Electronic Supporting Information

A ratiometric fluorescence strategy based on polyethyleneimine surface-modified carbon dots and Eosin Y for ultrasensitive determination of protamine and trypsin.

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Reagents

The chemical reagents used in the experiments are of analytical grade without further purification. The deionized water used in this experiment has a resistivity greater than 18 MΩ cm−1. PEI was provided by Aladdin Industrial Company. Tris-HCl was purchased from Sinopharm Chemical Reagent Co. Ltd. Eosin Y，Protamine, Arg, AA, Fru, Cys, GSH, Gly, Asp, ATP, Urease, G-ox, LZM and Pepsinand reduced L-glutathione (GSH) were purchased from Sangon Biotech (Shanghai). Potassium Chloride, Magnesium Chloride, Zinc Sulfate Sodium Chloride and Urea were purchased from Beijing Chemical Works. Glucose and trypsin were purchased from Aladdin. This experiment used a 10 mM Tris-HCl buffer solution to adjust the pH of the reaction. And the configured solutions were all stored at 4℃.

Instrumentation

Fluorescence (FL) spectra were recorded by a RF-5301 PC spectrofluorophotometer(Shimadzu, Japan). Ultraviolet-visible (UV-vis) absorption spectra were acquired with the U-5100 UV-vis spectrophotometer. Powder X-ray diffraction (XRD) patterns were conducted on a Rigaku D-Max 2550 diffractometer (Rigaku, Japan). Fourier transform infrared (FT-IR) spectra were recorded on a Nicolet 400 Fourier transform infrared spectrometer. Transmission electron microscope (TEM) was collected on a JEM-2100F Transmission Electron Microscope (JEOL, Japan). All temperature measurements were accomplished by using a water

bath. All pH measurements and the configured buffer solutions were performed using a PHS-3C pH meter (Tuopu Co., Hangzhou, China).

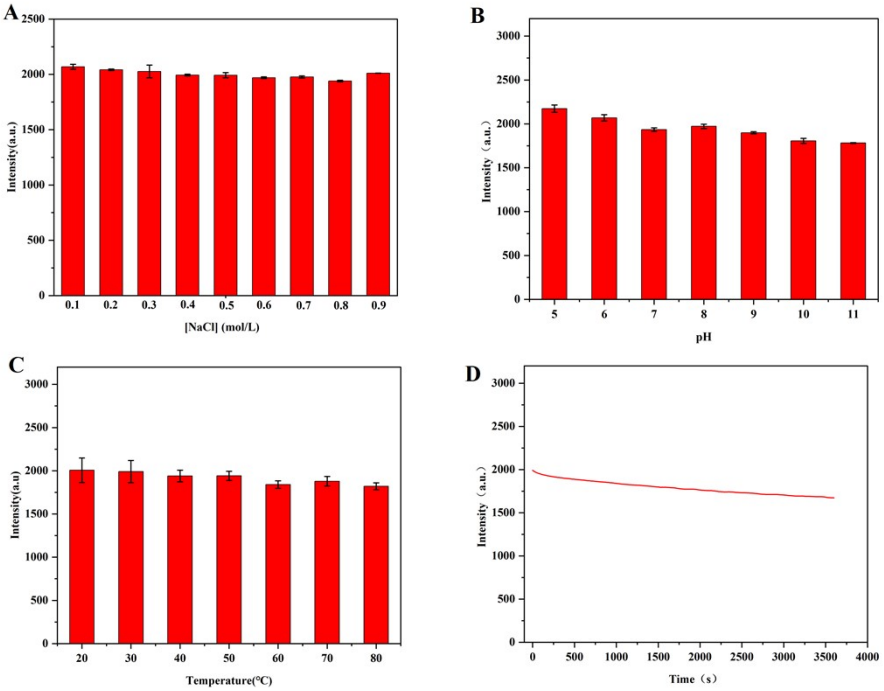

Fig. S1. Influences of （A）Ionic strength, (B) pH values,（C）Temperature，（D）Xenon lamp irradiation time on the fluorescence of CDs-PEI at 350 nm excitation wavelength.

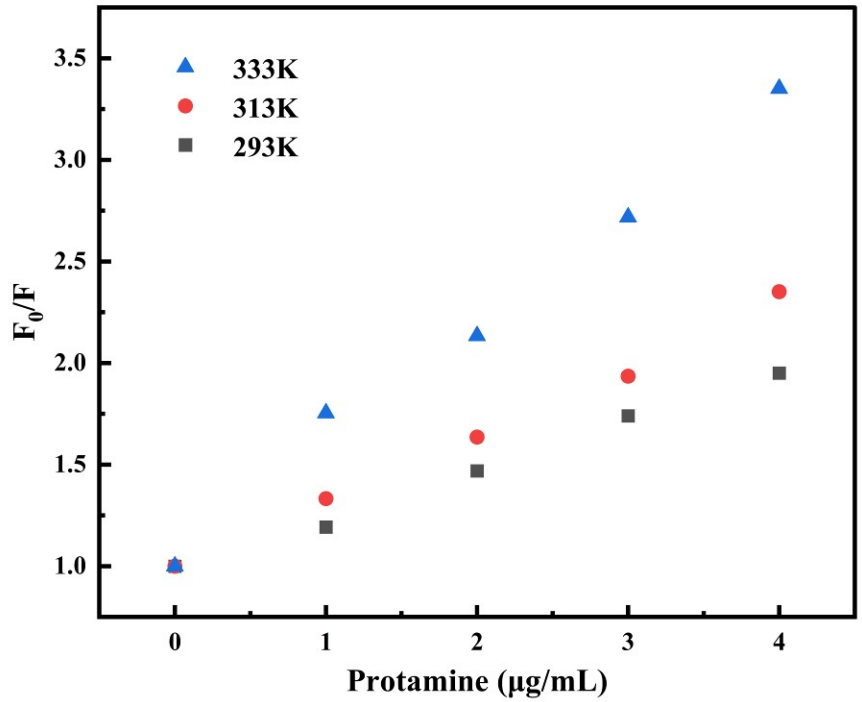

Fig. S2. Stern–Volmer curves for the CDs-PEI/Eosin Y/Protamine system at three different temperatures. (F_0 and F were the fluorescence intensity of Eosin Y in the absence and presence of protamine, respectively.)

Table S1 Comparison with previous methods for the detection of protamine.

Methods	Materials	Linear range (μg/mL)	LOD (μg/mL)	Reference

Fluorescence	water soluble Perylene diimides	0.1-13 μg /mL	0.09 μg /mL	1

Methods	Materials	Linear range	LOD	Reference
~~Electrochemical~~	~~poly(thionine) modified glassy~~	~~4-22 μg /mL~~	~~0.28 μg /mL~~	~~2~~
Chemiluminescence	gold nanoclusters carbon electrode (Au NCs)	2.4-48 μg/mL	0.19 μg/mL	7
Colorimetric	Anionic poly(2-(2-(4-methylthiophen-3-yloxy)ethyl)malonate acid)	0.1-30 μg /mL	0.1 μg /mL	3
Fluorescence	a pyrene derivative	0.5–8 μg/mL	0.5 μg/mL	4
Fluorescence	BZA-BOD@ZIF-90	0.25-0.4 μg/mL	0.07 μg /mL	5
Robust reverse phase-HPLC	Zorbax-SB C8 Column	0.5–5 mg/ml	0.06 mg/mL	6
Fluorescence	PEI-CDs and Eosin Y	0.1-5.2 μg/mL	0.03 μg/mL	This work

Chemiluminescence	bovine serum albumin (BSA)-stabilized gold nanoclusters (Au NCs)	0.01-50 μg /mL	9 ng/mL	8
Electrochemical	luminol and black phosphorus nanosheets	0.1 – 5 μg /mL	63.3 ng/mL	9
Colorimetric	silver nanoparticles (AgNPs)	2.5-200 ng/mL	2 ng/mL	10
Fluorescence	silicon quantum dots (SiQDs) and triangular silver nanoprisms (TSNPRs)	0-40 ng/mL	8 ng/mL	11
Fluorescence	AgInZnS QD	0.1-4 μg /mL	0.04 μg /mL	12
Fluorescence	PEI-CDs and Eosin Y	0.4-56 ng/mL	0.21 ng/mL	This work

Table S2 Comparison with previous methods for the detection of trypsin

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