Supporting Information

A self-powered electrochemical aptasensor for detection of 17β-estradiol based on carbon nanocages/gold nanoparticles and DNA bioconjugate mediated biofuel cells

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Supporting figure captions:

Fig. S1 SEM images of (A) PB and (B) PB@PDA.

Fig. S2 (A) SEM and (B) TEM images of prepared CNCs.

Fig. S3 XPS spectra of (A) C 1s and (B) Au 4f of CNCs/AuNPs nanocomposite.

Fig. S4 CV plots of CNCs/AuNPs/ITO biocathode in the absence (a) and presence (b) of 5 mM glucose in 100 mM PBS (pH 7.4).

Fig. S5 Feasibility of the proposed BFCs-based electrochemical aptasensor. E^{OCV} responses of BFCs-based electrochemical aptasensor in absence (a) and presence (b) of 0.1 ng/mL E2 in 100 mM PBS (pH 7.4).

Fig. S6 Optimization of experimental parameters. The effects of concentrations of (A) $Fe(CN)_6^{3-}$, (B) aptamer, (C) incubation time of PMNPs and aptamer, and (D) incubation time of E2 and PMNPs@aptamer on E^{OCV} response of BFCs-based electrochemical aptasensor. The assays were carried out in 100 mM PBS (pH 7.4) containing 1 ng/mL E2.

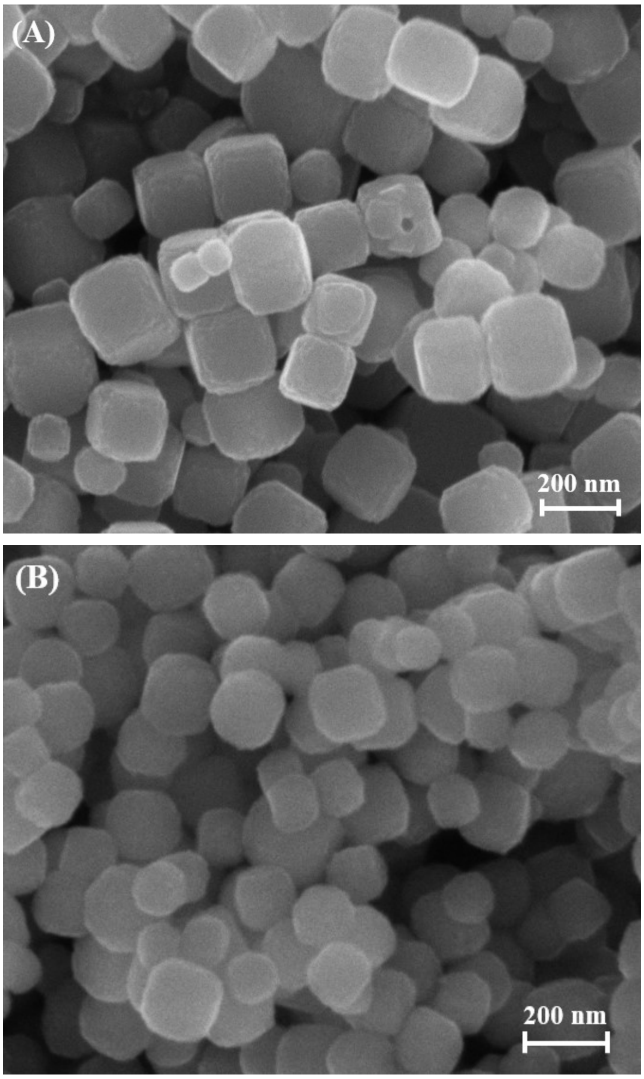
Fig. S7 Stability of BFCs-based self-powered electrochemical aptasensor.

Table S1

Comparison of the analytical performances of BFCs-based self-powered aptasensor with other sensors for E2 detection

Table S2

Determined results of E2 in milk and tap water samples using proposed method



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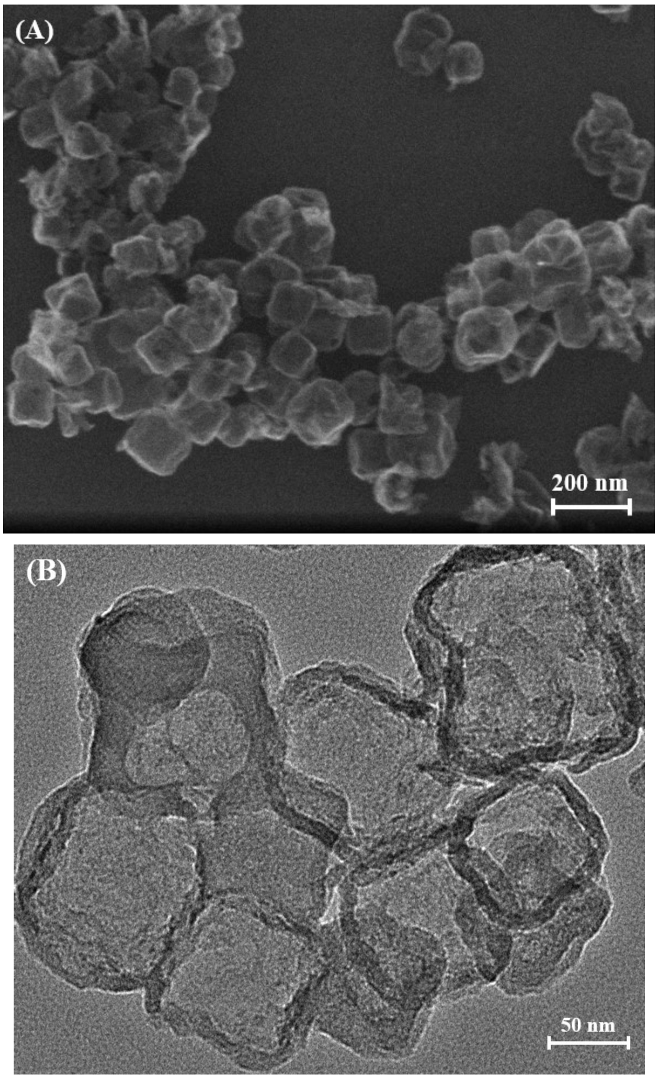

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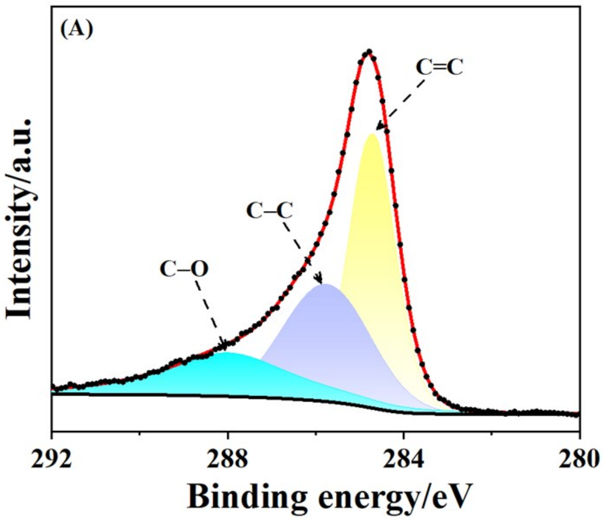

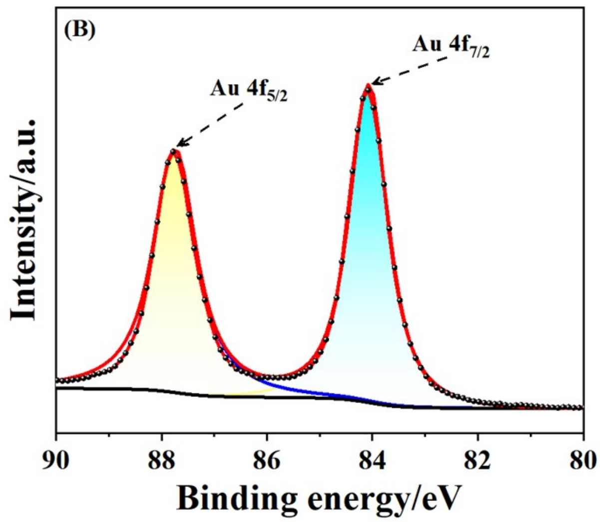

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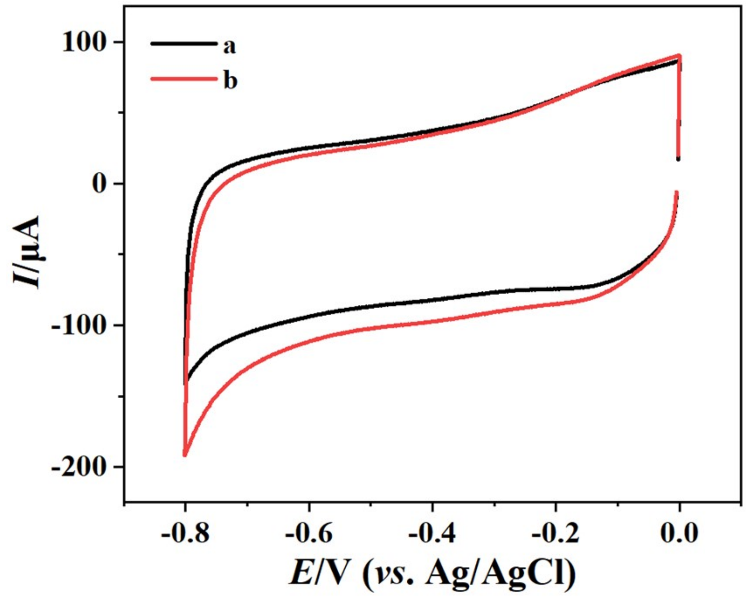


Fig. S4 CV plots of CNCs/AuNPs/ITO biocathode in the absence (a) and presence (b) of 5 mM glucose in 100 mM PBS (pH 7.4).

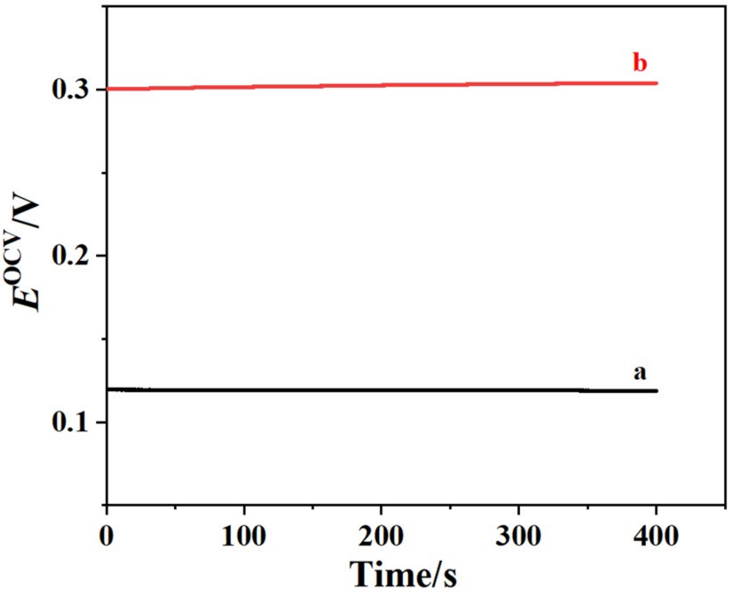
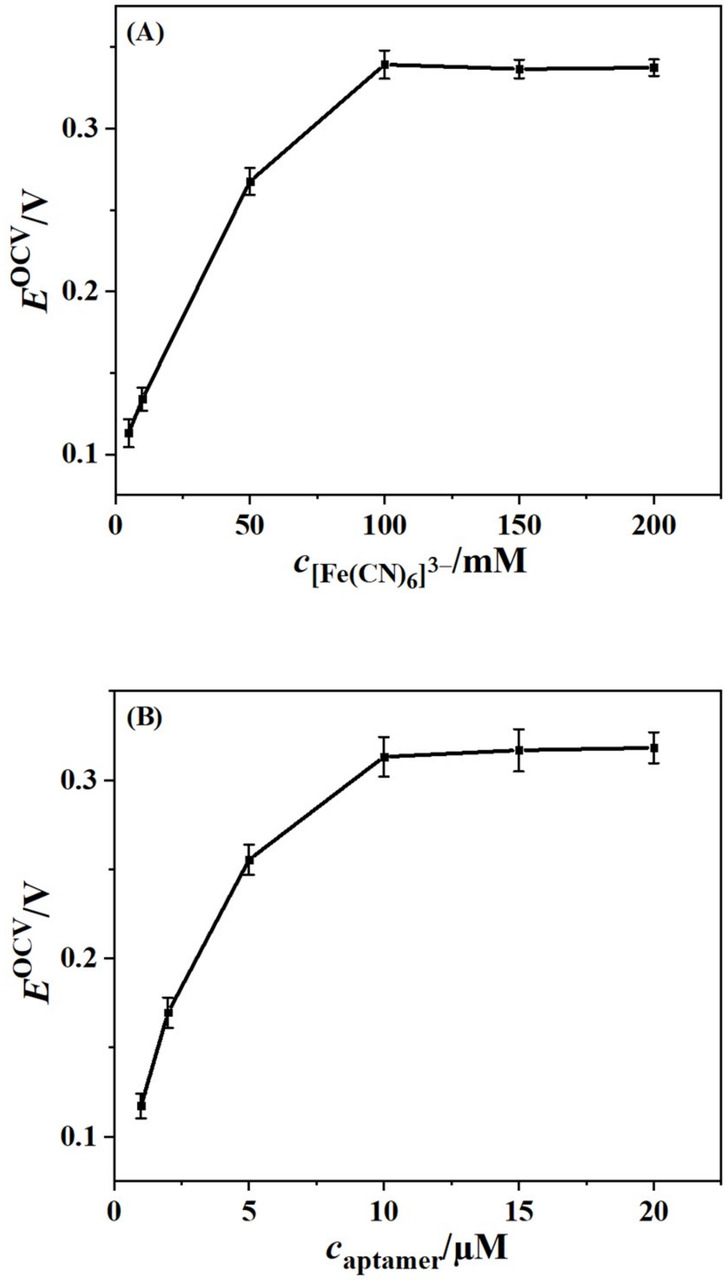
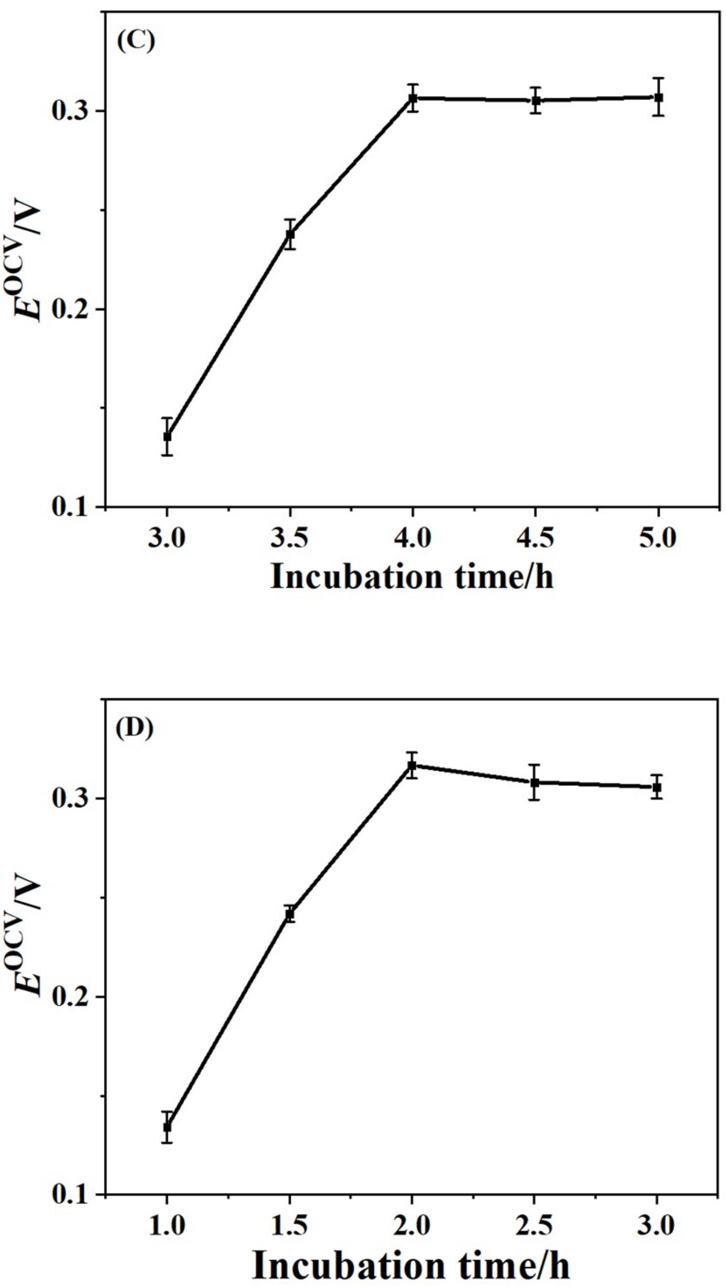


Fig. S5 Feasibility of the proposed BFCs-based electrochemical aptasensor. E^{OCV} responses of BFCs-based electrochemical aptasensor in absence (a) and presence (b) of 1 ng/mL E2 in 100 mM PBS (pH 7.4).


(A)
0.3
0.2
0.1
E^{OCV}/V
0
50
100
150
200
$c_{[Fe(CN)_6]^{3-}}$/mM
(B)
0.3
0.2
0.1
E^{OCV}/V
0
5
10
15
20
$c_{aptamer}$/μM



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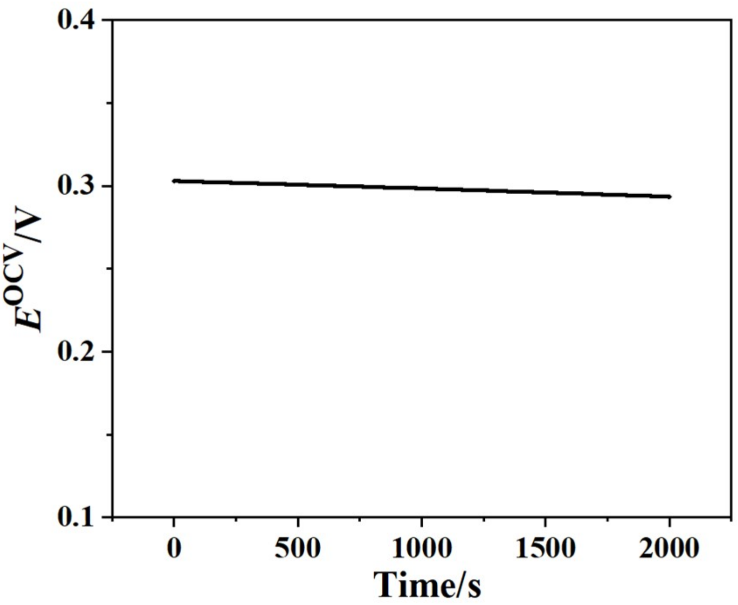

Fig. S7 Stability of BFCs-based self-powered electrochemical aptasensor.

Table S1

Comparison of the analytical performances of BFCs-based self-powered aptasensor with other sensors for E2 detection

Strategy	Technique	Linear range ($pg\ mL^{-1}$)	LOD ($pg\ mL^{-1}$)	Ref.
AuNPs-aptamer	CL	$10^2 – 10^8$	100	1
AuNPs-Ab	CL	$3 – 10^5$	3	2
MIL-53-aptamer/$RuSiO_2$-cDNA	FL	$136 – 2.7\times10^5$	54.5	3
CQDs-aptamer/Fe_3O_4-cDNA	FL	$2.7 – 2.7\times10^5$	0.95	4
$Ru(bpy)_3^{2+}$-aptamer/cDNA	ECL	$2.7 – 2.7\times10^3$	0.3	5
Ru(II) derivative-$InVO_4$/β-$AgVO_3$	ECL	$0.27 – 2.7\times10^4$	0.07	6
$ZnIn_2S_4$@NH_2-MIL-125(Ti)/ PDA NS/Mn:ZnCdS QDs-Ab	PEC	$0.5 – 2\times10^4$	0.3	7
CdS@C NRs/ALP-aptamer	PEC	$272 – 6.8\times10^4$	100	8
split aptamer-3D DNA walker	EC	$0.27 – 1.36\times10^5$	0.076	9
MWCNTs/thionine/AuNPs/SPWE	EC	$10 – 10^5$	10	10
SnS_2-aptamer	PFCs	$272 – 1.36\times10^4$	33	11
CNCs/AuNPs-DNA bioconjugate	**BFCs**	**$0.5 – 1.5\times10^4$**	**0.16**	**This work**

Table S2

Determined results of E2 in milk and tap water samples using proposed method

Samples	Spiked ($ng\ mL^{-1}$)	Found ($ng\ mL^{-1}$)	Recovery (%)	RSD (%)
Milk	0	–	–	–
	1.0	1.04	104.0	1.6
	5.0	5.04	100.8	4.2
	15.0	14.64	98.2	3.4
Tap water	0	–	–	–
	1.0	1.02	102.0	1.5
	5.0	4.82	96.4	4.1
	15.0	14.76	98.8	3.6

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