Supporting Materials

Nitrogen, Copper-doped Carbon Quantum Dots with Intrinsic Peroxidase-like Activity for Double-signals Detection of Phenol

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**Fig. S1** FTIR spectrum of the N, Cu-CQDs.

**Fig. S2** The UV-vis absorption spectra of 4-AAP + H$_2$O$_2$ + phenol in the presence (black line) and absence (red line) of the N, Cu-CQDs.
Fig. S3 The UV-vis absorption spectra of four different systems.

Fig. S4 The UV-vis absorption spectra of the 4-AAP + H₂O₂ + phenol in the presence of the Cu-free CQDs (black line) or the N, Cu-CQDs (red line).
Fig. S5 (A) Fluorescence emission spectrum of the N, Cu-CQDs (black line) and UV-vis absorption spectrum of the N, Cu-CQDs/4-AAP/H$_2$O$_2$/phenol solution (red line). (B) Time-resolved decays of the N, Cu-CQDs before (black line) and after (red line) addition of H$_2$O$_2$, 4-AAP and phenol.

Fig. S6 Dependency of catalytic activity of N, Cu-CQDs on synthetic temperature.
Fig. S7 Dependency of catalytic activity of N, Cu-CQDs on reaction time.

Fig. S8 Time-dependent absorbance of the N, Cu-CQDs/4-AAP/H₂O₂ system with the addition of phenol at room temperature.
**Fig. S9** Absorption response of N, Cu-CQDs/phenol/4-AAP/H$_2$O$_2$ system at different pH values.

**Fig. S10** 4-AAP-dependent absorbance changes at 505 nm during the assay for peroxidase activity of the N, Cu-CQDs.
**Fig. S11** The H$_2$O$_2$-dependent absorbance changes at 505 nm during the assay for peroxidase activity of the N, Cu-CQDs.

**Fig. S12** The UV-vis absorption spectra of the N, Cu-CQDs/4-AAP/H$_2$O$_2$/phenol (black line, photograph a), N, Cu-CQDs/4-AAP/H$_2$O$_2$/phenol/K$_2$Cr$_2$O$_7$ (red line, photograph b) and N, Cu-CQDs/4-AAP/H$_2$O$_2$/phenol/TBA (blue line, photograph c).