

An ultrasensitive colorimetric and fluorescence dual-readout assay for
glutathione with carbon dots-MnO₂ nanosheets platform based on inner
filter effect

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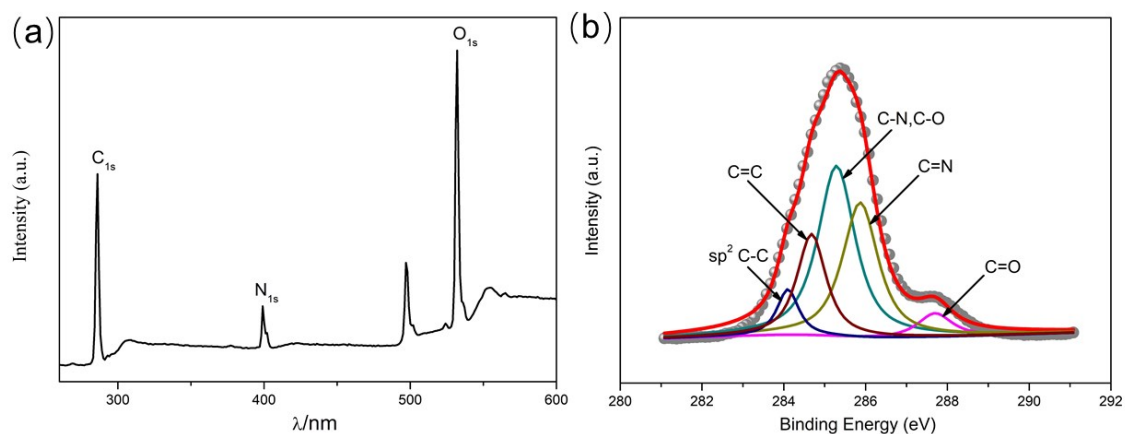


Fig. S1 (a) XPS spectrum of the C-dots. (b) High-resolution C-dots XPS spectra of C_{1s}.

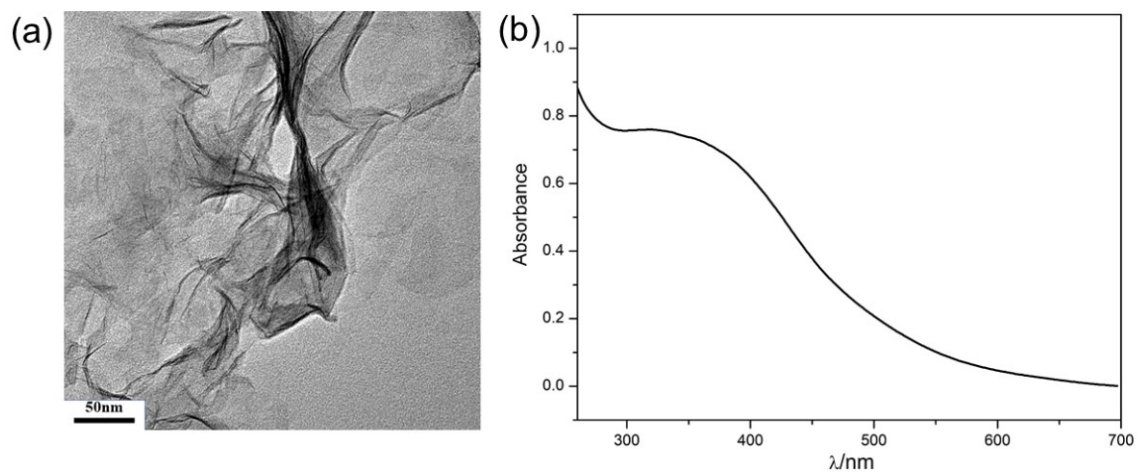


Fig. S2 (a) TEM image of MnO₂ nanosheets. (b) The UV-vis absorption spectrum of MnO₂ nanosheets.

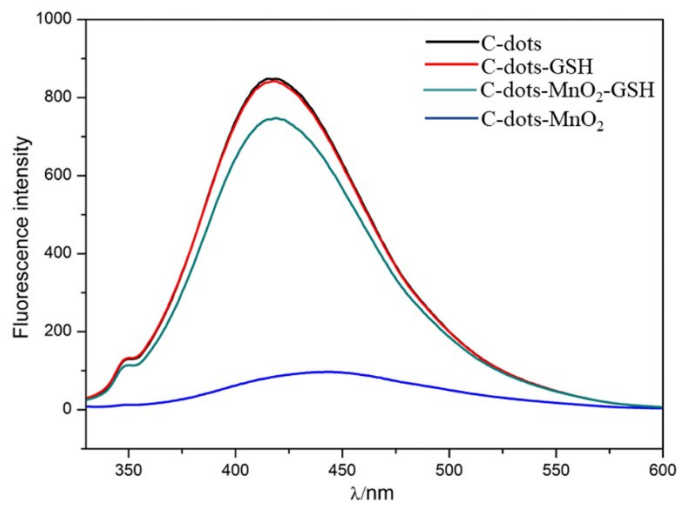


Fig. S3 The fluorescence emission spectra of C-dots in the absence and presence of MnO₂ nanosheets and GSH.

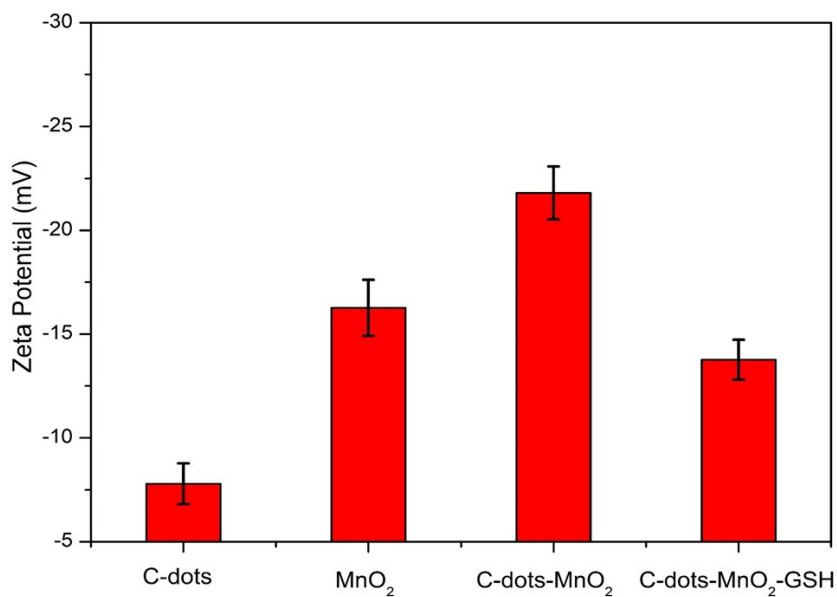


Fig. S4 The zeta potential of C-dots, MnO₂ nanosheets, C-dots-MnO₂ nanosheets mixture, and C-dots-MnO₂ nanosheets mixture added with GSH. All of these characters were measured in MES buffer (10 mM, pH 6.0).

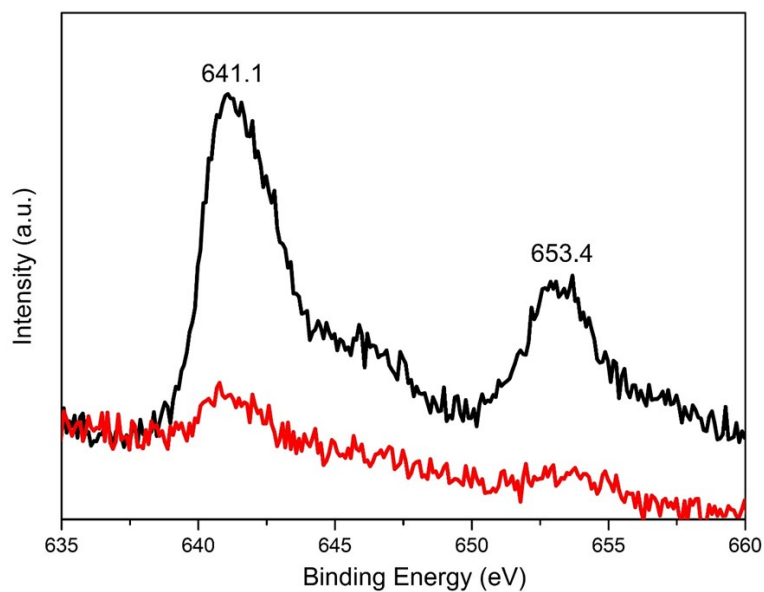


Fig. S5 The XPS spectrum of the C-dots-MnO₂ nanosheets mixture in the absence and presence of GSH.

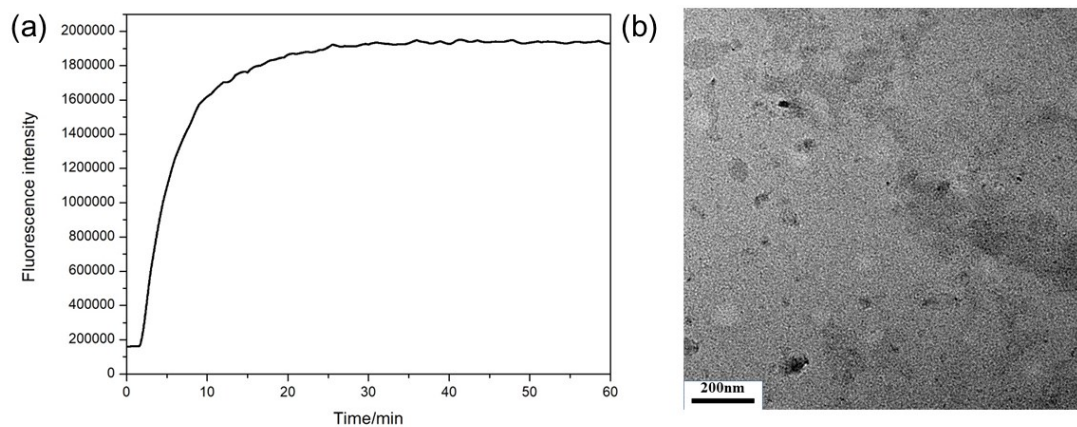


Fig. S6 (a) The fluorescence recovery kinetics between C-dots-MnO₂ mixture and GSH. (b) TEM image of the mixture of Cdots-MnO₂ nanosheets and GSH.

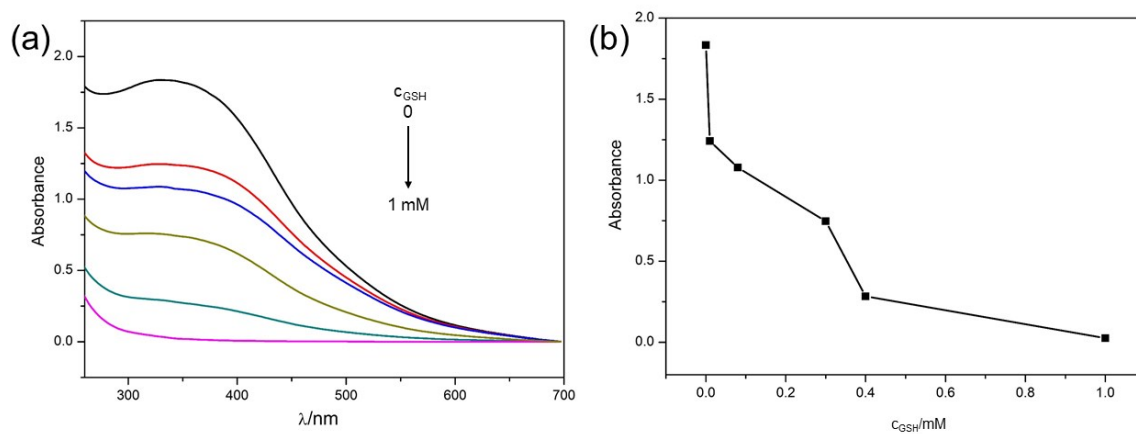


Fig. S7 (a) UV-vis spectra of the C-dots-MnO₂ mixture in the presence of different concentrations of GSH (0, 0.01, 0.08, 0.3, 0.4, 1.0 mM). (b) The absorbance of C-dots-MnO₂ mixture at 375 nm in the presence of different concentrations of GSH.

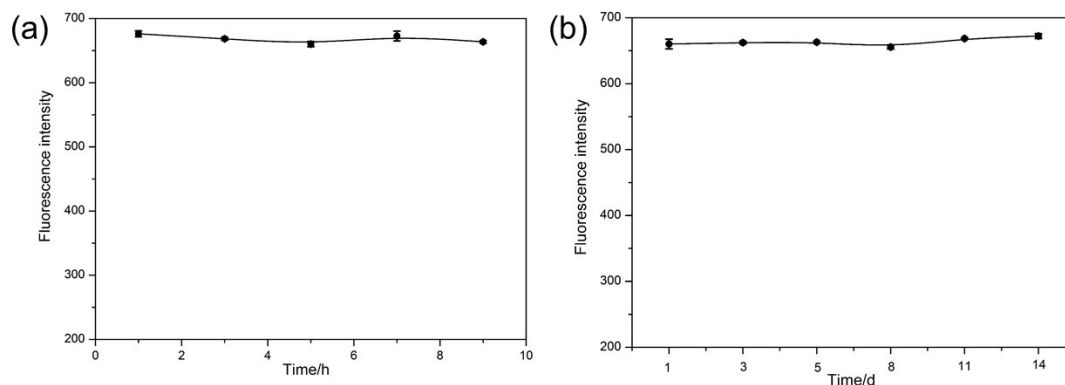


Fig. S8 (a) The fluorescence intensity of C-dots when C-dots-MnO₂ nanosheets mixture were used to detect GSH (0.4 mM) every two hour on the same day. (b) The fluorescence intensity of C-dots when C-dots-MnO₂ nanosheets mixture were used to detect GSH (0.4 mM) in 14 days.

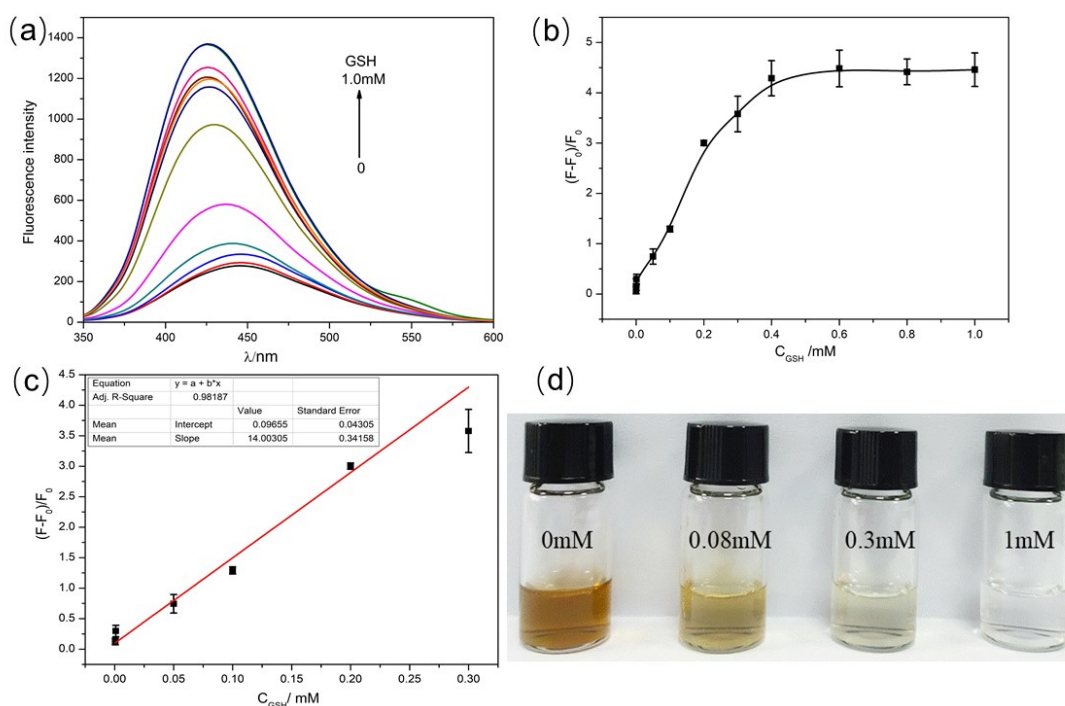


Fig. S9 (a) Fluorescence spectra of the system with the concentrations of GSH within 0-1.0 mM in 400-fold diluted human urine. (b) The fluorescence recovery in the presence of different concentrations of GSH. (c) Calibration plot of fluorescence recovery versus GSH concentration. (d) The photos of C-dots-MnO₂ mixture with different concentrations of GSH (0, 0.08, 0.3, 1.0 mM) in 400-fold diluted human urine.

Table S1 Fitting results of the fluorescence lifetimes for the C-dots, C-dots-MnO₂ mixture, and C-dots-MnO₂ mixture added with GSH.

| Sample | τ_1 (ns) | A_1 | τ_2 (ns) | A_2 | τ_{average} (ns) |
|------------------------------|---------------|--------|---------------|--------|------------------------------|
| C-dots | 1.3 | 1388.5 | 7.4 | 678.3 | 5.80 |
| C-dots-MnO ₂ | 1.2 | 1359.3 | 7.2 | 670.5 | 5.71 |
| C-dots-MnO ₂ -GSH | 7.4 | 691.8 | 1.3 | 1414.6 | 5.77 |