Label-free microfluidic paper-based electrochemical aptasensor for ultrasensitive and simultaneous multiplexed detection of cancer biomarkers

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Experimental

Preparation of AuNPs

A solution of 15 nm AuNPs was prepared according to a literature (Yang el al. 2009). Briefly, an aqueous solution of $HAuCl_4$ (0.01%, 50 mL) was heated and refluxed for 10min. After boiling, a solution of trisodium citrate (1%, 2.5 mL) was rapidly added to the refluxed $HAuCl_4$ solution. The solution was refluxed and stirred for an additional 15min. After being slowly cooled down to room temperature, 10 mL of the solutions were centrifuged at 8000 r/min for 10 min to remove surplus water and ions. Finally, 9.5 mL of supernatants were removed and diluted with 500 μL ethanol. The absorption peak of AuNPs was at 520 nm.

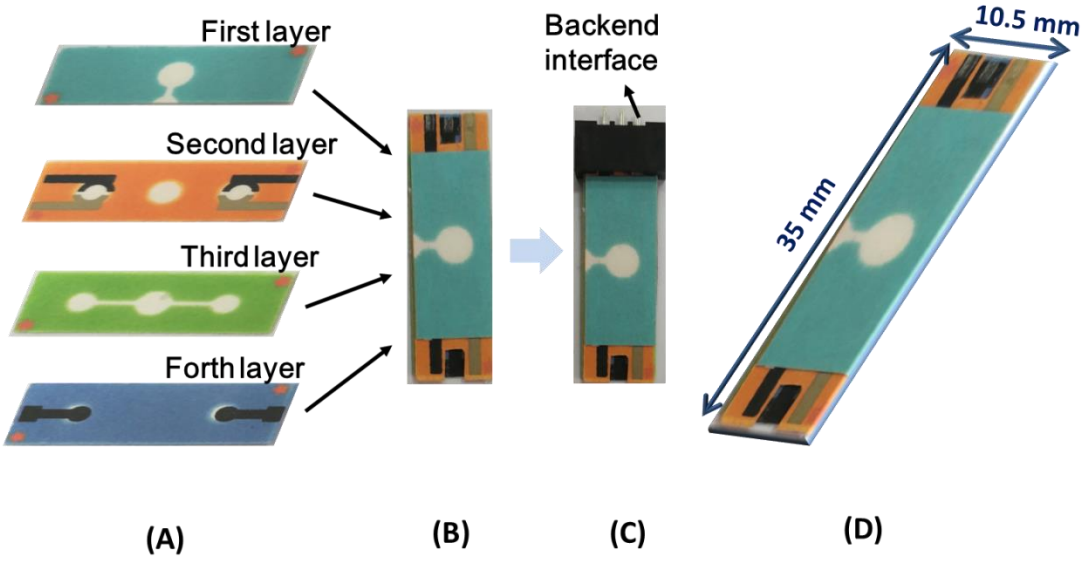

Fig.S1 Pictures of the two-parameter electrochemical paper-based device: (A) pictures of each layer of the device; (B) picture of the integrated paper-based device; (C) the paper-based device with backend interface; (D) the real size of the paper-based device.

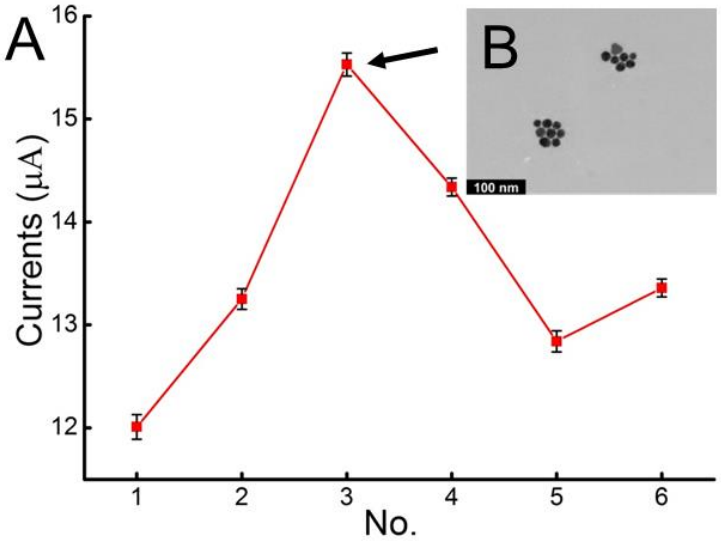

Fig.S2 (A) Effects of the size of AuNPs on DPV responses and (B) the TEM image of AuNPs with best DPV response.

Table.S1 Comparisons of different kinds of biosensors and their analytical properties towards CEA and NSE.

No.	Method	Linear Range (ng mL^{-1})		LOD (ng mL^{-1})		References
		CEA	NSE	CEA	NSE	
1	Fluorescence Immunoassay based on quantum dots	3~100	3~100	1	1	Li et al. 2011
2	Electrochemical immunosensors based on PANI derivatives	0.01~100	0.01~100	0.0063	0.0079	Wang et al. 2015
3	Fluoroimmunoassay based on dual-color quantum dots	1.25~80	1.25~80	0.625	0.625	Cao et al. 2011
4	Nanobeads-Based Lateral Flow Test Strip	1~50	1~50	0.094	0.045	Lu et al. 2017
5	SERS-based sandwich immunoassay	0.01~100	0.01~100	0.00148	0.00204	Song et al. 2016
6	Microfluidic paper-based electrochemical aptasensor	0.01~500	0.05~500	0.002	0.01	This work

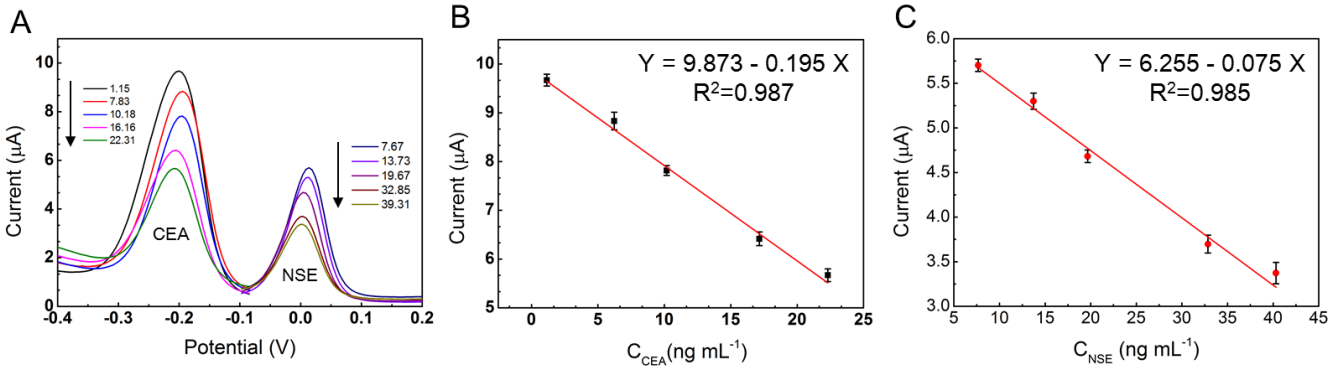

Fig.S3 Assay results of simultaneous multiplexed detection of CEA and NSE in clinical serum samples. (A) DPV responses to different concentrations of CEA and NSE antigens in clinical serum samples; (B) The calibration curve between the peak current and concentration of CEA; (C) The calibration curve between the peak current and concentration of NSE.

References

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