

## Rapid Quantitative Detection of Live *Escherichia coli* Based on Chronoamperometry

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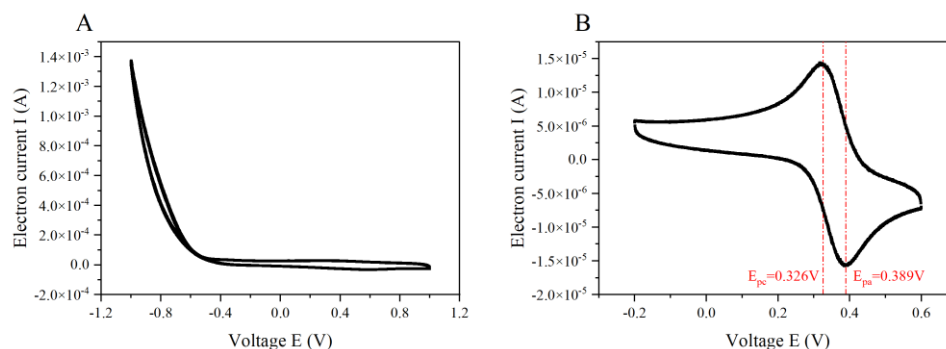
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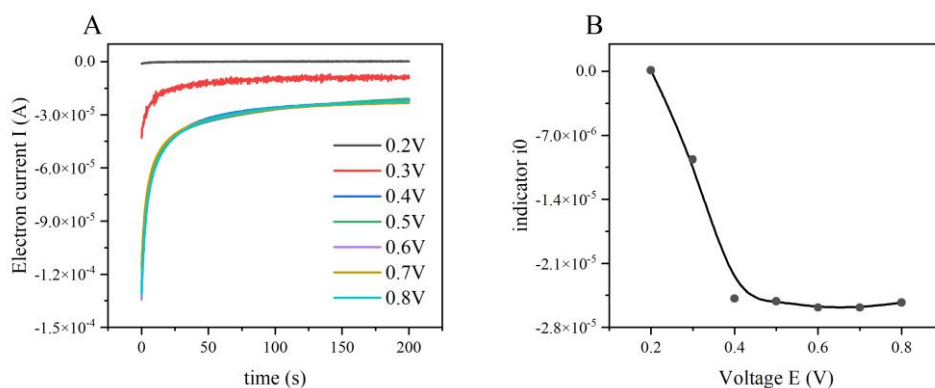
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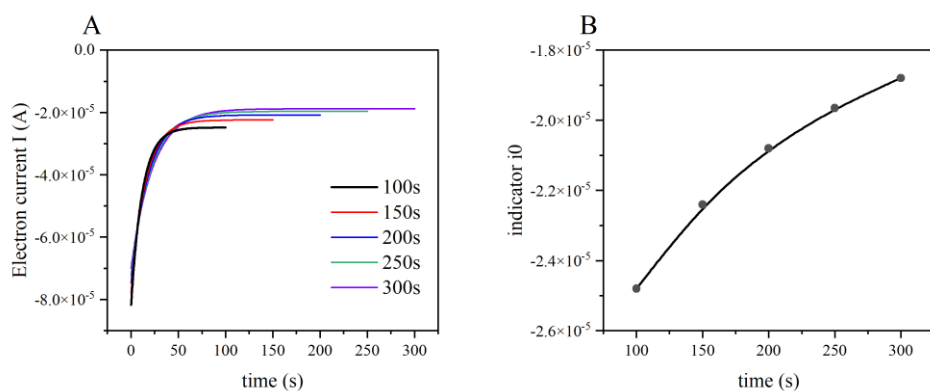
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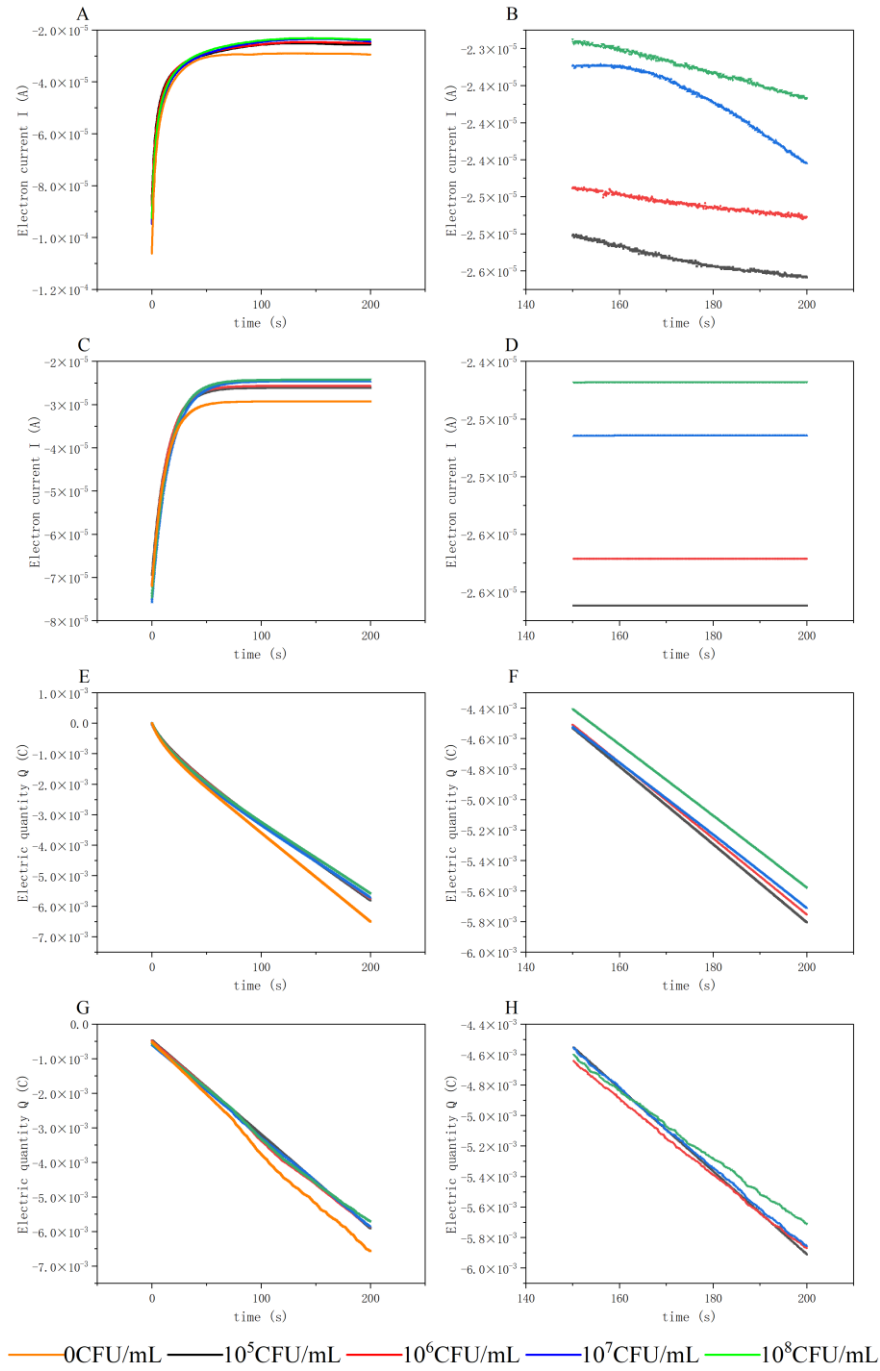
**Figure S1.** GCE activation process. A, activation cyclic voltammogram; B, detection cyclic voltammogram. After activation,  $\Delta E_p$  was  $< 80$  mV, and the peak current ratio was around 1:1, confirming that the GCE surface was free of impurities and that the reaction was sensitive.



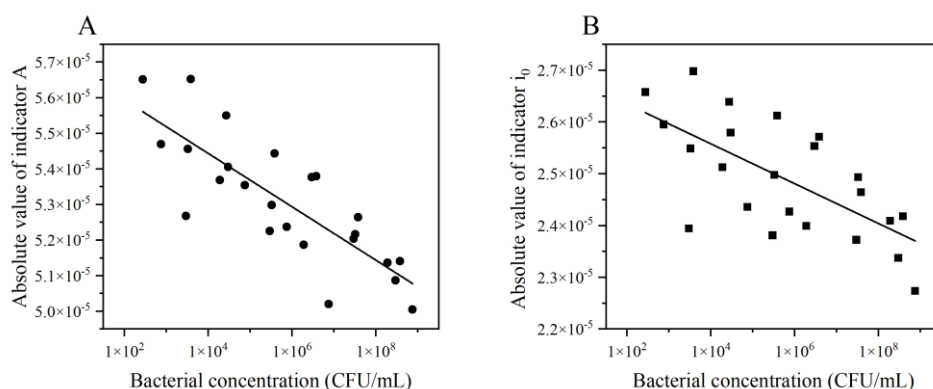
**Figure S2.** Step voltage selection. A, the response current under different step voltages; B, the stable current  $i_0$  under different step voltages. When the step voltage was  $> 0.5$  V, the stable current  $i_0$  did not change with the voltage, and the electrochemical process was controlled by diffusion. To ensure the stability of the electrochemical process, the step voltage used was 0.6 V.



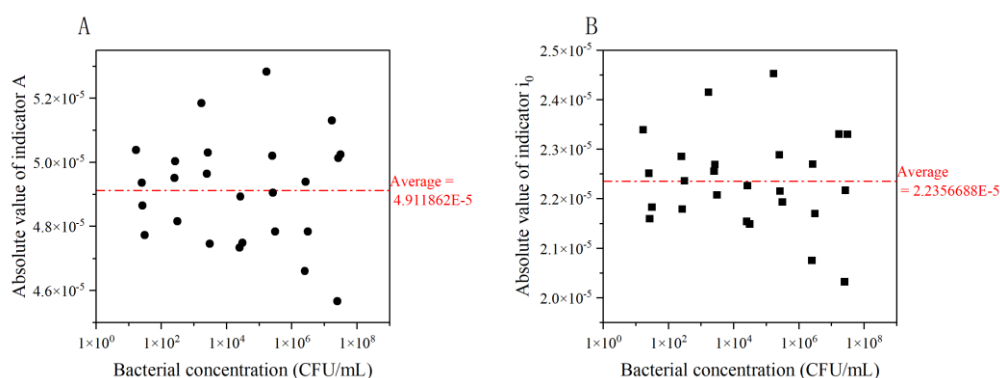
**Figure S3.** Detection time selection. A, the response current under different detection times; B, the stable current  $i_0$  under different detection times. When the detection time reached 200 s, the current was basically stable. Excessively high detection time might lead to the accumulation of surface-adsorbed *E. coli*, affecting the detection result. Therefore, the detection time used was 200 s.



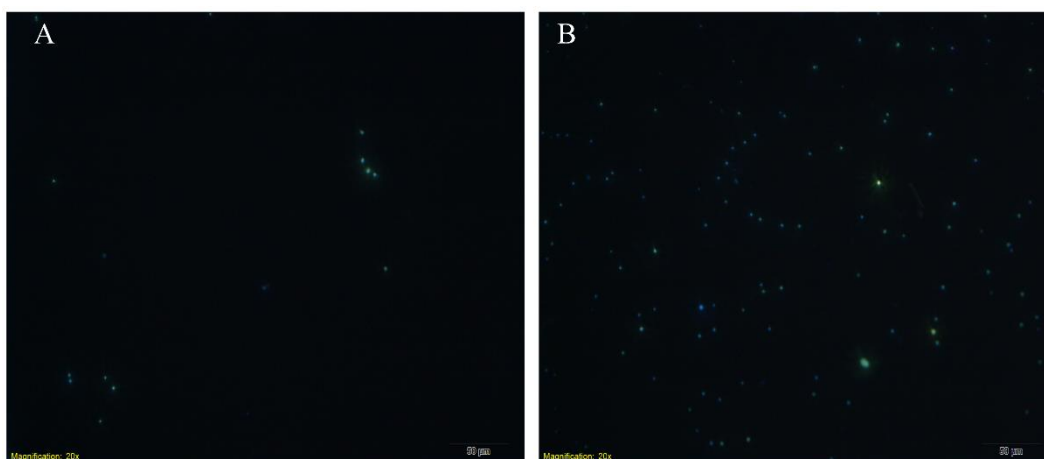
**Figure S4.** Schematic diagram of curve fitting. A and B, original  $i-t$  curve; C and D, fitted  $i-t$  curve; E and F, original  $Q-T$  curve; G and H, fitted  $Q-T$  curve.



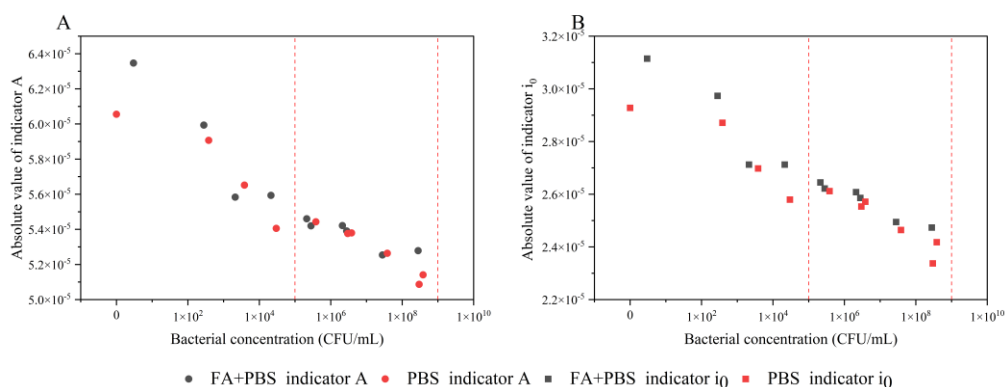
**Figure S5.** Electrochemical response of the different electrode system to bacterial solution. A, electric quantity index; B, electric current index.



**Figure S6.** Electrochemical response of *S. aureus*. A, electric quantity index; B, electric current index. Under the same detection method, the electrochemical response of *S. aureus* was completely different from that of *E. coli*, and there was no similar correlation observed in the diagram, so the method of quantify *E. coli* was unsuitable for the analysis of *S. aureus*. This might be because the degree of adsorption of *S. aureus* on the GCE surface had a limited effect on the electrochemical process, but in fact the electrochemical process was still controlled by diffusion.



**Figure S7.** Fluorescence microscopy of the electrode surface after the electrochemical detection of *S. aureus*. A, electrode surface with  $10^5$  CFU/mL bacteria and B,  $10^8$  CFU/mL bacteria. When the concentration of *S. aureus* was the same as that of *Escherichia coli*, the amount of *S. aureus* adsorbed on the GCE surface was much lesser than that of *E. coli*. Even if high concentrations of *S. aureus* were electrochemically detected, the amount adsorbed on the GCE surface was still very low. This might be related to some of the characteristics of *S. aureus* mentioned in the main text.



**Figure S8.** Effect of humic acid on the electrochemical response of *Escherichia coli*. The red mark indicated the control group without humic acid, and the black mark indicated the experimental group containing 10mg/L fulvic acid. A, electric quantity index; B, electric current index.

**Table S1.** Recoveries of *E. coli* in PBS.

<i>E. coli</i> added (log CFU/mL)	Found (log CFU/mL)	Recovery (%)	RSD (%)
3.86	5.16	133.68	6.54
4.60	5.95	129.35	7.06
5.75	5.42	94.26	3.38
6.60	5.60	84.85	5.74
7.70	6.30	81.82	6.05
8.60	7.44	96.51	4.62

RSD (%) was calculated for the average of 5 teials.

**Table S2.** Performance comparison of *Escherichia coli* electrochemical biosensors

Electrode modification materials	Labelling	Transduce technique	Range	Detection time	Ref.
--	--	Chronoamperometry	$1 \times 10^4$ - $1 \times 10^8$ CFU/mL	5min	This study
SiO <sub>2</sub> NPs, Abs	--	Cyclic voltammetry	$1 \times 10^3$ - $1 \times 10^6$ CFU/mL	30min	[1]
AuNPs, PNA, aptamer probes, HRP, aniline	--	Conductance	$1 \times 10^3$ - $1 \times 10^8$ CFU/mL	3h	[2]
--	MNPs, engineering phages	Linear sweep voltammetry	$1 \times 10^5$ CFU/mL (LOD)	4h	[3]
--	Au@Pt, NR- rGO@BSA	Cyclic voltammetry	$8.9 \times 10^3$ - $8.9 \times 10^9$ CFU/mL	--	[4]

## References

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