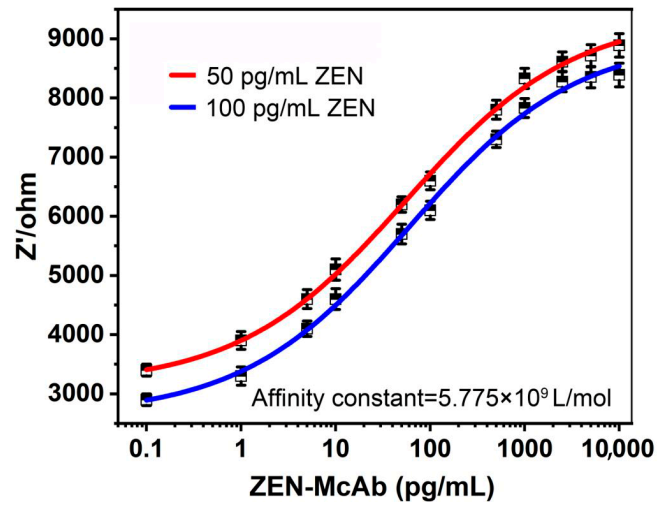


## Supplementary materials

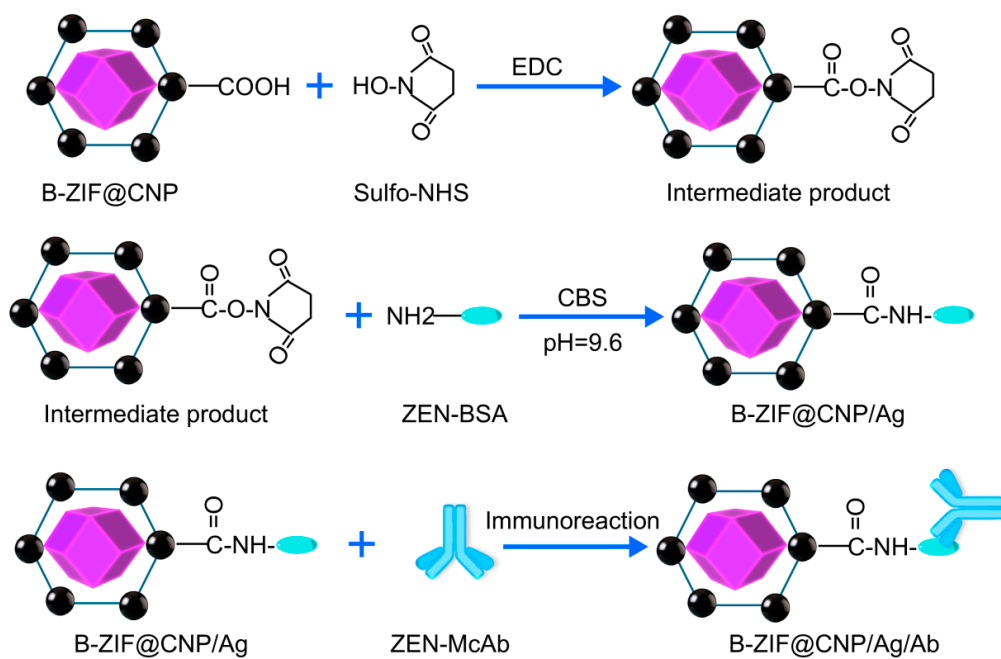
- 2 **Figure S1.** Affinity constant for ZEN-McAb.
- 3 **Figure S2.** Chemical reaction between B-ZIF@CNP and ZEN-BSA/ZEN-McAb.
- 4 **Table S1.** Electrochemical parameters for different modified electrodes.
- 5 **Table S2.** Electrochemical surface area (ECSA) for each electrodes.
- 6 **Table S3.** *t*-test results for intraday and interday measurements.
- 7 **Table S4.** Cross-reactivity of TCAE-bioanalysis for other analytes.
- 8 **Table S5.** Recovery of TCAE-bioanalysis in spiked sample.



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Figure S1. Affinity constant for ZEN-McAb.



**Figure S2.** Chemical reaction between B-ZIF@CNP and ZEN-BSA/ZEN-McAb.

**Table S1.** Electrochemical parameters for different modified electrodes.

Modified electrode	Rct (Ω)	Capacitive (C, μF)	i <sub>0</sub> (×10 <sup>-6</sup> A/cm <sup>2</sup> )	k <sub>0</sub> (×10 <sup>-5</sup> cm/s)
a	1279	5.2488	19.68301	65.17181
b	11094	5.2488	2.269932	7.515403
c	682	5.4375	328.9416	1089.609
d	1914	5.2053	11.71476	38.80112
e	3199	5.6326	7.006882	23.19736
f	8701	5.1557	2.576657	8.538633
g	15486	5.1364	1.448083	4.797251
Attachment	Zview software	I <sub>c</sub> =C× $\frac{dV}{dt}$	i <sub>0</sub> = $\frac{RT}{nFRct}$	k <sub>0</sub> = $\frac{i_0}{nFAC}$

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**Table S2.** Electrochemical surface area (ECSA) for each electrodes.

Modified electrode	Bare AuE	B-ZIF@CNP	B-ZIF@CNP /Ag	B-ZIF@CNP /Ag/Ab	B-ZIF@CNP /Ag/Ab/Anti-IgG-GOx
ECSA (cm <sup>2</sup> )	0.0706	0.1056	0.0637	0.0549	0.0390

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**Table S3.** *t*-test results for intraday and interday measurements.

	ZEN (pg/mL)	T value	P value
Intraday	1.0	0.272	0.799
	5.0	1.055	0.351
	10	1.651	0.174
	100	1.452	0.220
	1000	2.025	0.113
Interday	1.0	-0.232	0.828
	5.0	0.943	0.399
	10	1.612	0.182
	100	1.433	0.225
	1000	1.373	0.242

**Table S4.** Cross-reactivity of TCAE-bioanalysis for other analytes.

Analyte	IC <sub>50</sub> (pg/mL)	CR (%)
ZEN	30.8	100
Mixture	28.4	108.4
$\alpha$ -ZEL	421.3	7.31
$\beta$ -ZEL	607.5	5.07
$\alpha$ -ZAL	1987.1	1.55
$\beta$ -ZAL	2248.2	1.37
OTA	> 5000	< 0.62
AFB <sub>1</sub>	4738.5	0.65
DON	4338.0	0.71
FB1	> 10,000	< 0.31
Blank	> 10,000	< 0.31

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**Table S5.** Recovery of TCAE-bioanalysis in spiked samples.

Sample	Spiked (pg/g)	Found <sup>a</sup> (pg/g)	Recovery (%)	RSD (%)
Wheat	0	ND <sup>b</sup>	/	/
	50	54.1	108.2	7.6
	500	521.0	104.2	10.2
	5000	4870.5	97.4	6.9
Peanut	0	ND	/	/
	50	48.6	97.2	5.2
	500	516.5	103.3	9.3
	5000	4925.3	98.5	6.7
Feed	0	ND	/	/
	50	38.2	76.4	8.4
	500	514.0	102.8	8.9
	5000	4725.9	94.5	7.3
Attachment		T value=0.041	P value=0.967	

22 <sup>a</sup> Three replicates were performed, and extracts were performed 20-fold dilution.23 <sup>b</sup> ND: not detected, less than 17.4 pg/g of LOD for TCAE-bioanalysis.