Biosens. Bioelectron. **2018**, 120, 153-159.

(6) Ma Y. R.; Niu H. Y.; Zhang X. L.; Cai Y. Q. One-step synthesis of silver/dopamine nanoparticles and visual detection of melamine in raw milk. *Analyst* **2011**, 136, 4192-4196.

(7) Guan H. N.; Yu J.; Chi D. F. Label-free colorimetric sensing of melamine based on chitosan-stabilized gold nanoparticles probes. *Food Control* **2013**, 32, 35-41.

(8) Inamuddin; Kanchi S. One-step biosynthesis of silver nanoparticle using Colocasia esculenta extract: colorimetric detection of melamine in biological samples. *J. Photoch. Photobio. A* **2020**, 391, 112310.

(9) Kaleeswaran P.; Nandhini T.; Pitchumani K. Naked eye sensing of melamine: aggregation induced recognition by sodium d-gluconate stabilised silver nanoparticles. *New J. Chem.* **2016**, 40, 3869-3874.

(10) Daniel S. K.; Julius L. A. N.; Gorthi S. S. Instantaneous detection of melamine by interference biosynthesis of silver nanoparticles. *Sensor. Actuat. B-Chem.* **2017**, 238, 641-650.

(11) Alam M. F.; Laskar A. A.; Ahmed S.; Shaida M. A.; Younus H. Colorimetric method for the detection of melamine using in-situ formed silver nanoparticles via tannic acid. *Spectrochim. Acta, Part A* **2017**, 183, 17-22.

(12) Farrokhnia M.; Karimi S.; Askarian S. Strong Hydrogen Bonding of Gallic Acid during Synthesis of an Efficient AgNPs Colorimetric Sensor for Melamine Detection via Dissynthesis. Strategy *ACS Sustainable Chem. Eng.* **2019**, 7, 6672-6684.