Supplementary Information

Colorimetric detection of acrylamide in potato chips based on nucleophile-initiated thiol-ene Michael addition

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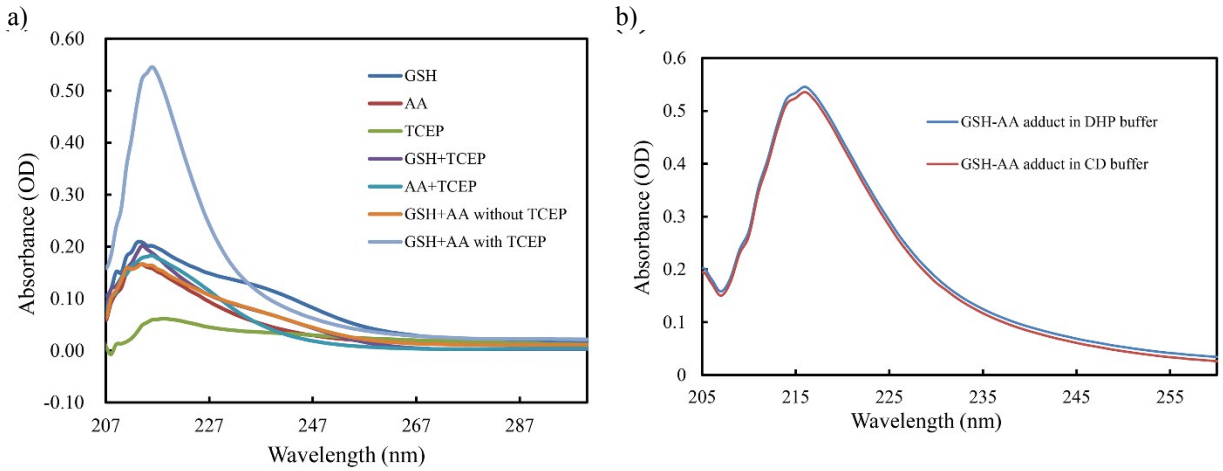

Fig. S1 (a) Characterization of thiol-ene Michael addition between GSH and AA by UV-vis absorption spectra. (b) Stability of GSH-AA adduct in CD buffer verified by UV-vis spectra.

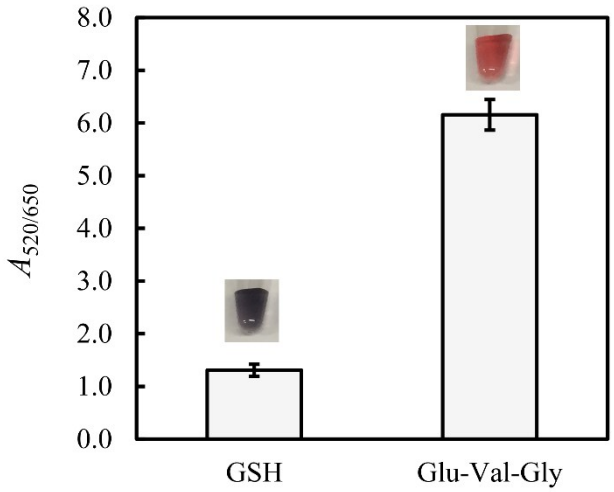

Fig. S2 The interaction between AuNPs and GSH, as well as Glu-Val-Gly tripeptide without thiol group.

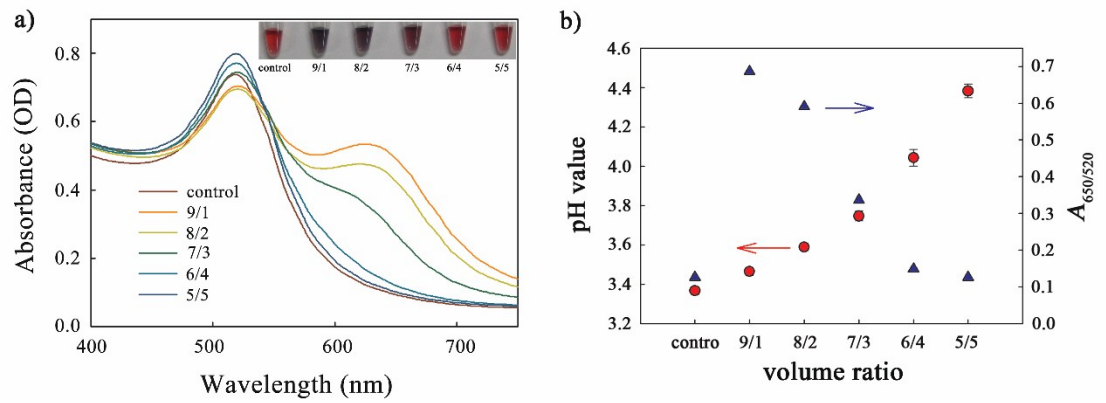

Fig. S3 (a) The UV-vis absorption spectra of AuNPs with GSH at different $R_{C/D}$ of 10/0 (control), 9/1, 8/2, 7/3, 6/4, and 5/5, (insert: photographs of AuNPs with different treatments corresponding to the spectra); (b) changes in pH value (red circle) and $A_{650/520}$ (blue triangle) with different $R_{C/D}$ values.

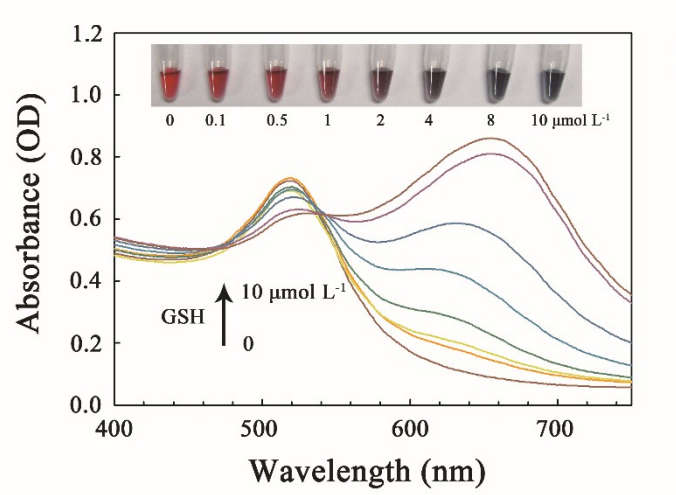

Fig. S4 The UV-vis absorption spectra of AuNPs with different concentrations (0, 0.1, 0.5, 1, 2, 4, 8, and 10 μmol L^{-1}) of GSH, (insert: the photograph of AuNPs corresponding to the spectra).

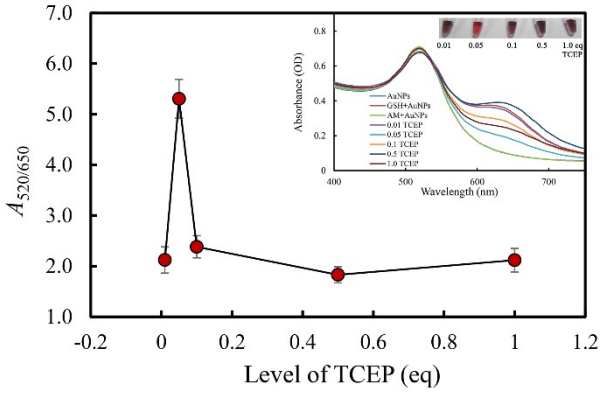

Fig. S5 The effect of TCEP levels on thiol-ene Michael addition reaction between GSH and AA. The levels of TCEP were 0.01, 0.05, 0.1, 0.5, and 1.0 eq, remaining the concentration of GSH constant (80 μmol L^{-1}, 1 eq), (insert: the UV-vis spectra of AuNPs containing GSH-AA adduct with different levels of TCEP and their corresponding photograph).

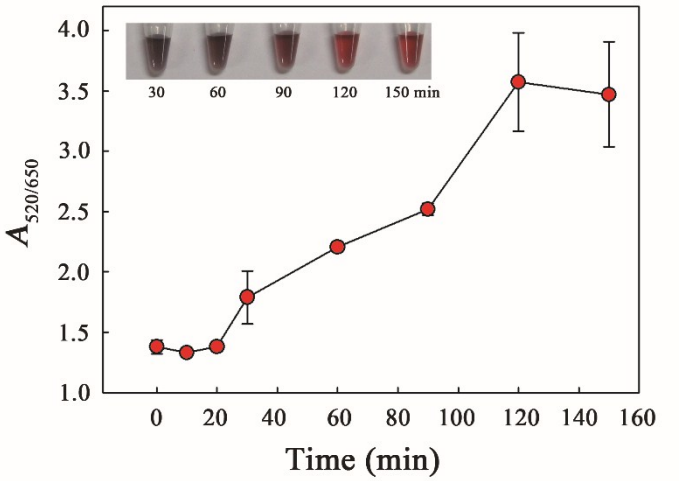

Fig. S6 The effect of addition reaction time on the colorimetric responses of AuNPs. Both the concentrations of AA and GSH were 80 μmol L^{-1}, (insert: the photograph of AuNPs with different reaction time corresponding to the spectra).

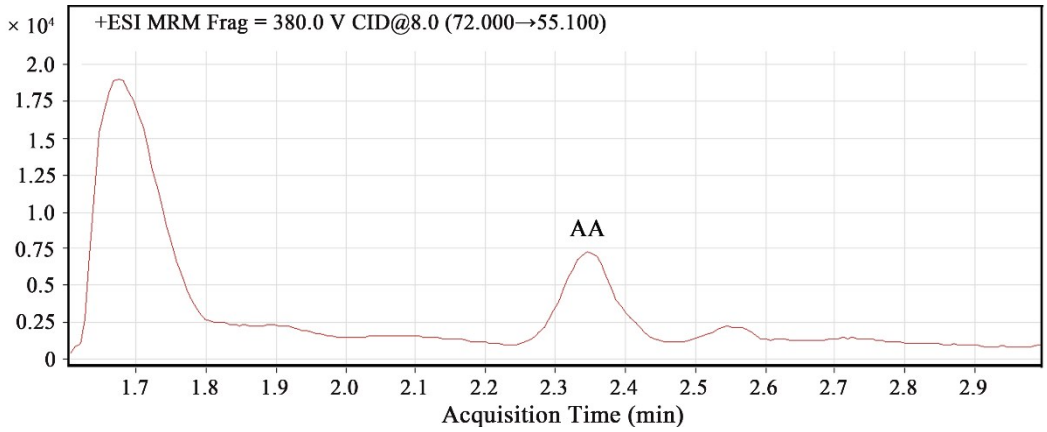

Fig. S7 The UPLC-MS/MS chromatogram of the detection of AA in potato chips.

Table S1 Sensitivity comparison between new colorimetric method and other methods

Method		Linear range (μg/kg)	LOD (μg/kg)	Reference
Standard methods	LC-MS/MS	2 ~ 100	5	1
		1~200	1	2
	GC-MS	10~1000	5	3
		30~10000	1	4
Rapid methods	Electrochemical biosensors	0.35~ 5.3×10^{6}	1.4×10^{-2}	5
		0.71~710	2.84	6
	ELISA	51.76~3311.5	65.7	7
		26.3 ~ 221.1	18.6	8
		10 ~ 100000	6	9
		0.25 ~ 24.15	0.036	10
	Fluorescent method	35 ~ 350000	35	11
		50 ~ 20000	15	12
	Colorimetric method	7.1~5687.2	2.03	This study

Table S2 The accuracy of rapid methods in comparison with standard methods for the detection of AA in foods

Sample	Rapid Method	Standard Method	Relative error (δ)	Reference
Instant noodles	ECL-ELISA	HPLC	1.63%~11.9%	8
Potato fries	BA-ELISA	HPLC	1.51%~7.06%	9
Potato chips	ci-ELISA	HPLC-MS/MS	16.1%~26.3%	10
Potato crips	Fluorescent sensing	LC-MS/MS	6.64%	11
French fries	FLD	HPLC-DAD	1.67%	12
Potato chips	Colorimetric method	UPLC-MS/MS	9.14%	This study

Note: BA-ELISA, biotin-avidin ELISA; ci-ELISA, competitive indirect ELISA; ECL-ELISA, enhanced chemiluminescence ELISA; FLD, fluorescence detection

Relative error (δ) was defined as $\delta = \frac{|x - x_0|}{x_0} \times 100\%$, where x and x_0 are the measured concentrations of AA with rapid methods and standard methods, respectively. According to the relative error (δ) values, this colorimetric method showed lower accuracy than fluorescent methods but better accuracy than ELISA.

References

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