Electrochemical detection of two tumor markers based on functionalized polypyrrole microspheres as immunoprobes

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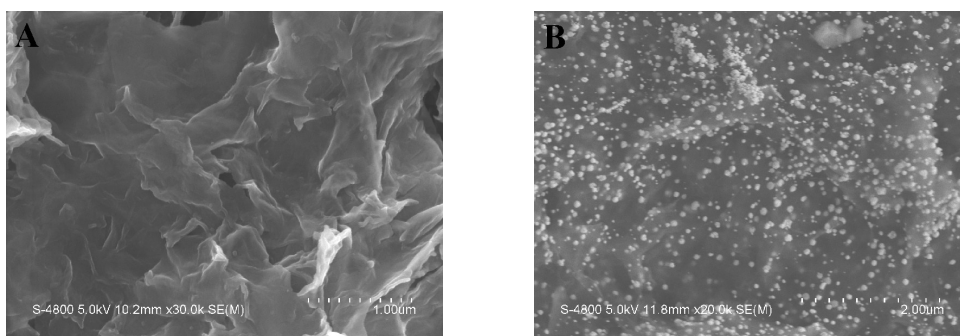E-mail address: zhyz65@mail.ahnu.edu.cn (Y. Zhang).

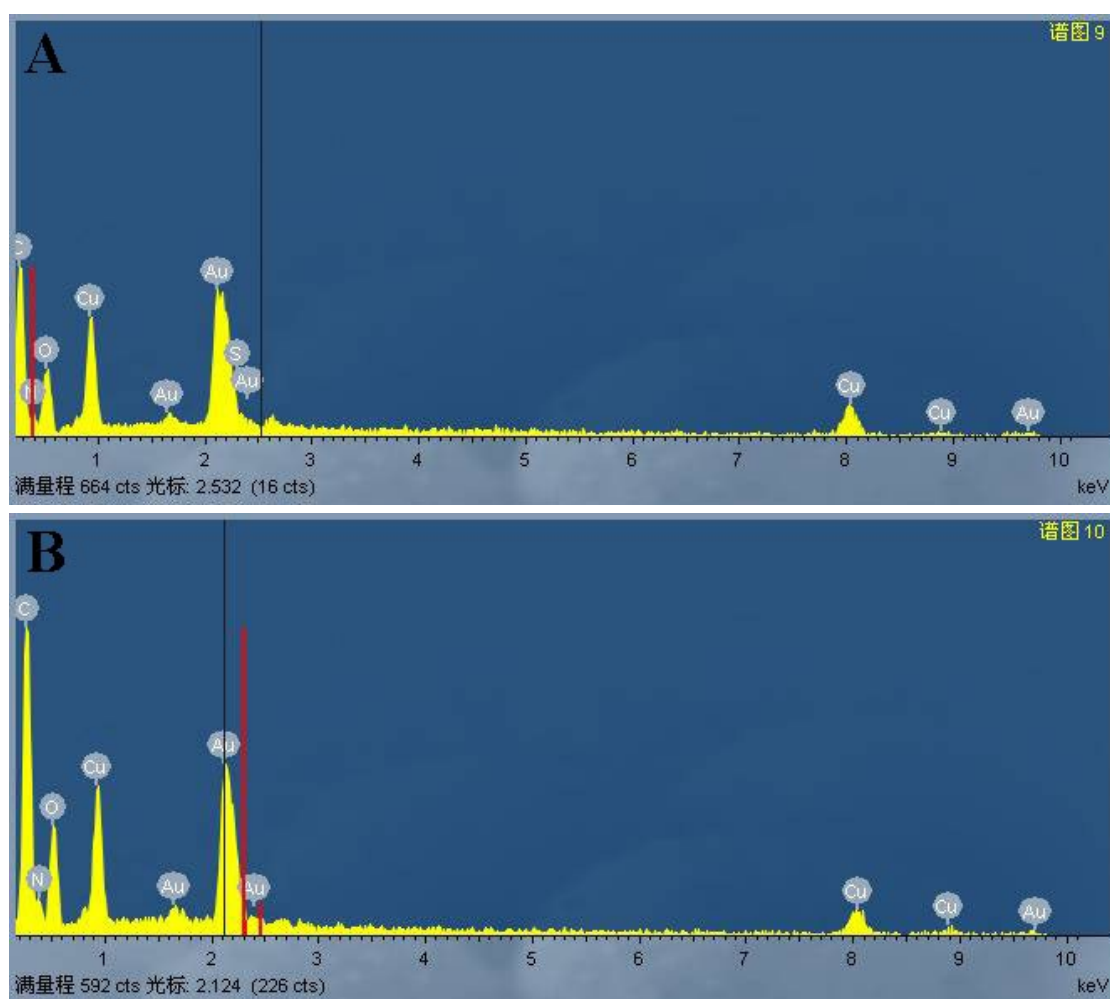Fig. 1S SEM analysis of (A) rGO, (B) rGO/Au NPs nanocomposites

Fig. 2S EDS analysis (Cu as the basement) of (A) PPy@thionine@Au NPs, (B) PPy@adriamucin@Au NPs nanocomposites
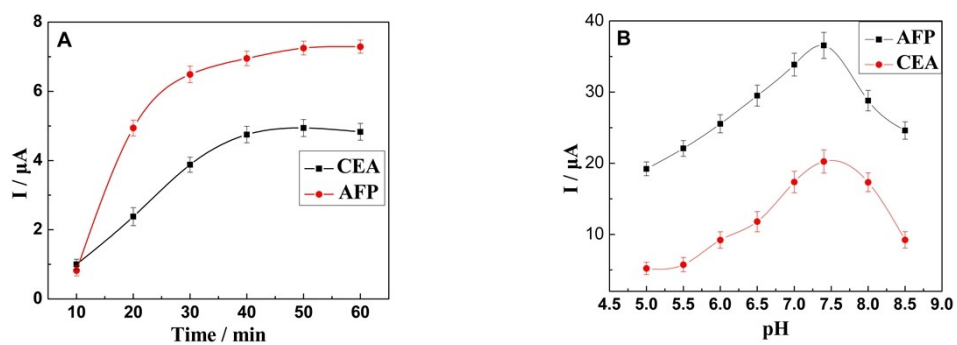
Fig. 3S Optimization of experimental conditions: (A) incubation time, (B) pH
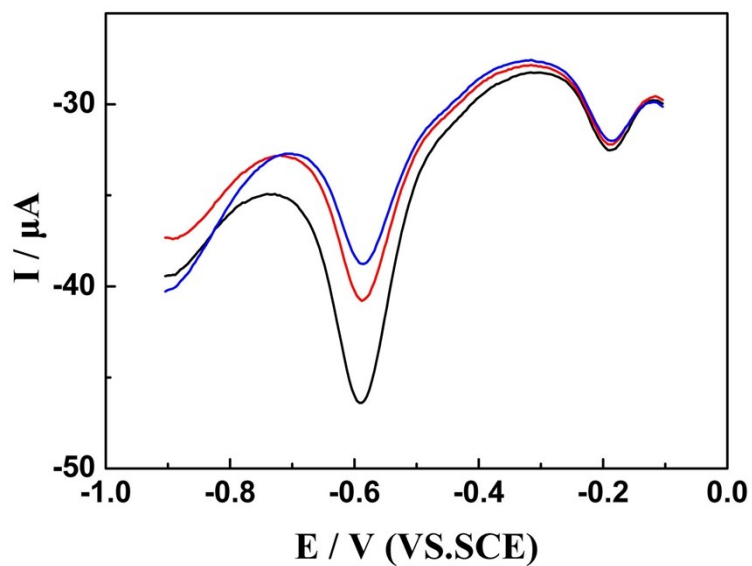

Fig. 4S The cross-reactivity investigation of immnuosensor using DPV technology in the presence of 0.01 ng mL^{-1}

CEA and various AFP concentriations (0.01 ng mL^{-1}, 0.05 ng mL^{-1},0.1 ng mL^{-1}).

Table 1S Comparison of several electrochemical immunosensors

	Line arrange (ng mL^{-1})		Detection limit (ng mL^{-1})		References
	CEA	AFP	CEA	AFP	
Magneto-controlled graphene immunosensing platform and distinguishable signal tags	0.01-80	0.01-200	0.001	0.001	[24]
A label-free Immunosensor based on modified mesoporous silica	0.5-45	1-90	0.2	0.5	[25]
Immunoassay of biomarkers using chitosan nanocomposites	0.05-100	0.05-100	0.02	0.03	[26]
Immunoassay using HRP-functionalized Pt hollow nanospheres	0.5-50	0.3-45	0.05	0.08	[27]
Immunoassay using functionalized grapheme nanocomposites	0.6-80	0.6-80	0.12	0.08	[28]
This work	0.001-50	0.001-80	0.0004	0.00033	

Table 2S The recovery experiment in serum samples

Serum sample	added (ng/mL)		found (ng/mL)[a]		Recoveries (%)	
	CEA	AFP	CEA	AFP	CEA	AFP
1	0.1	0.1	0.107	0.098	107	98
2	1.00	1.00	0.995	0.998	99.5	99.8
3	10.0	10.0	10.48	9.87	104.8	98.7
4	40.0	40.0	40.25	39.98	100.6	99.9
5	50.0	50.0	51.23	49.16	102.5	96.3

a Mean value of five measurements