A simple and sensitive graphene oxide/nanogold SPR Rayleigh scattering-energy transfer analytical platform for detection of iodide and H_2O_2

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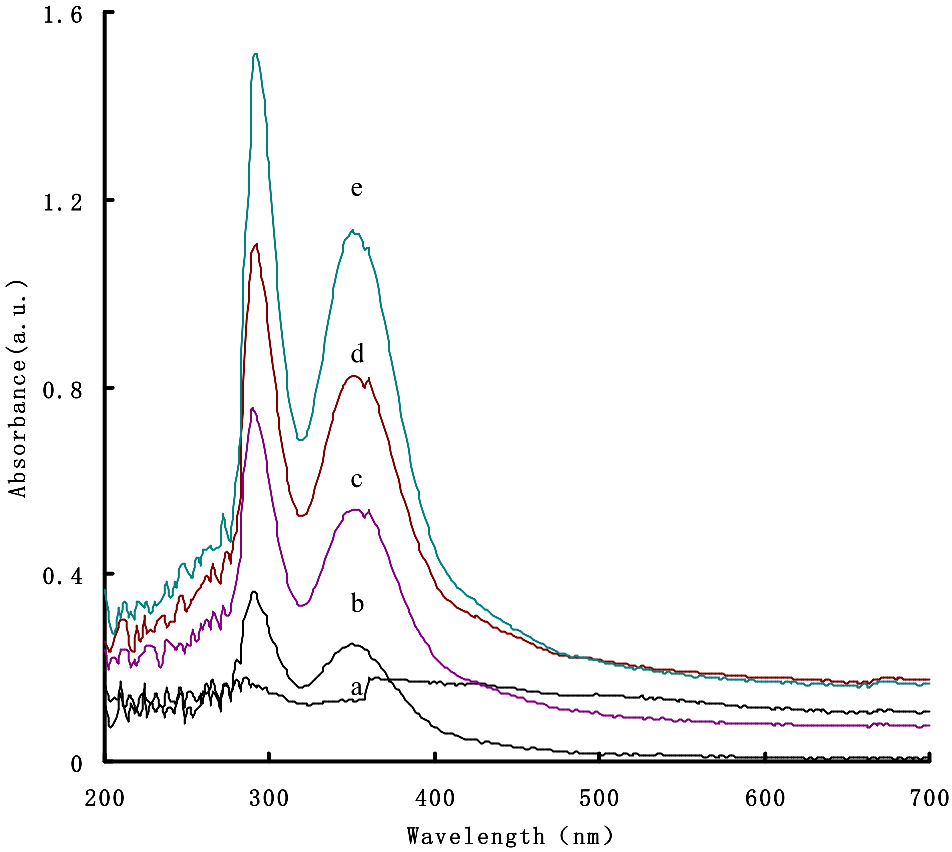


Fig. 1S Absorption spectra of the GO/GN-KI-KIO_3 system
(a) pH 2.8 Na_2HPO_4-citric acid-4mmol/LKI-4.78µg/mL GO/GN; (b) a+5µmol/L KIO_3; (c) a+10µmol/L KIO_3; (d) a+20µmol/L KIO_3; (e) a+25 µmol/L KIO_3.

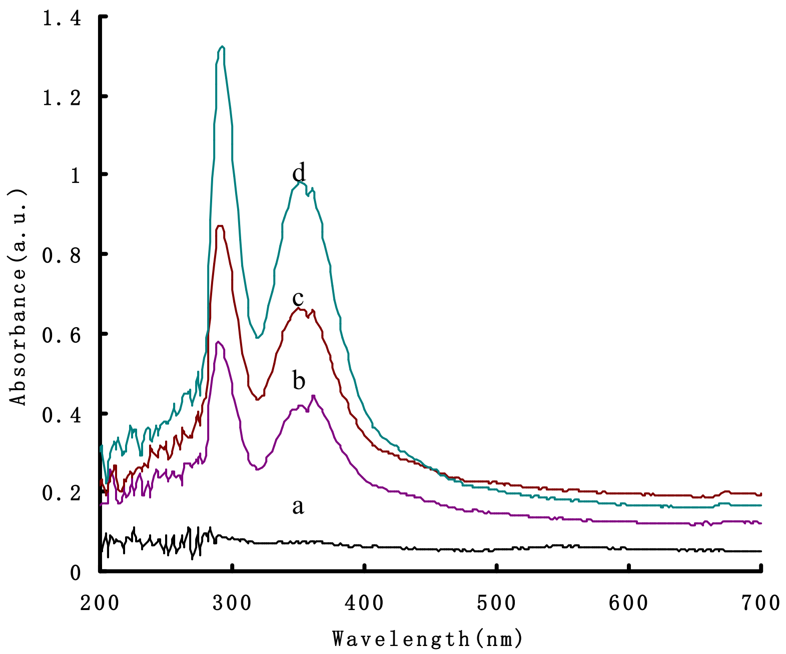


Fig. 2S Absorption spectra of the GN-KI-KIO_3 system
(a) pH 2.8 Na_2HPO_4- citric acid-4mmol/L KI-4.782μg/ml GN; (b) a+15μmol/L KIO_3; (c) a+20μmol/L KIO_3; (d) a+25μmol/L KIO_3**.**

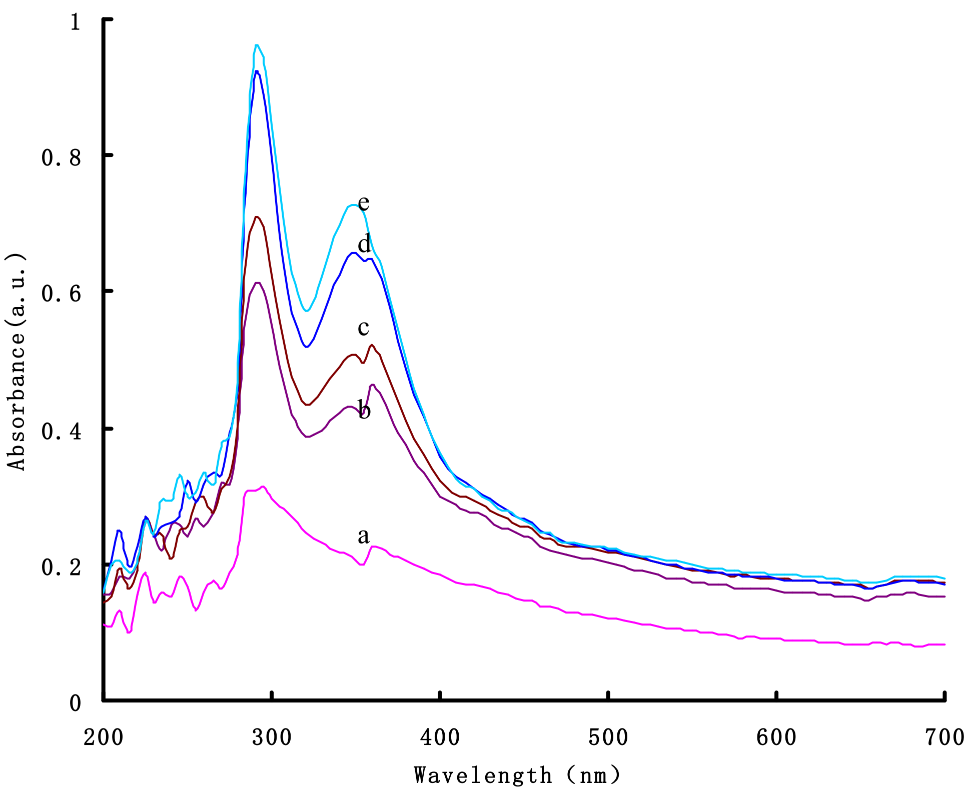


Fig. 3S Absorption **spectra of the GO-KI-KIO_3 system**

(a)pH 2.8 Na_2HPO_4-citric acid-4mmol/L KI-15μg/L GO; (b) a+5.5μmol/L KIO_3; (c)a+7μmol/L KIO_3; (d)a+8.5μmol/L KIO_3; (e)a+10μmol/L KIO_3.

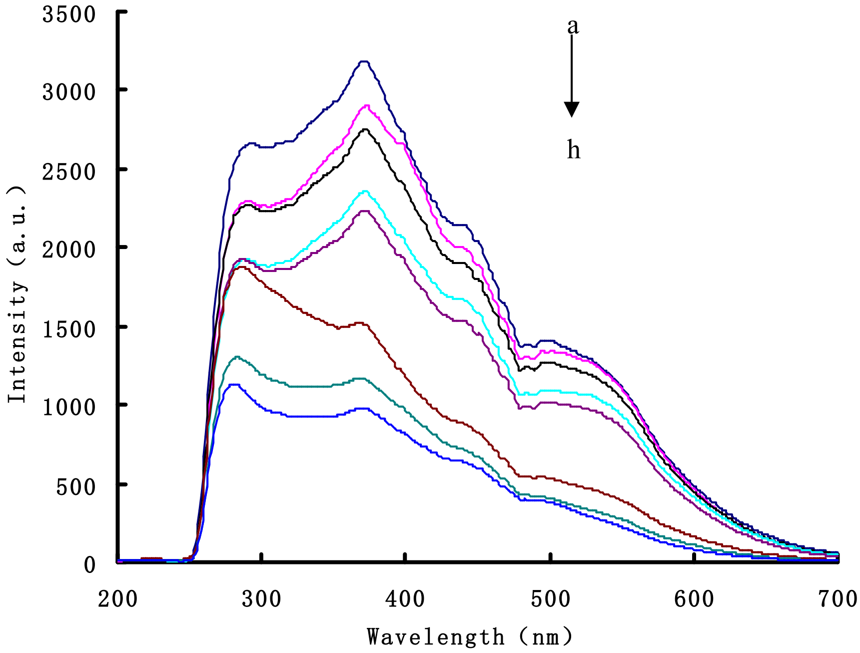


Fig. 4S RRS spectra of the GN-KI-KIO_3 system

(a) pH 2.8 Na_2HPO_4- citric acid-4mmol/L KI-4.782μg/ml GN; (b)a+0.25μmol/L KIO_3;(c) a+1μmol/L KIO_3; (d) a+2μmol/L KIO_3; (e) a+2.5μmol/L KIO_3;(f) a+4μmol/L KIO_3; (g) a+4.5μmol/L KIO_3; (h) a+5μmol/L KIO_3.

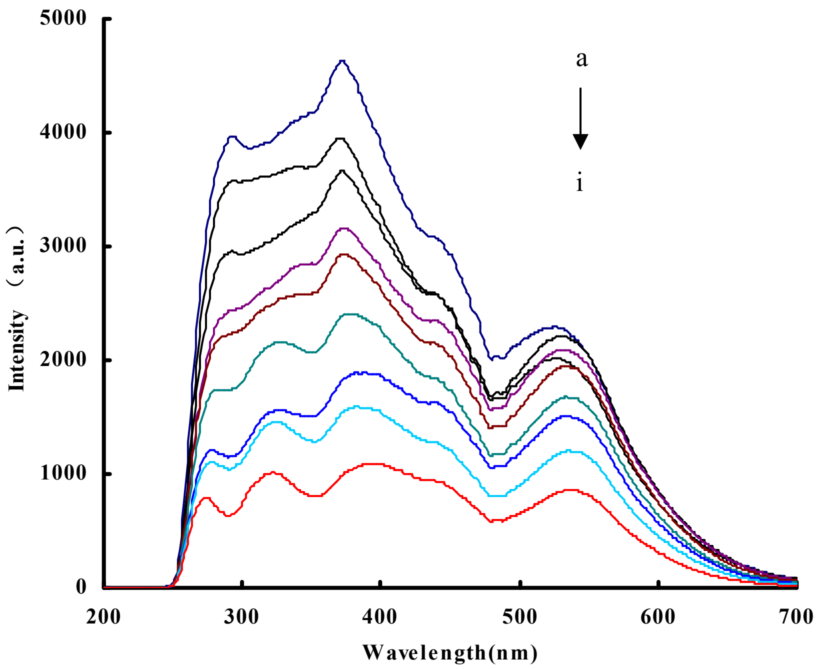


Fig. 5S RRS of the GN-KI-H_2O_2 system

(a) pH 3.4 Na_2HPO_4-citric acid-3mmol/L KI-4.782μg/ml GN; (b)a+10μmol/L H_2O_2;(c) a+20μmol/L H_2O_2; (d) a+30μmol/L H_2O_2; (e) a+40μmol/L H_2O_2; (f) a+50μmol/L H_2O_2; (g) a+60μmol/L H_2O_2; (h)a+70μmol/L H_2O_2; (i)a+80μmol/L H_2O_2

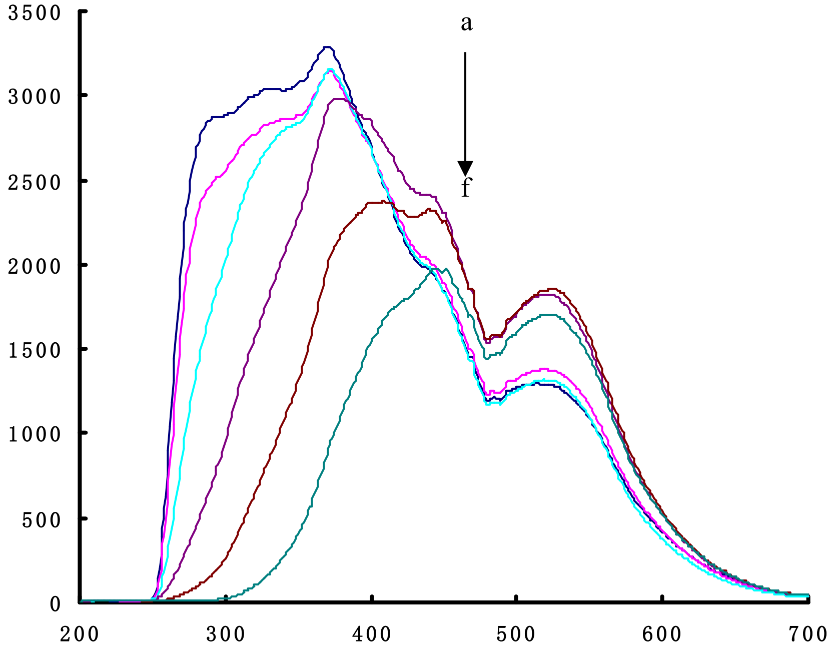


Fig. 6S RRS of the GN-KI-H_2O_2-Fe^{3+} catalytic system

（a）pH 2.8 Na_2HPO_4- citric acid-4mmol/L KI-25mmol/L H_2O_2-Fe^{3+}-4.782μg/ml GN; (b) a+0.025mmol/L Fe^{3+}; (c) a+0.1mmol/L Fe^{3+}; (d) a+0.25mmol/L Fe^{3+}; (e) a+0.5mmol/L Fe^{3+}; (f) a+1mmol/L Fe^{3+}**.**

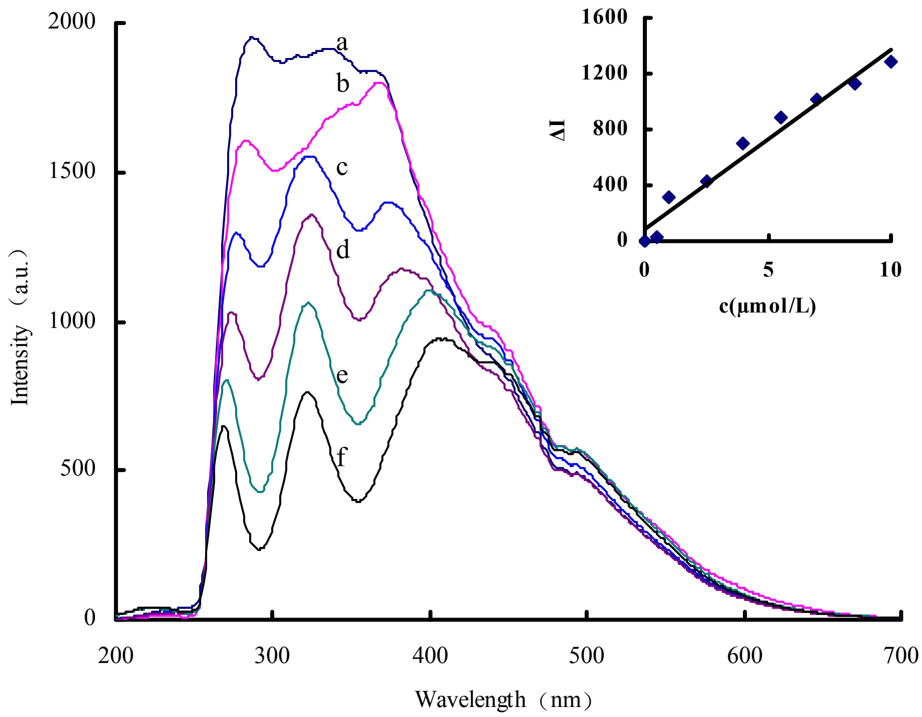


Fig. 7S RRS spectra of the GO-KI-KIO_3 system

(a) pH 2.8 Na_2HPO_4-citric acid-4mmol/L KI-15μg/L GO; (b)a+0. 5μmol/L KIO_3; (c) a+1μmol/L KIO_3; (d) a+2.5μmol/L KIO_3; (e) a+7μmol/L KIO_3; (f) a+10μmol/L KIO_3.

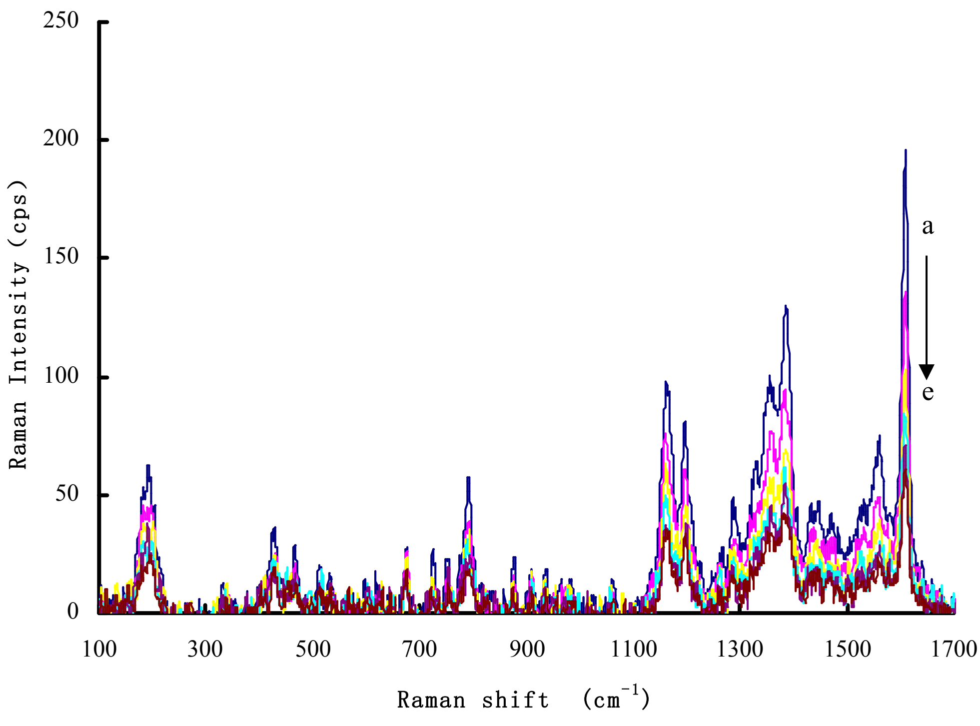


Fig. 8SA SERS spectra of KIO_3-KI-GN system

a: pH 2.8Na_2HPO_4-citric acid-4mmol/L KI-1.0μmol/L VBB-12μg/mL GN; b:

a+1μmol/L KIO_3; c: a+2.0μmol/L KIO_3; d: a+3.0μmol/L KIO_3 ; e: a+4.0μmol/L KIO_3.

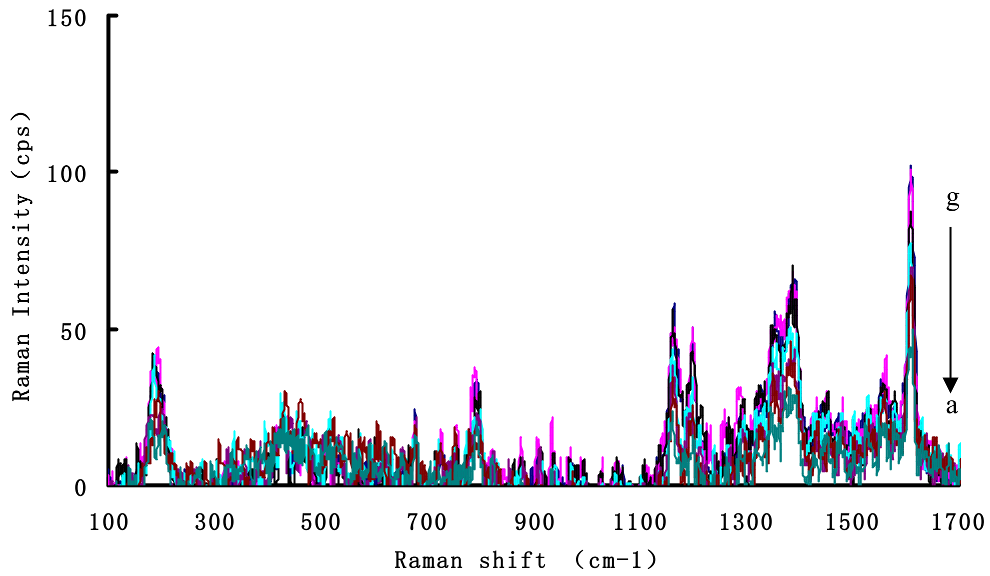
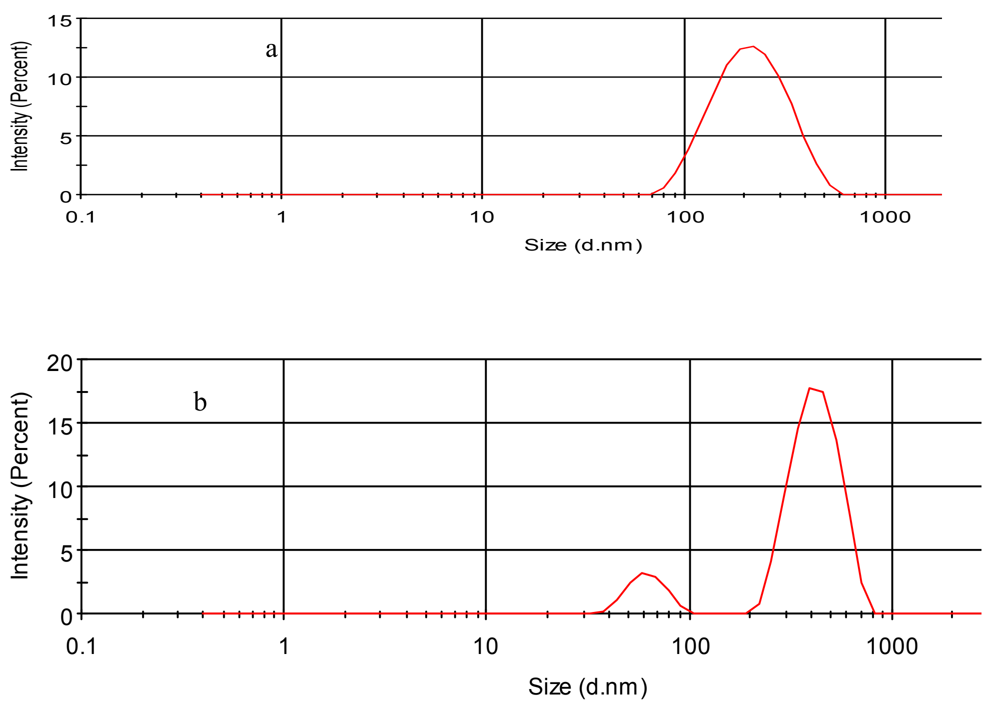


Fig. 8SB SERS spectra of KIO_3-KI-GO/GN system

a: pH 2.8Na_2HPO_4-citric acid-4mmol/L KI-1.0μmol/L VBB-12μg/mL GO/GN; b: a+0.25μmol/L KIO_3; c: a+0.5μmol/L KIO_3 ; d: a+1μmol/L KIO_3; e: a+2.5μmol/L KIO_3; f: a+4.0μmol/L KIO_3; g: a+5.5μmol/L KIO_3.



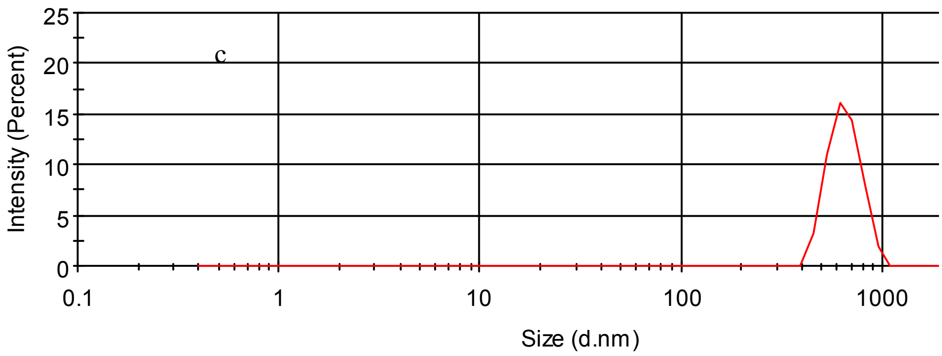


Figure 9S Laser scattering graph of the NG/GO systems

a: GO; b: GO/GN; c: GO/GN-2.8 Na_2HPO_4-citric acid-4 mmol/L KI-2.5μmol/L KIO_3.

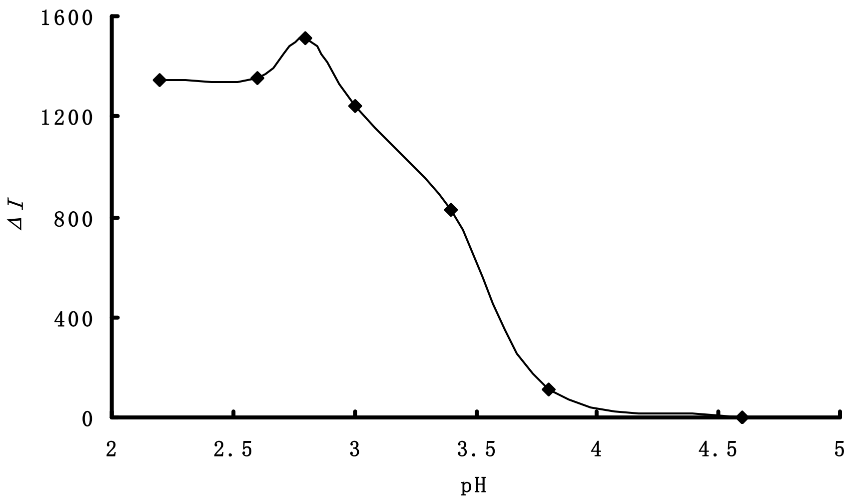


Fig. 10S Effect of pH Na_2HPO_4-citric acid buffer

3 mmol/L KI-2.5 μmol/L KIO_3-7.17μg/mL GN

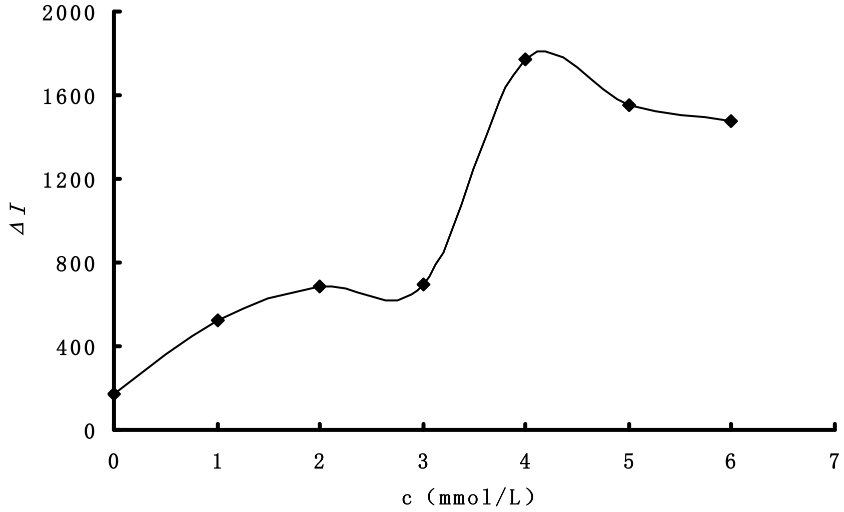


Fig. 11S Effect of KI concentration

pH 2.8Na_2HPO_4-citric acid buffer-2.5μmol/L KIO_3-7.173μg/mL GN

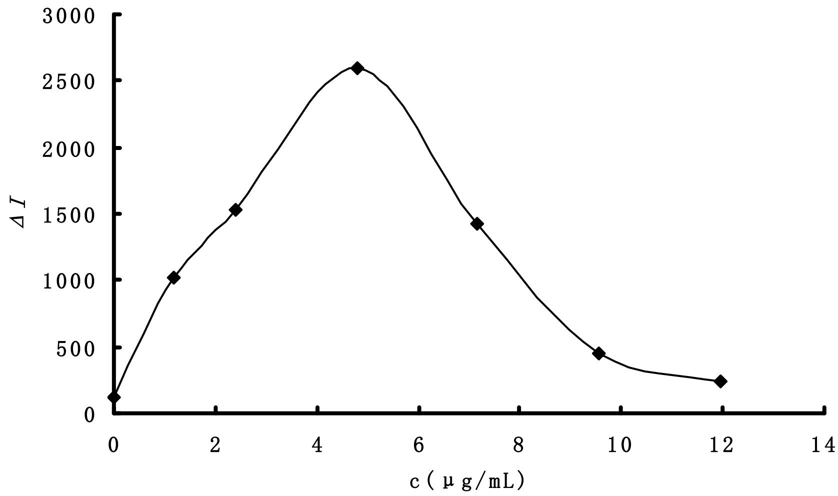


Fig. 12S Effect of GN concentration

pH 2.8Na_2HPO_4-citric acid buffer-4mmol/L KI-2.5μmol/L KIO_3

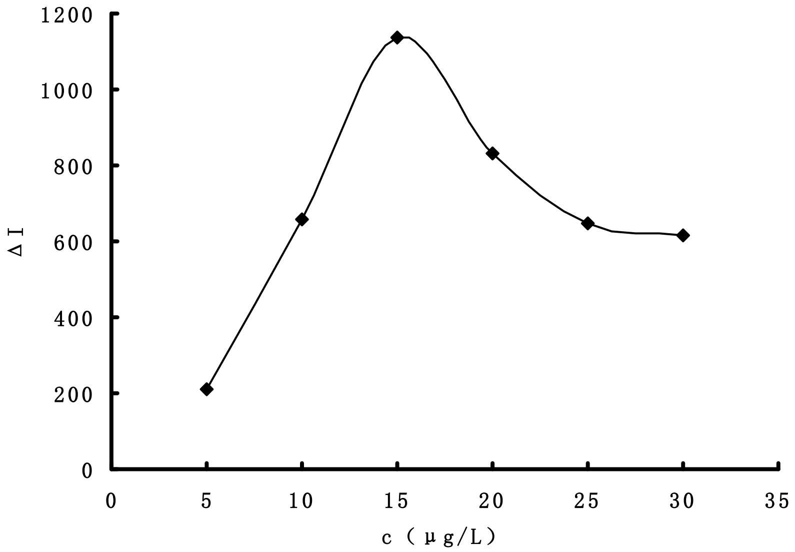


Fig. 13S Effect of GO concentration

pH 2.8Na_2HPO_4-citric acid buffer-4mmol/L KI-2.5μmol/L KIO_3.

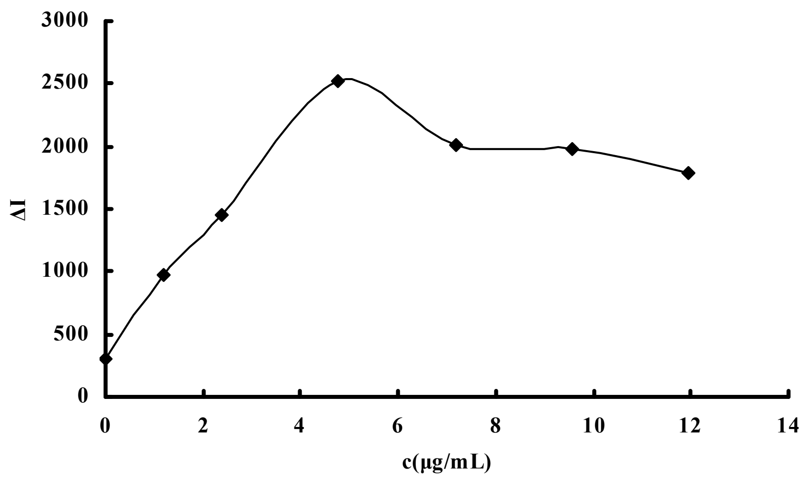


Fig. 14S Effect of GO/GN concentration

pH 2.8Na_2HPO_4-citric acid buffer-4mmol/L KI-2.5μmol/L KIO_3

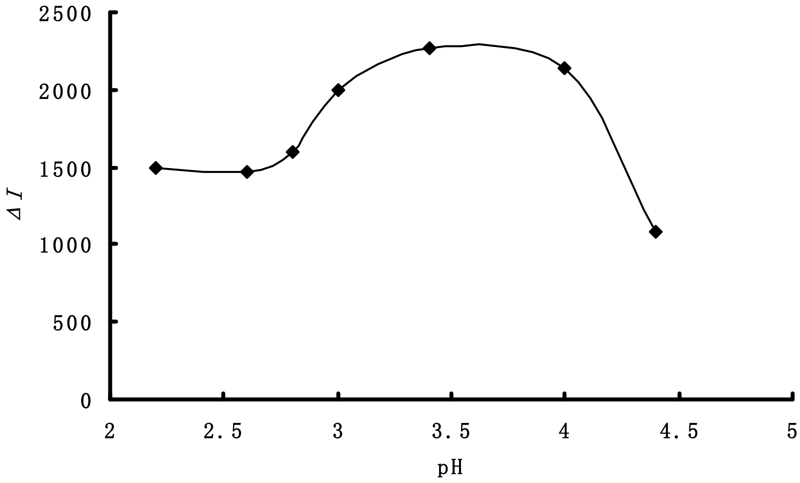


Fig. 15S Effect of pH Na_2HPO_4-citric acid buffer

3mmol/L KI-50μmol/L H_2O_2-7.173 μg/mL GN-50mmol/L NaCl

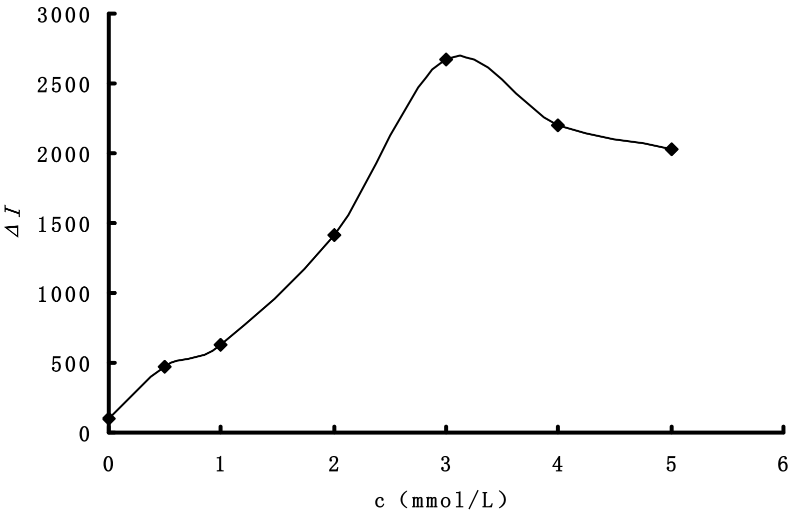


Fig. 16S Effect of KI concentration

pH3.4Na_2HPO_4-citric acid buffer-KI-50μmol/L H_2O_2-7.173μg/mL GN-50mmol/L NaCl

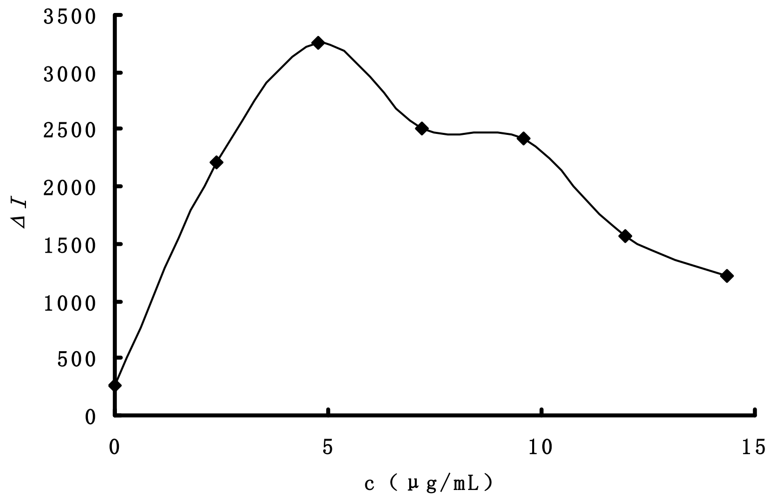


Fig. 17S Effect of GN concentration

pH3.4Na_2HPO_4-citric acid buffer-3 mmol/L KI-50μmol/L H_2O_2- GN-50mmol/L NaCl

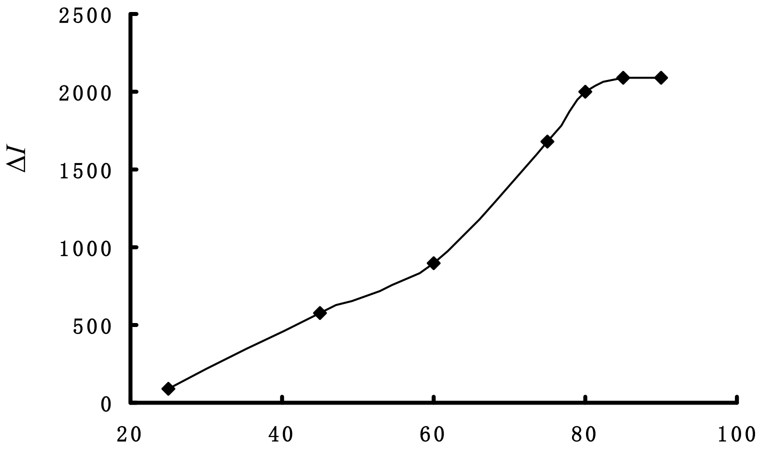


Fig. 18S Effect of temperature

pH 3.4Na_2HPO_4-citric acid-3 mmol/L KI-50 μmol/L H_2O_2-4.782μg/mL GN.

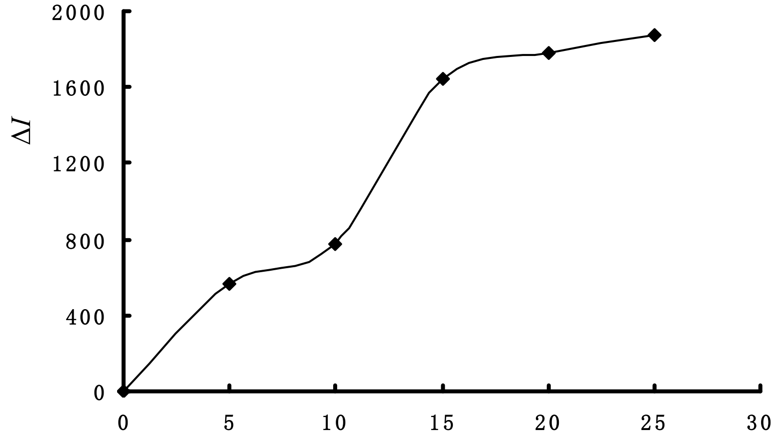


Fig. 19S Effect of reaction time

pH 3.4 Na_2HPO_4-citric acid-3 mmol/L KI-50μmol/L H_2O_2-4.782μg/mL GN.

Table 1S The reproducibility for some nanoparticle systems

System	Single value I	Average	RSD (%)
4.78μg/ml GN	197,210,235,201,194	207	8.0
pH 2.8 Na_2HPO_4-citric acid-4mmol/L KI-4.78μg/ml GN	4365,3918,3537,3343,3803	3793	10.3
15μg/L GO	810,887,875,800,823	839	4.7
pH 2.8 Na_2HPO_4-citric acid-4mmol/L KI-15μg/L GO	906,900,872,917,869	893	2.4
4.78μg/mL GO/GN	1394,1425,1282,1351,1492	1389	5.7
pH 2.8 Na_2HPO_4-citric acid-4mmol/LKI-4.78μg/mL GO/GN	1578,1727,1742,1607,1558	1642	5.2

Table 2S Comparison of the reported methods for I

Method	Principle	LR (μmol/L)	DL (μmol/L)	Comments	Ref.
SM *	Iodate reacts with iodide to form I_3^- that combined with starch to form blue complex with an absorption peak at 580 nm.	1.6-7.0	0.8	Simple, but low sensitivity	37
ISE	Using standard addition method and iodine ISE, iodine ion in iodine fortified beverages were determined.	0.5-1.0×10^5	0.63	Simple and automatic, but low sensitivity	38
IC-ICP/MS	Alkaline extraction and IC-ICP /MS were applied as the sample pretreat mentmethod and the detection technique respectively, for iodate and iodide determ ination.	0.002-7.9	0.0008	Highly sensitive, but high-cost and complex.	39
Sensor	The colorimetric iodide sensor was based on the anti-aggregation of GNs that relied upon the distance-dependent optical properties of GNs, the combination of mercapto-functionalized thymine on GNs, and the stronger affinity between I^- and Hg^{2+}.	0.02-0.6	0.01	Simple and sensitive, but Hg^{2+} used and complex.	33
RRS	Iodate reacts with iodide to form I_3^- that combined with rhodamine 6G to form ion- associated particles with a RRS peak at 400 nm.	0.1-2.0	0.03	Simple, but low sensitivity	35

RRS-ET	The SPRRS energy of GO/GNs transferred to I_3^- complex that the decreased RRS intensity is linear to IO_3^- concentration.	0.025-5	0.008	Simple, fast, highly sensitive.	This paper

* SM-spectrophotometric method, ISE-ion selective electrode, IC-ICP/MS-ion chromatography-inductively coupled plasma mass spectrometry.

Table 3S Effect of foreign substances on the determination of iodide

Coexistent substance	Tolerance Concentration (μmol/L)	Relative error (%)	Coexistent substance	Tolerance Concentration (μmol/L)	Relative error (%)
K^+	250	8.7	Ni^{2+}	250	3.0
Ca^{2+}	250	3.0	MoO_4^{2-}	200	-0.9
Zn^{2+}	250	2.4	SO_4^{2-}	250	-4.9
Glucose	200	-6.1	BrO_3^-	250	-2.0
Co^{2+}	250	-5.4	Cu^{2+}	200	0.8
Al^{3+}	250	1.8	Mn^{2+}	250	7.5
Ba^{2+}	250	1.6	Cr^{3+}	12.5	-7.1
Mg^{2+}	250	1.1	SeO_3^{2-}	12.5	-5.4

Table 4S Effect of foreign substances on the determination of H_2O_2

Coexistent substance	Tolerance Concentration (μmol/L)	Relative error (%)	Coexistent substance	Tolerance Concentration (μmol/L)	Relative error (%)
K^+	1000	2.0	Mg^{2+}	1000	0.7
Ca^{2+}	500	-8.9	SeO_3^{2-}	2000	0.4
Zn^{2+}	1000	1.4	SO_4^{2-}	1000	2.8
Glucose	500	2.4	BrO_3^-	2500	3.6
BPO	250	6.1	Cu^{2+}	1000	3.1
Al^{3+}	250	-7.8	Mn^{2+}	75	8.6
Ba^{2+}	500	-8.7	Cr^{3+}	500	-7.6