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Supporting material

Overoxidized polypyrrole / overoxidized poly(3, 4-ethylenedioxythiophene) / graphene quantum dots-chitosan as enhanced electrochemical sensing platform for luteolin determination in peanut shells

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2.4 Optimization of Preparation of oPPy/oPEDOT/GQDs-CS/GCE

Table. S1 BBD experimental factors and levels for optimization of composite electrode preparation conditions

	mass ratio of CS : GQDs （A）	polymerization cycle number of EDOT (B)	polymerization cycle number of Py (C)
1	2	4	4
2	5	8	8
3	8	12	12

3.2 Optimization of preparation conditions of oPPy/oPEDOT/GQDs-CS/GCE

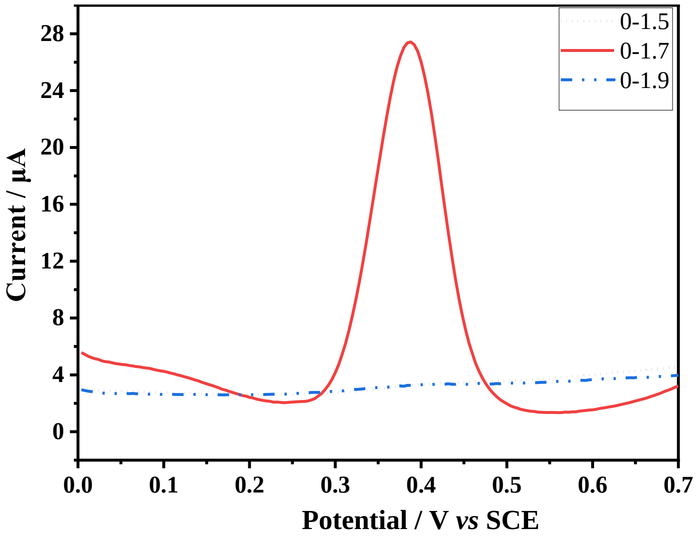
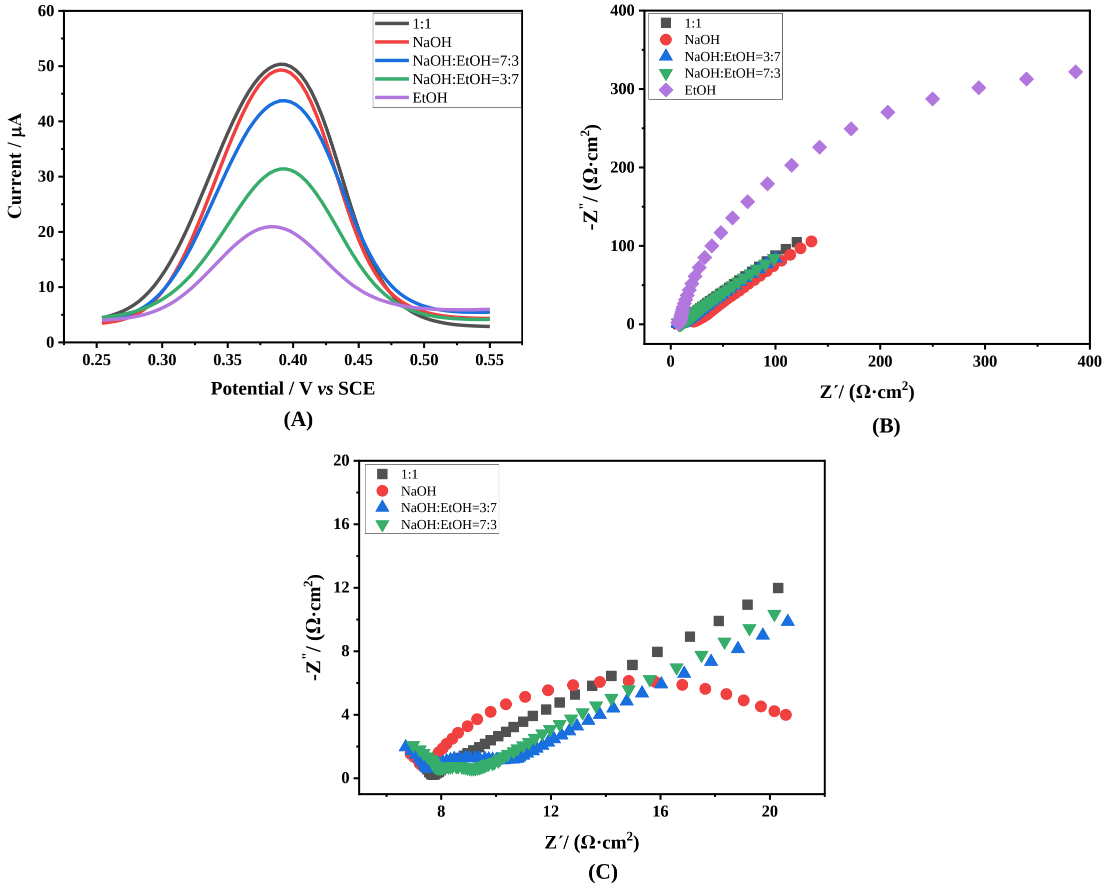


Fig. S1 DPV curves of 10 μM luteolin on oPPy/oPEDOT/GQDs-CS/GCE prepared with different electropolymerization range after incubation in NaOH-EtOH solution (1:1).



(A)

(B)

(C)

Fig. S2 (A) DPV diagrams of 10 μM liuteolin solution and (B) EIS of 5.0 mM $[Fe(CN)_6]^{3-/4-}$ solution containing 0.10 M KCl on oPPy/oPEDOT/GQDs-CS /GCE after incubation in solution with different volume ratios; (C) Effect of incubation time on DPV peak current of luteolin solution on composited electrode.

Fig. S2-A showed the DPV curves of luteolin solution detected by oPPy/oPEDOT/GQDs-CS/GCE after incubation in different volume ratios of 0.2mol/L sodium hydroxide and ethanol solution for 30 min to detect luteolin solution. When the incubation solution was ethanol, the peak current of the composite electrode to luteolin was the smallest. With the increase of the volume ratios of NaOH solution in the incubation solution, the peak current of the electrode to luteolin gradually increased. When the volume ratio of ethanol reached 7:3, the peak current decreased, but was still larger than the peak current of 3:7, indicating that incubation in NaOH solution could help to improve the electrocatalytic ability of the composite electrode to luteolin. The peak current of the composite electrode after incubation in NaOH solution was close to that of the electrode incubated NaOH : EtOH solution with the volume ratio of 1:1. In order to further determine incubation solution, the EIS of the composite electrode after incubation in different solution was investigated in Fig.S2-B.

The EIS of the composite electrode after incubation in ethanol had the largest semicircle diameter in the high frequency region, that is, the largest resistance, with a R_{ct} of 567.8 $\Omega\cdot cm^2$, followed by the composite electrode incubated in NaOH incubation solution, with a R_{ct} of 34.9 $\Omega\cdot cm^2$, while that of the composite electrode are almost a straight line after incubation in NaOH-EtOH solution with the volume ratio of 3:7, 1:1 and 7:3, and the R_{ct} values is 18.9, 11.4 and 16.3 $\Omega\cdot cm^2$, respectively. With the increase of the volume of NaOH solution in the incubation solution, the smaller the resistance of the composite electrode was, the stronger the electrocatalytic ability was. However, the resistance of the composite electrode increased instead after incubation in NaOH solution. This may be because the excessive amount of sodium hydroxide will lead to the generation of more overoxidized groups in PEDOT and PPy, which will enhance the electronegativity of the polymer, thus repelling the negatively charged $[Fe(CN)_6]^{3-/4-}$probe in the charge transfer on the electrode surface. Combined with DPV analysis, NaOH-EtOH with a volume ratio of 1:1 was selected as the incubation solution for the composite electrode.

As can be seen from Fig.S2-C, with the increase of incubation time, the DPV peak current of luteolin gradually increased. The peak current reached the maximum after incubated for 30min, and then decreased significantly. Therefore, 30min was selected as the optimum incubation time.

3.5 Anti-interference, repeatability and stability

High performance liquid chromatography (HPLC) method was carried out for the luteolin content analysis in samples to further verify the results based on the constructed sensor. The mobile phase was comprised of methanol (A) and 0.2% acetic acid (B) with the flow rate of 1mL/min at 30°C. The gradient elution conditions were as follows: 5% A at 0 ~ 5min, 5-30% A at 5~30min, 30-50% A at 30~60min, 50-80% A at 60~70min. The sample injection volume was set at 5 µL, and fractions was monitored at 294 nm.

Table S2 Calculation results of main components in peanut shell

Component	Peak area of sample solution	Peak area of standard solution	Concentration of standard solution(10^{-4}mol/L)	Component concentration in sample solution(µmol/L)	C/C_{Lu}
CA	89.6556	10528.9215	2.2518	1.9174	0.0403
IA	46.0246	1186.6781	0.7641	2.9635	0.0624
Er	141.7992	3290.4433	1.3839	5.9637	0.1255
Lu	850.5608	4947.9965	2.7648	47.5268	1