

## Supporting materials

### Functionalized copper metal-organic framework with laccase-like activity for colorimetric detection of sodium ion in cigarette paper

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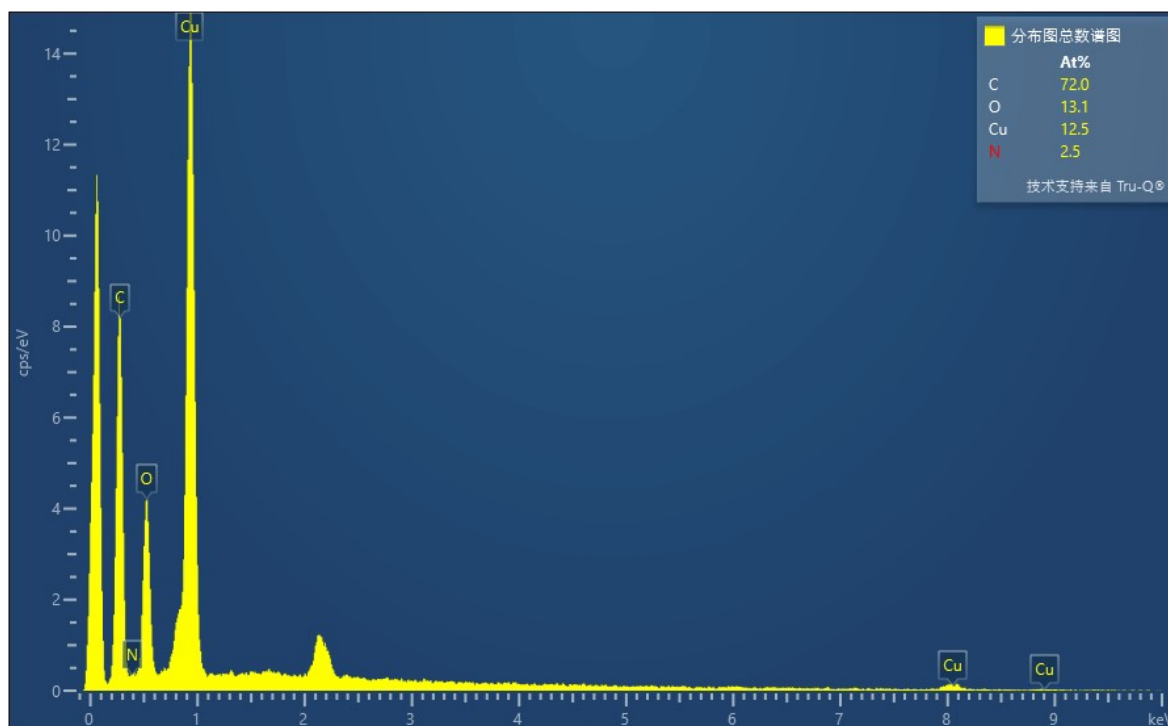
### 1.Experimental section

#### Assessment of catalytic stability

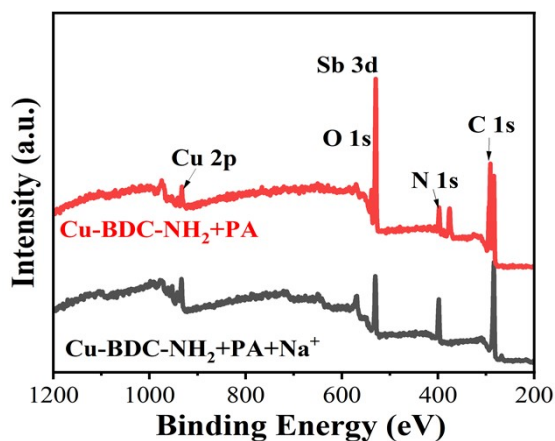
The Cu-BDC-NH<sub>2</sub> nanozyme was incubated for 7 h under different pH values (3 to 9), and then its catalytic activity was evaluated. The relative activity was compared with that at pH 7 to investigate the effect of pH. To study the thermal stability of Cu-BDC-NH<sub>2</sub>, it was stored at 14 to 74°C for 1 h, with the catalytic activity at 24°C as the reference, and then its catalytic activity was measured. Cu-BDC-NH<sub>2</sub> was dispersed in pure water and stored at 24°C. The remaining catalytic activity during storage was measured every other day for ten days. To measure the effect of ionic strength on catalytic activity, different concentrations of NaCl (0, 50, 100, 150, 200, 250, 300, and 350 mM) were added to the reaction. To investigate the effect of organic solvents on catalytic activity, different amounts of ethanol (0, 20%, 40%, 60%, 80%, and 100% by volume) were mixed with the reactants. In these experiments, the

catalytic reaction was allowed to proceed for 30 min, and then the absorbance of the supernatant was monitored at 505 nm. To assess the recyclability of Cu-BDC-NH<sub>2</sub>, 2,4-DP (20 mM, 100  $\mu$ L), 4-AP (20 mM, 100  $\mu$ L), and Tris-HCl buffer solution (pH 7.4) were mixed with 1 mg/mL of Cu-BDC-NH<sub>2</sub> (100  $\mu$ L) at 24°C for each cycle, which lasted for 30 min. The collected Cu-BDC-NH<sub>2</sub> was washed three times with Milli-Q water by centrifugation (8000 rpm, 10 min) and reused in the next reaction cycle.

## 2. Figures

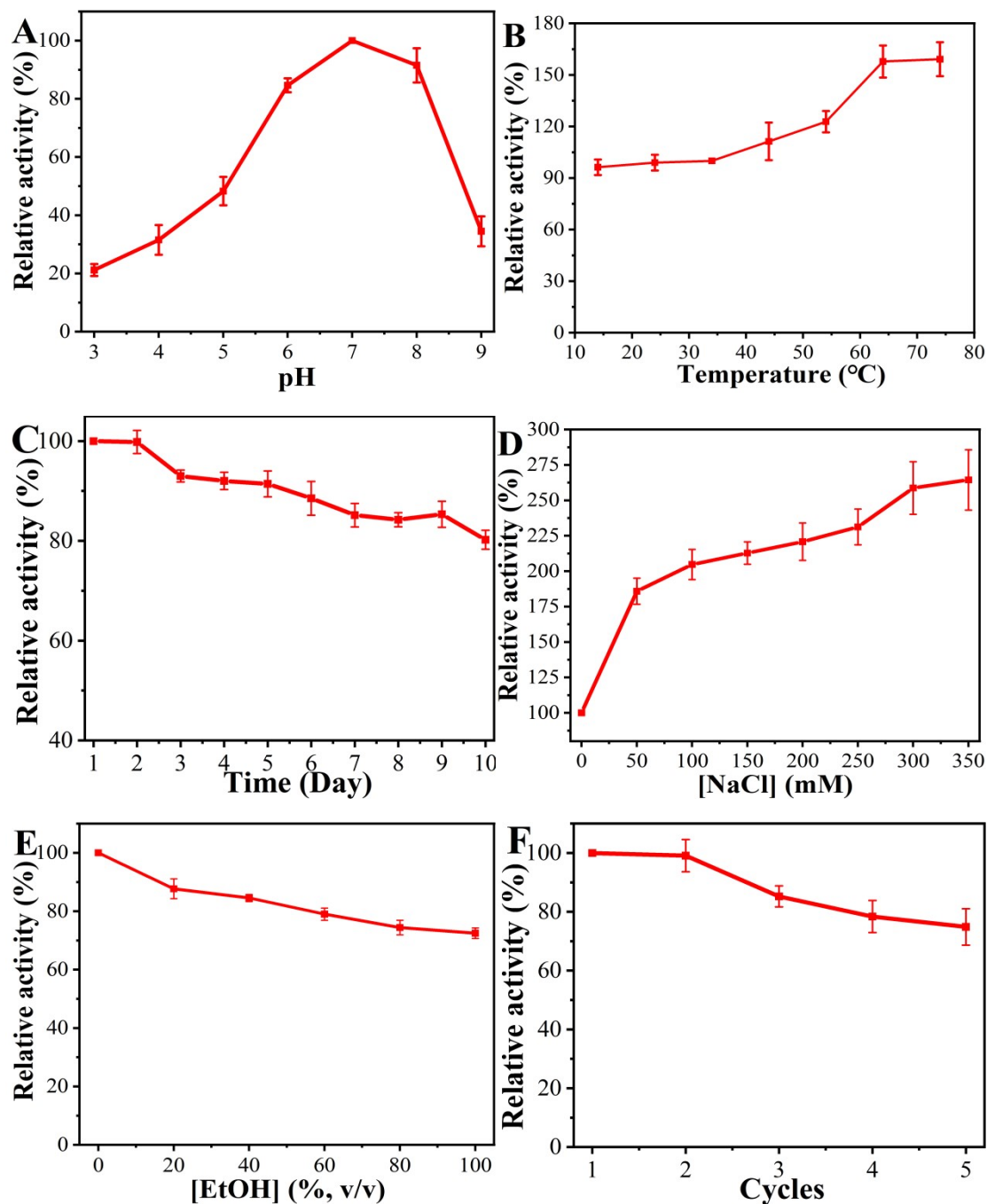


**Fig. S1. (A)** The EDXS spectrum spectra of Cu-BDC-NH<sub>2</sub>.



**Fig. S2.** XPS analysis of the variation in PA coverage on the surface of Cu-BDC-NH<sub>2</sub>

before and after the addition of  $\text{Na}^+$ .



**Fig. S3.** Stability of Cu-BDC-NH<sub>2</sub> at different (A) pH, (B) temperature, (C) storage time, (D) NaCl concentration and (E) content of ethanol. (F) Relative activity of Cu-BDC-NH<sub>2</sub> in the chromogenic reaction during the recycling and reuse process.

### 3. Table

**Table S1** The impact of Na<sub>2</sub>(PA) on the particle size and  $\zeta$  - potential of nanozymes

Nanozymes	PdI	Z-Average (d.nm)	Zeta Potential (mV)
Cu-BDC-NH <sub>2</sub>	0.185	1037	18.9
+PA+Na <sup>+</sup>	0.344	1444	-45.5
+PA+Na <sup>+</sup> (Washed)	0.233	1155	-29.5