

The synthesis of nitrogen and sulfur co-doped graphene quantum dots for fluorescence detection of cobalt(II) ions in water

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1. Characterizations of N,S-GQDs

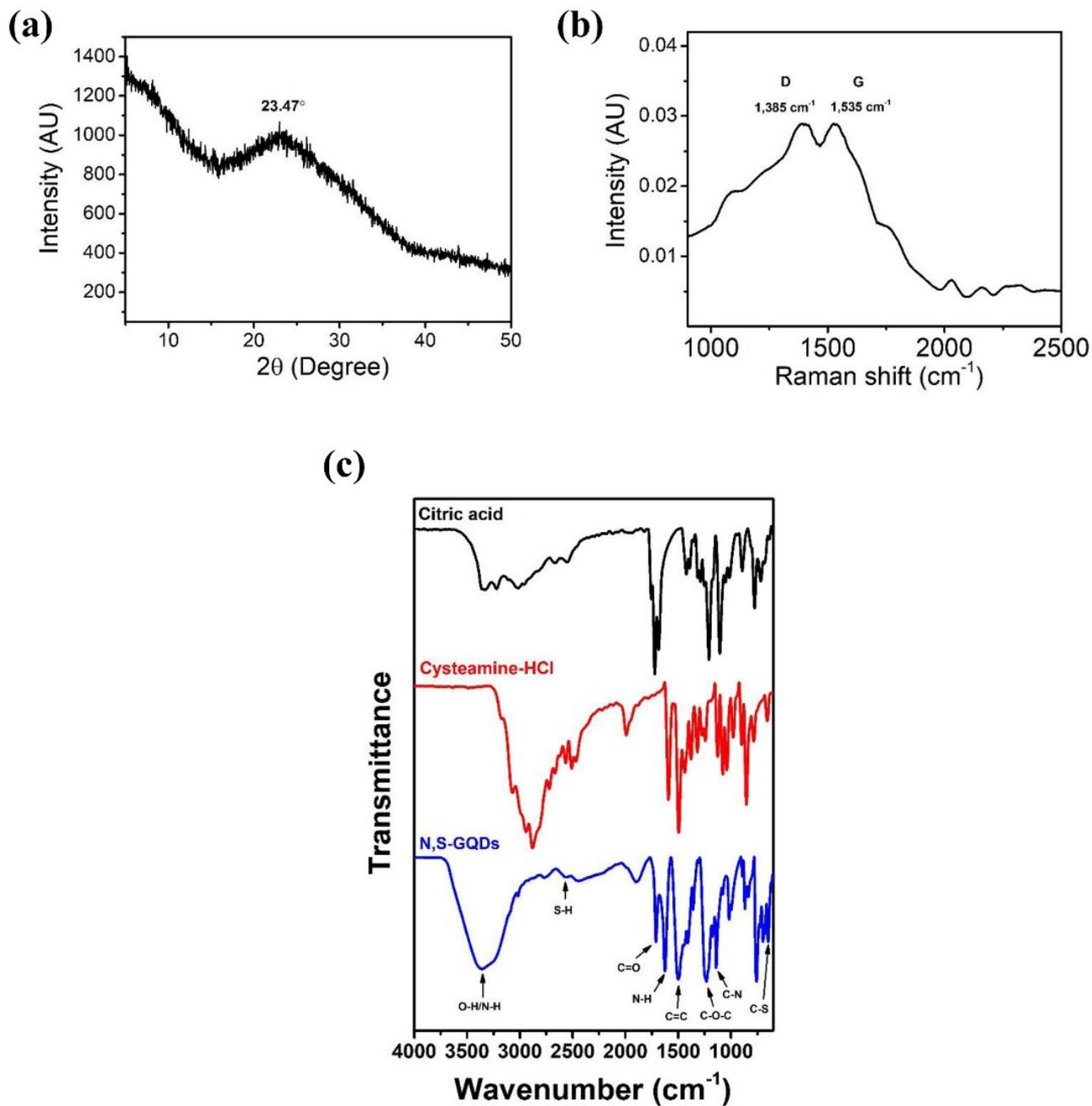


Fig. S1 (a) XRD patterns (b) Raman spectrum and (c) ATR-FT-IR spectra of N,S-GQDs.

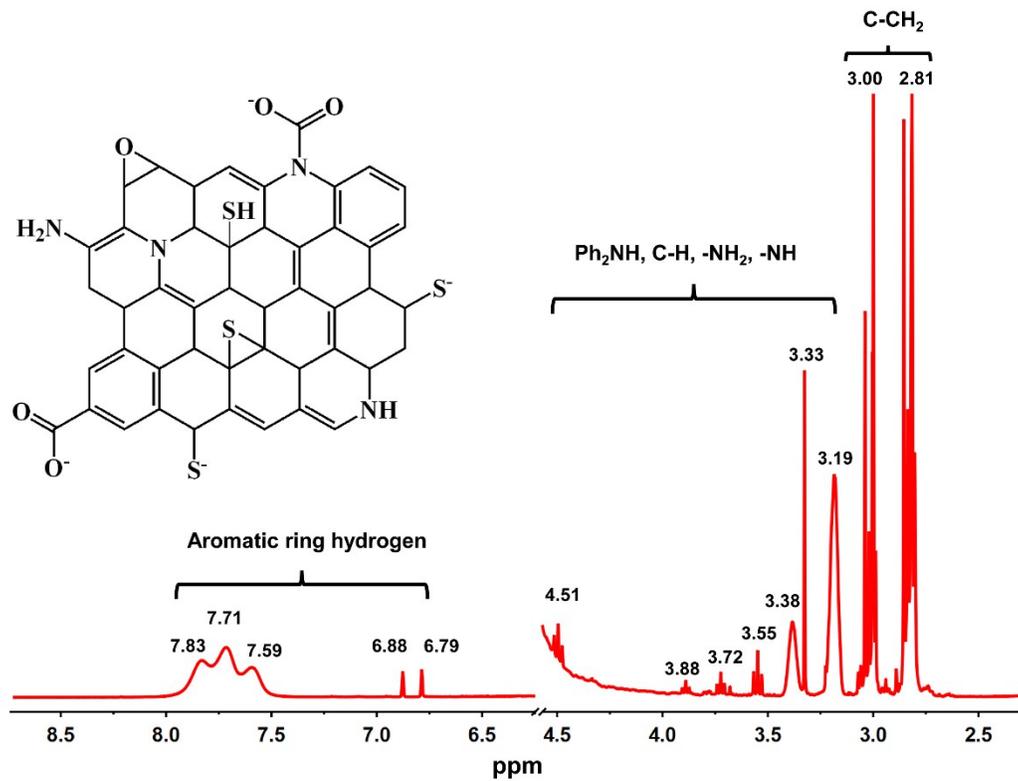


Fig. S2 $^1\text{H-NMR}$ spectrum of N,S-GQDs in D_2O .

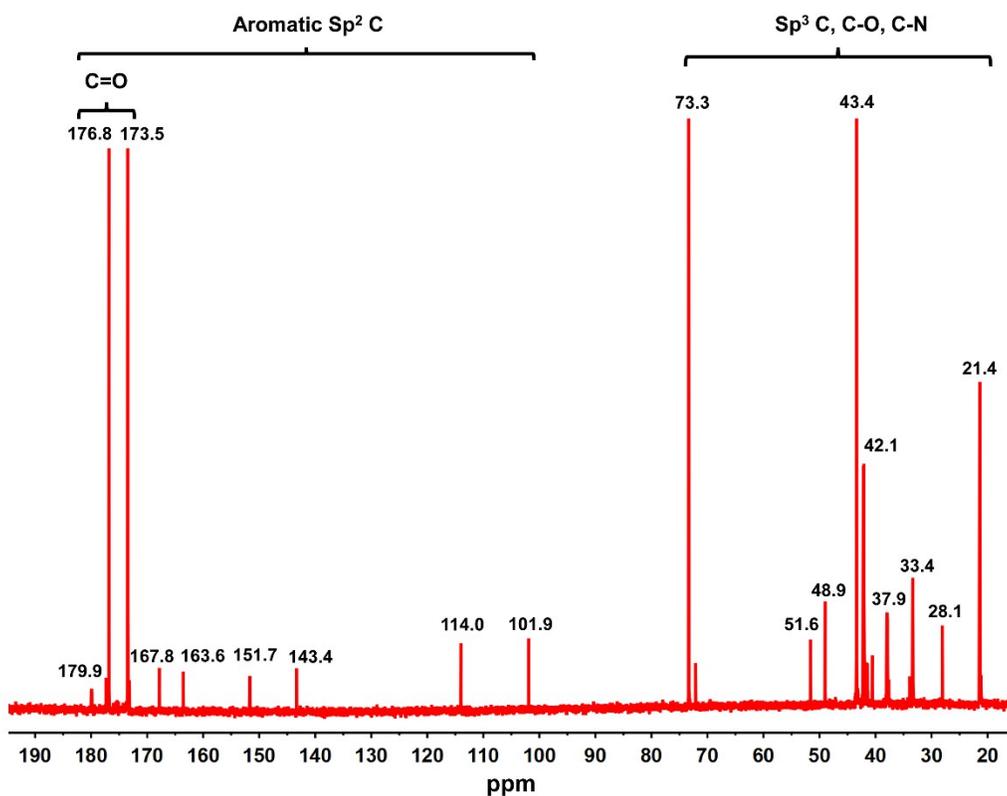


Fig. S3 $^{13}\text{C-NMR}$ spectrum of N,S-GQDs in D_2O .

2. Fluorescence quenching mechanism

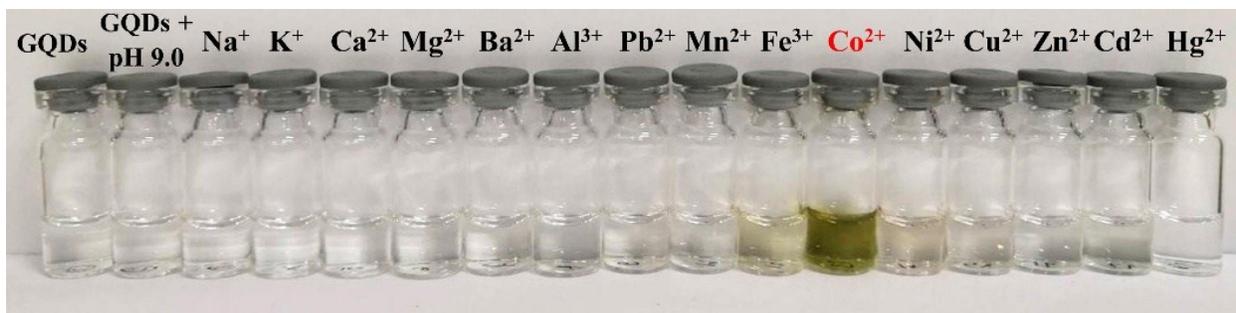


Fig. S4 Photo images of N,S-GQDs in the presence of the 20 mM N,S-GQDs in the presence of 1 mM of various cations in 2.5 mM Tris-HCl buffer solution pH 9.0.

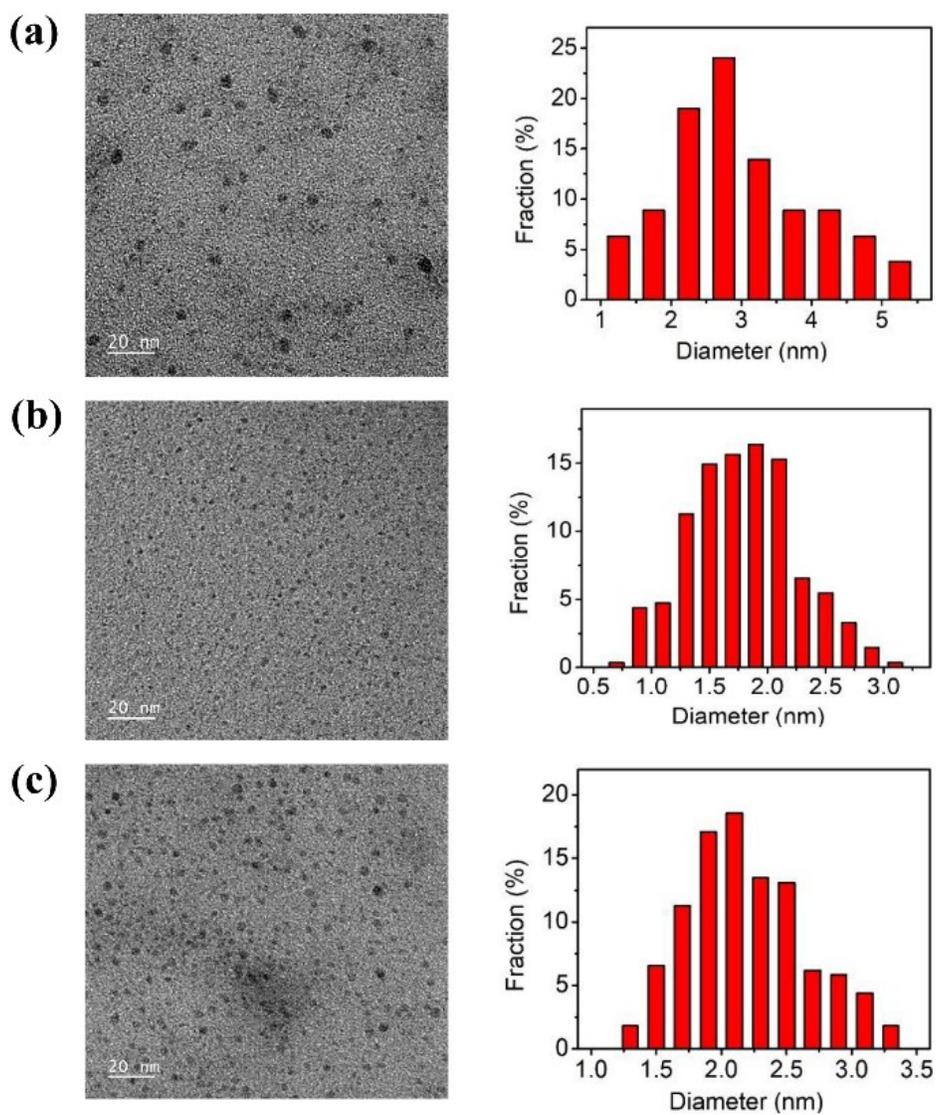


Fig. S5 TEM images and size distributions of (a) N,S-GQDs, (b) N,S-GQDs + Tris-HCl buffer pH 9.0, and (c) N,S-GQDs + Tris-HCl buffer pH 9.0 + Co²⁺.

Table S1. The conclusion of TEM results.

Samples	The particle size distribution (nm)	Average diameter (nm)	Counts
a. N, S-GQDs	1.1-5.4	3.0 ± 1.0	79
b. N, S-GQDs + Tris-HCl buffer pH 9.0	0.6-3.1	1.8 ± 0.5	275
c. N, S-GQDs + Tris-HCl buffer pH 9.0 + Co^{2+}	1.3-3.3	2.2 ± 0.4	275