Supplementary Materials

Rapid and sensitive detection of alkaline phosphatase and glucose oxidase activity through fluorescence and colorimetric dual-mode analysis based on CuO NPs@ZIF-8 mediated enzyme-cascade reactions

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Mass spectrometry analysis

All mass spectrometry (MS) experiments were performed on a Triple Quad 5500+ mass spectrometer (AB SCIEX, Singapore) equipped with standard ESI source. The reaction mixtures of CuO NPs@ZIF-8 + AAP + OPD, CuO NPs@ZIF-8 + ALP + AAP + OPD, CuO NPs@ZIF-8 + AAP + GOX +OPD, and CuO NPs@ZIF-8 + ALP + AAP + GOX + OPD were analyzed by MS, respectively. CuO NPs@ZIF-8, 100 μL; ALP (20.00 U/mL), 1 μL; AAP (10.00 mM), 600 μL; GOX (17.53 U/mL), 100 μL. The above reaction solutions were added into a 1.5-mL centrifuge tube, respectively. After incubation at 60 ℃ for 10 min, 600 μL of OPD (20.00 mM) was added into the above solution and incubated for another 10 min. Then, the solution after reaction was centrifugation for 1 min at 10000 rpm. Pass the supernatant through a 0.22 μm membrane and take 0.5 mL of supernatant for MS analysis. The MS analysis conditions are as follows. MS: scan range: 50–1000 *m/z*; Ion Source Gas 1, Atomization assisted heating gas 2, Curtain Gas, and Collision Gas are N_2, and the corresponding parameters are 50, 50, 30, and 9 psi. The heating temperature of Gas 2 is 500 ℃, the de-clustering voltage is 110 V, and the Ion spray voltage is 5500 V, respectively. All analyses were conducted in a positive ion mode.

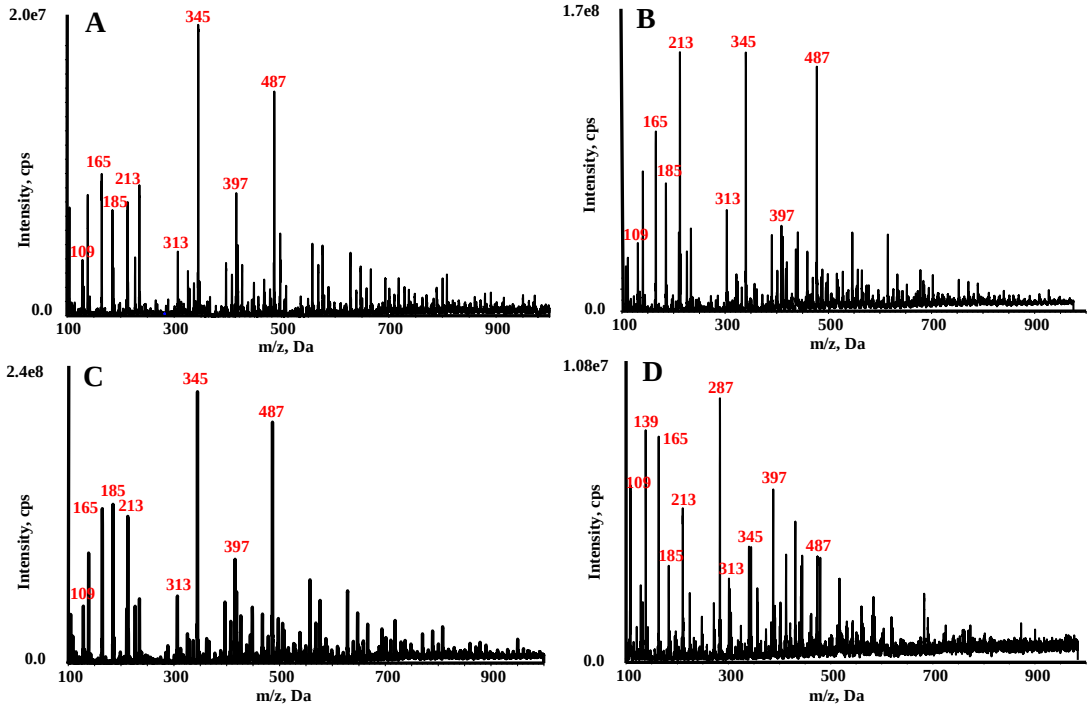

Fig. S1 Mass spectra of the reaction mixtures of CuO NPs@ZIF-8 + AAP + OPD (**A**), CuO NPs@ZIF-8 + ALP + AAP + OPD (**B**), CuO NPs@ZIF-8 + AAP + GOX +OPD (**C**), and CuO NPs@ZIF-8 + ALP + AAP + GOX + OPD (**D**)

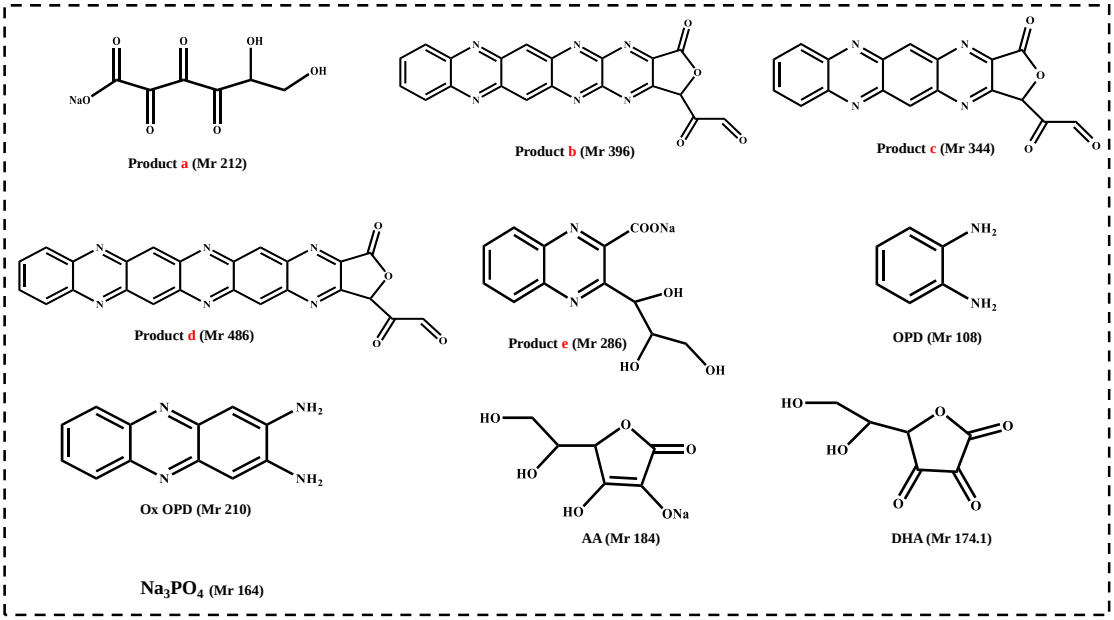

Fig. S2 The chemical structures of identified compounds

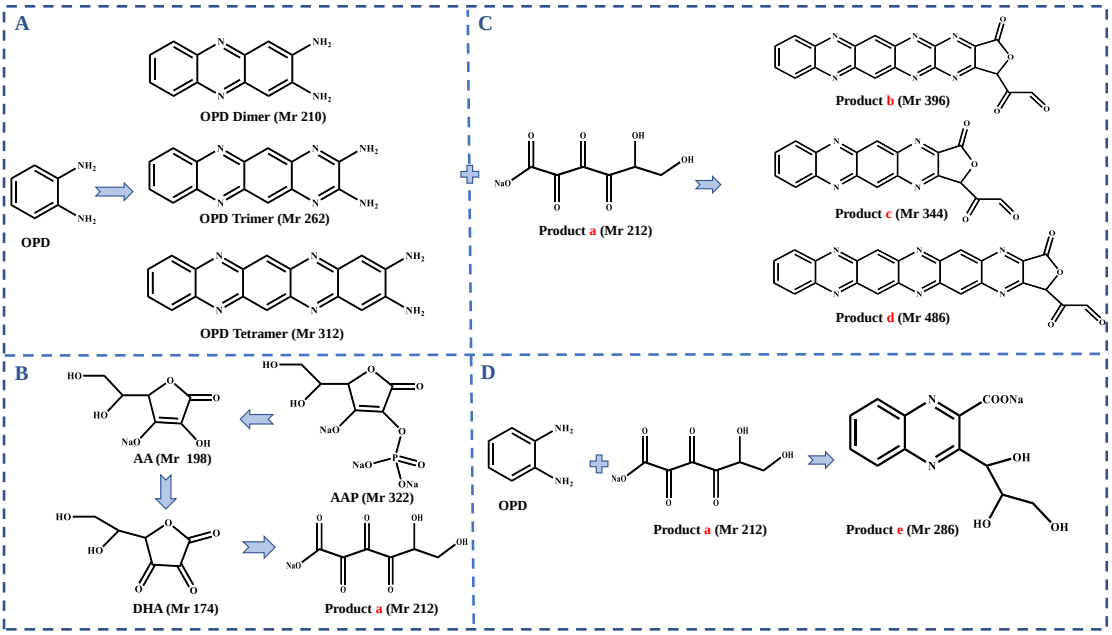

Fig. S3 The main possible catalytic reaction processes between CuO NPs@ZIF-8, AAP, and OPD.

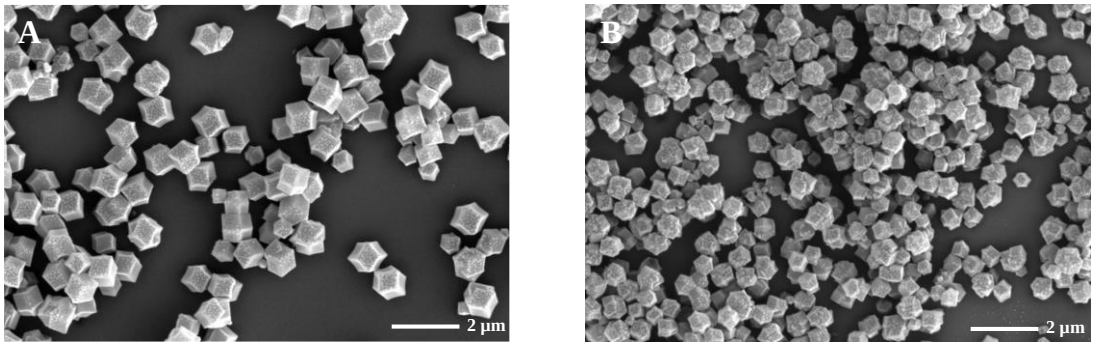

Fig. S4 The SEM images of CuO NPs@ZIF-8 with CuO NPs 5 mg (A) and 8 mg (B)

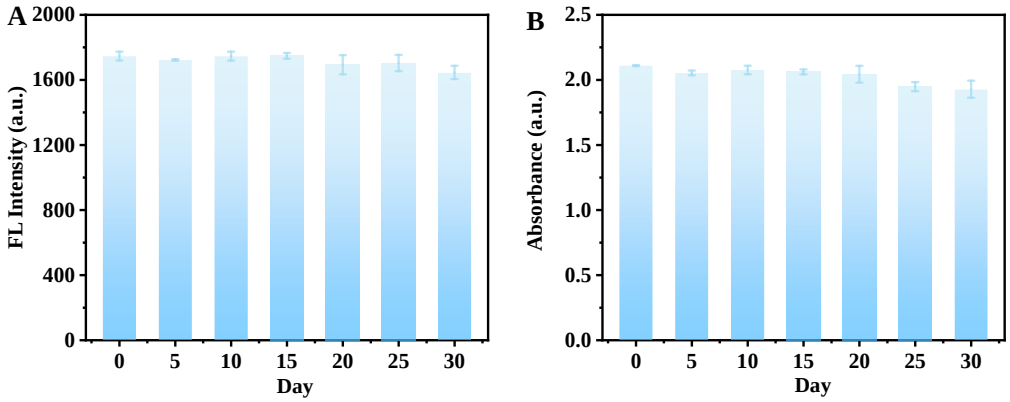

Fig. S5 The storage stability by fluorescence (A) and UV-Vis (B) analysis