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A novel fluorescence strategy for mercury ions and trypsin activity assay based on nitrogen-doped graphene quantum dots

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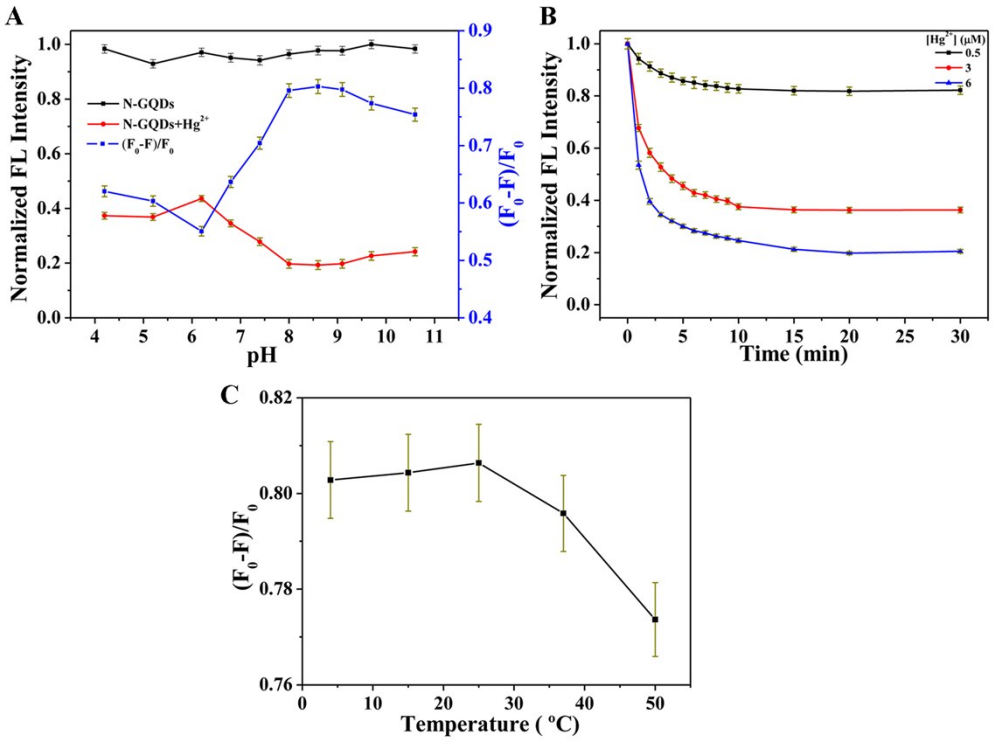

Fig. S1 (A) The effect of pH in the range of 4.2-10.6 on Hg^{2+} assay; (B) The effect of reaction time in the presence of different concentrations of Hg^{2+} on Hg^{2+} assay; (C) The effect of reaction temperature in the range of 4-50 ºC on Hg^{2+} assay.

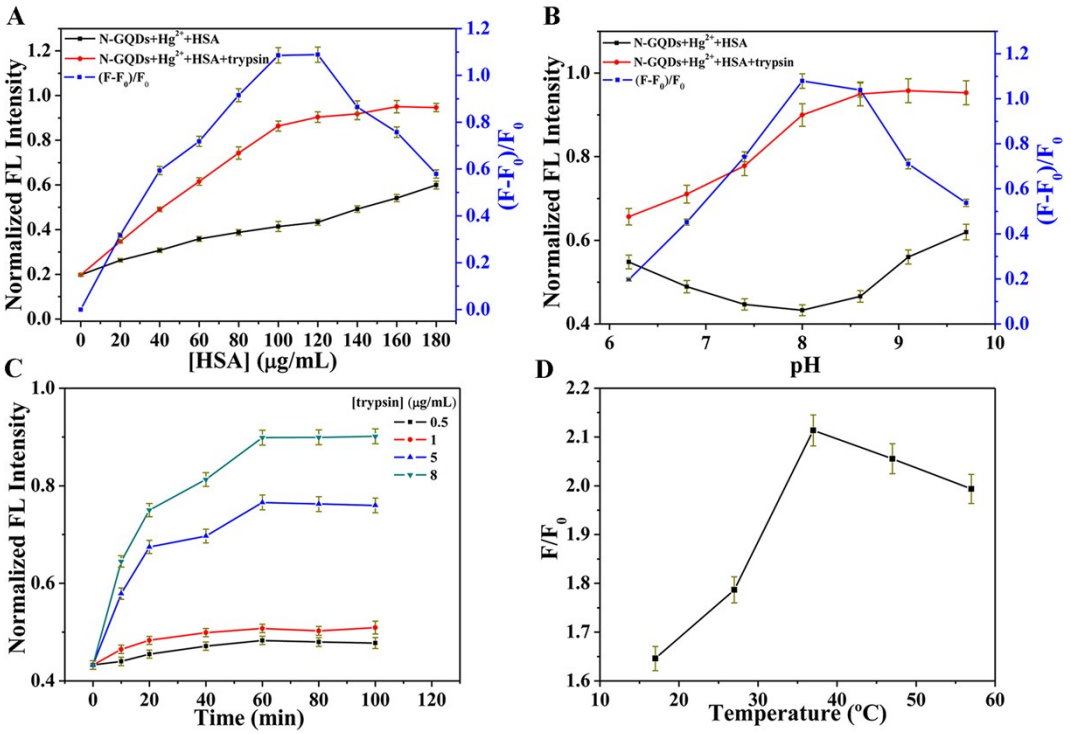

Fig. S2 (A) The effect of the concentration of HSA on trypsin activity assay; (B) The effect of the pH on trypsin activity assay; (C) The effect of the enzymatic incubation time in the presence of different concentrations of trypsin on trypsin activity assay; (D) The effect of the enzymatic incubation temperature on trypsin activity assay.

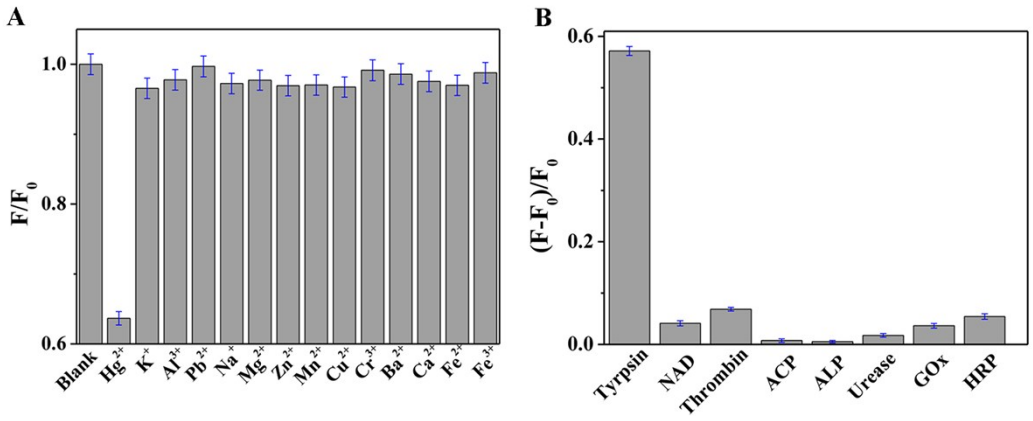

Fig. S3 (A) The selectivity of N-GQDs for Hg^{2+} assay. The Hg^{2+} concentration was 1 μM while metal ions (Al^{3+}, Pb^{2+}, Zn^{2+}, Mn^{2+}, Cu^{2+}, Cr^{3+}, Ba^{2+}, Fe^{2+}, Fe^{3+}) were 10 μM and metal ions (K^{+}, Na^{+}, Mg^{2+}, Ca^{2+}) were 10 mM; (B) The selectivity of the proposed nanosensor for trypsin activity assay. The trypsin concentration was 4 μg/mL while β-nicotinamide adenine dinucleotide (NAD), thrombin, horse radish peroxidase (HRP) were four times (16 μg/mL) and acid phosphatase (ACP), alkaline phosphatase (ALP), urease, glucose oxidase (GOx) were ten times (40 μg/mL). Conditions: [Hg^{2+}] = 6 μM, [HSA] = 120 μg/mL, pH = 8.0. The error bar represented standard deviation of three replicate measurements.

Table S1 Comparison of different methods for the determination of Hg^{2+}.

Methods	Probe	Linear range (μM)	LOD (μM)	References
Fluorescence	CuDTC2-CDs	0.04-1	0.02	[1]
Fluorescence	N-CDs	0-24	0.02	[2]
Fluorescence	CDs	0.1-20	0.062	[3]
Fluorescence	N. B-CDs	0.02-0.16	0.0073	[4]
Fluorescence	CDs-labeled DNA	0.005-0.2	0.0026	[5]
Colorimetry	L-Cys-GNPs	0.1-2	0.1	[6]
Fluorescence	N-GQDs	0.02-1	0.0047	This work

Table S2 Comparison of different methods for the determination of trypsin.

Methods	System	Linear range (μg/mL)	LOD (μg/mL)	References
Fluorescence	BSA-GQDs/CMR2	0-6	0.7	[7]
Fluorescence	Mn ZnSe QDs/Arg6	0.1-12	0.04	[8]
Fluorescence	GO/Arg6-FAM	0.1-10	0.1	[9]
Fluorescence	Conjugated polymers (F-BSF)	0-2.5	0.2	[10]
Fluorescence	Polymer/BSA/Cu^{2+}	0-8	0.0525	[11]
Colorimetry	BSA-AuNCs/TMB	0.9-1000	0.6	[12]
Colorimetry	H_2O_2/cyt c/TMB	0.05-1	0.0045	[13]
Electrochemistry	electrochemical probes	0.005-0.15	0.0018	[14]
Fluorescence	N-GQDs/Hg^{2+}/HSA	0.03-8	0.0063	This work

Table S3 Determination of Hg^{2+} in real water samples.

Samples	Added (μM)	founded (μM)	Recovery (%)	RSD (n = 3, %)
Tap water	0	-	-	-
	0.08	0.07	87.5	1.01
	0.40	0.41	102.5	2.69
	0.90	0.87	96.7	1.67
Lake water	0	-	-	-
	0.08	0.08	100.0	1.06
	0.40	0.37	92.5	1.70
	0.90	0.85	94.4	1.14

Table S4 Determination of trypsin in human serum samples.

Samples	Added (μM)	Founded (μM)	Recovery (%)	RSD (n = 3, %)
1	0	-	-	-
	0.50	0.55	110.0	0.80
	5.00	5.09	101.8	0.70
	7.00	6.92	98.9	0.71
2	0	-	-	-
	0.50	0.52	104.0	1.35
	5.00	5.14	102.8	1.86
	7.00	7.16	102.3	0.61

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