Electronic Supplementary Material (ESI) for Sensors & Diagnostics.

Supplementary Materials

Ultrasensitive detection of flap endonuclease 1 using a chemiluminescence optical fiber biosensor with hybridization chain reaction

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Pretreatment of optical fiber

4 cm bare fiber (SFS400/440/700 T, numerical aperture 0.22. Wyoptics Technology Co., Ltd., Shanghai, China) was used to construct sensor in the assay. First, the distal end of optical fiber (about 1.5 cm) was immersed into chloroform solution for 10 min and then in 24% HF for 20 min to remove the acrylic sheath and silica cladding. After rinsing with 0.1 M HCl to get rid of impurities, the fiber was inserted in 0.1 M NaOH for 1 h to activate the silanol group on the surface. The obtained bare core of the optical fiber was washed with ultrapure water and dried by nitrogen gas.

Table S1 Sequences of DNAs used in the present study.

Name	Sequence (from 5 ’to 3’)
CP	COOH-TCACACCATGTCACTCCAGCAATTTGGAGTGACATG
H_1	TGGAGTGACATGGTGTGACATGTCACTCCAAATTGC-biotin
H_2	biotin-TCACACCATGTCACTCCAGCAATTTGGAGTGACATG
5’ flap	TGGAGTGACATGGTGTGA
T	CCCCACTCGCTGCAATCACTGAACGTTACTAGAT
D	TGGAGTGACATGGTGTGAGTGATTGCAGCGAGTGGGG-biotin
U	ATCTAGTAACGTTCAT

Table S2 Comparison of different methods for FEN1 determination.

Method	Detection system	LOD	Linear range	Ref
Reverse transcription polymerase chain reaction		semiquantitative		1
Western blot		qualitative		2
Immunohistochemistry		qualitative		3
Fluorescence method	DNA-Ag nanoclusters sensor	10 pM	20–1000 pM	4
Enzyme-assistant rolling circle amplification	Dumbbell DNA-SYBR green I fluorescence sensor	15 fM	20–8000 fM	5
Nt.BstNBI-induced tandem signal amplification*	G-quadruplex-thioflavin T fluorescence sensor	0.002-3.6 fmol (0.001−1.5 U)	1.68 amol (0.75 mU)	6
Enzyme-assistant exponential amplification reaction	DNA-SYBR green I fluorescence sensor	0.5 fM	1 fM–10 pM	7
Enzyme-free branched* hybridization chain reaction	DNA-$Ru(phen)_3^{2+}$ electrochemiluminescence sensor	0.052 fM (2.2×10^{-2} U/L)	0.16–1.4×10^4 fM (6.5×10^{-2}–6.5×10^3 U/L)	8
Enzyme-free Hybridization chain reaction	Chemiluminescent optical fiber sensors	3.4 fM	10 fM –74 pM	This work

*The unit of FEN1 was unified molar concentration according the conversion formula of 1 U/L = 2.4 fM which is obtained by New England biolabs Inc.

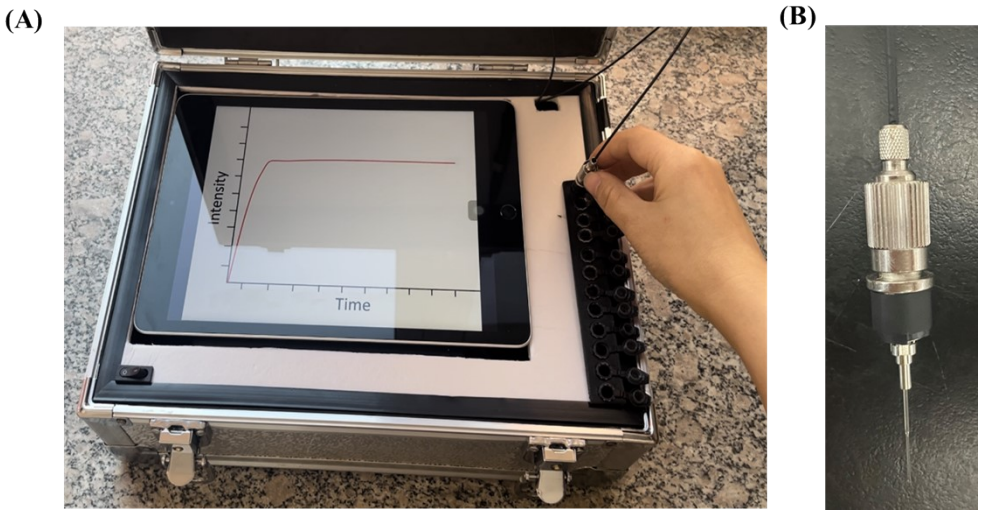

Fig. S1 The picture of the biosensor system (A) and optical fiber sensing unit (B).

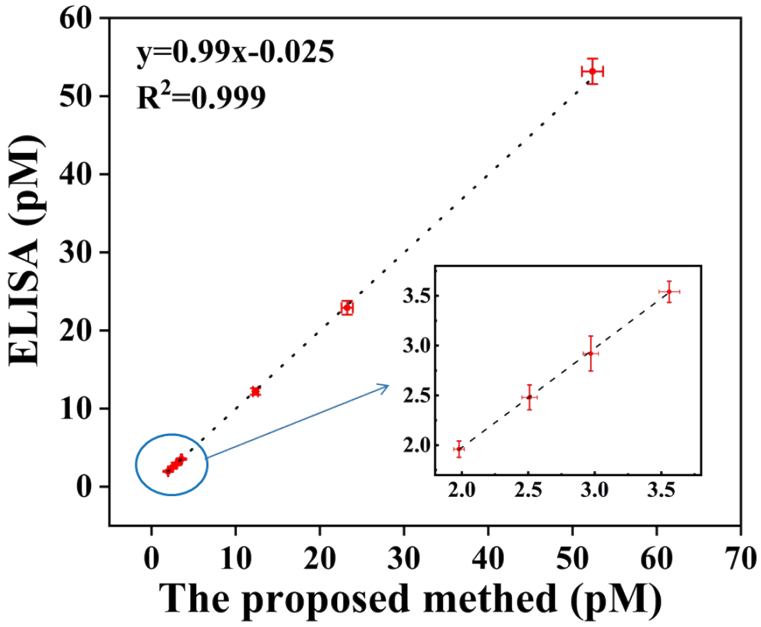

Fig. S2. Correlation between the proposed method and ELISA (n=5). The data shows 95% confidence interval of the mean.

Reference

1. K. Wang, C. Xie and D. Chen, *Int. J. Mol. Med.*, 2014, **33**, 1268-1274.
2. T. Nikolova, M. Christmann and B. Kaina, *Anticancer Research*, 2009, **29**, 2453-2460.
3. L. He, Y. Zhang, H. Sun, F. Jiang, H. Yang, H. Wu, T. Zhou, S. Hu, C. S. Kathera, X. Wang, H. Chen, H. Li, B. Shen, Y. Zhu and Z. Guo, *EBioMedicine*, 2016, **14**, 32-43.
4. B. Li, P. Zhang, B. Zhou, S. Xie, A. Xia, T. Suo, S. Feng and X. Zhang, *Anal. Chim. Acta.*, 2021, **1148**, 238194.
5. B. Li, A. Xia, S. Xie, L. Lin, Z. Ji, T. Suo, X. Zhang and H. Huang, *Anal. Chem.*, 2021, **93**, 3287-3294.
6. H. Yang, C. Wang, E. Xu, W. Wei, Y. Liu and S. Liu, *Anal. Chem.*, 2021, **93**, 6567-6572.
7. B. Zhou, L. Lin and B. Li, *Sens. Actuators B*, 2021, **346**, 130457.
8. X. Li, Y. Huang, J. Chen, S. Zhuo, Z. Lin and J. Chen, *Bioelectrochemistry*, 2022, **147**, 108189.