Ultrasensitive Voltammetric Determination of Catechol at Gold Atomic Cluster/Poly(3,4–ethylenedioxythiophene) Nanocomposite Electrode

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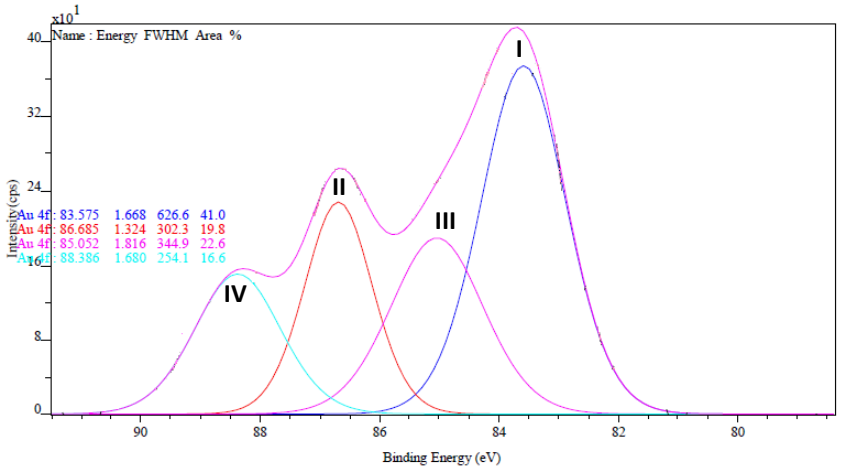


Figure S1: XPS spectra of electrochemically synthesized Au clusters in presence of 50mM CTAB

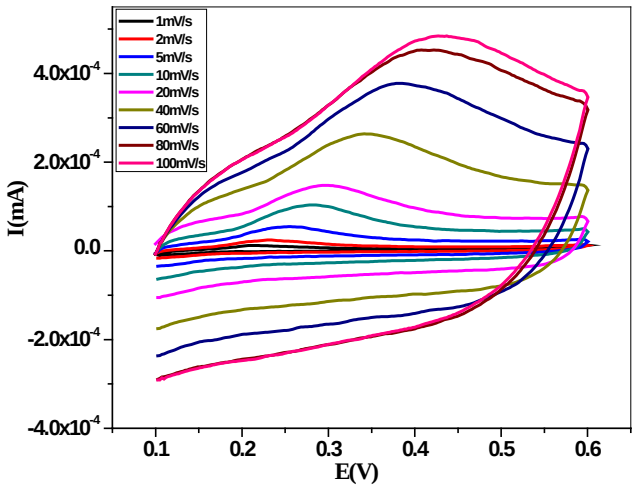


Figure S2

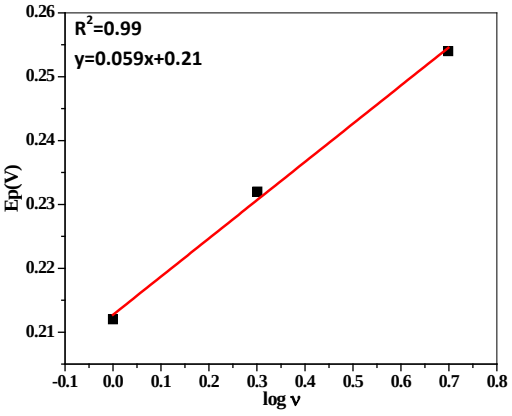


Figure S2 (i)

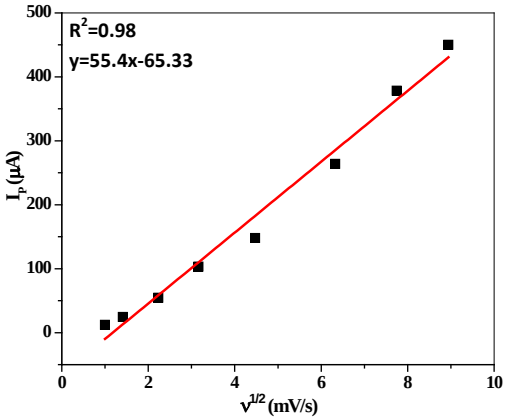


Figure S2 (ii)

Figure S2: Cyclic voltammograms of oxidation of catechol (10^{-4} M) at various scan rates (1 to 100mV/s) at AuAC/PEDOT/Au nanocomposite modified gold electrode, Figure S2 (i): Plot of Ep Vs log ν, Figure S2 (ii): Plot of Ip Vs $\nu^{0.5}$

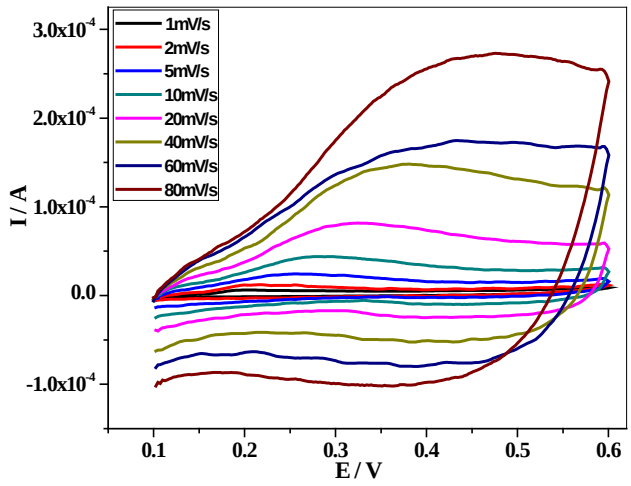


Figure S3

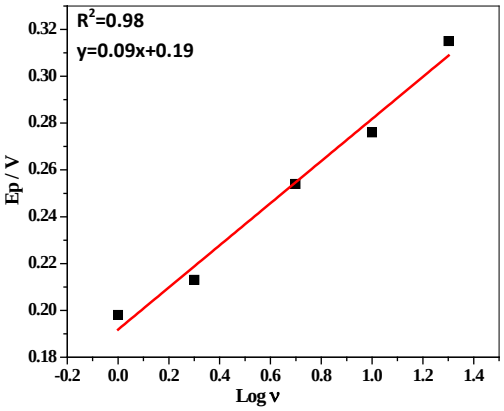


Figure S3 (i)

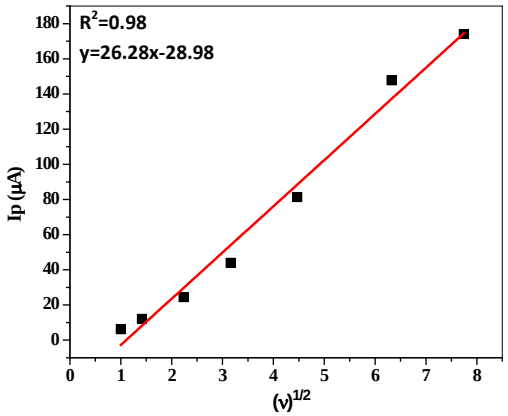


Figure S3 (ii)

Figure S3: Cyclic voltammograms of oxidation of catechol (10^{-4} M) at various scan rates (1 to 80mV/s) at PEDOT/Au electrode, Figure S3 (i): Plot of Ep Vs log ν, Figure S3 (ii): Plot of Ip Vs $\nu^{0.5}$

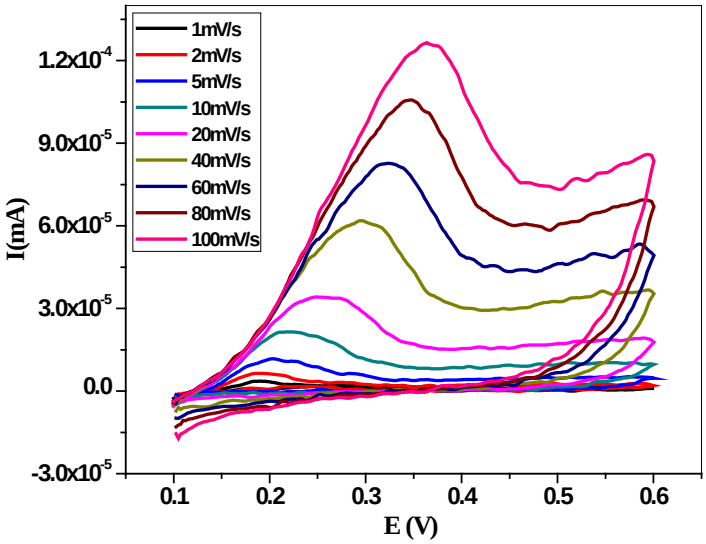


Figure S4

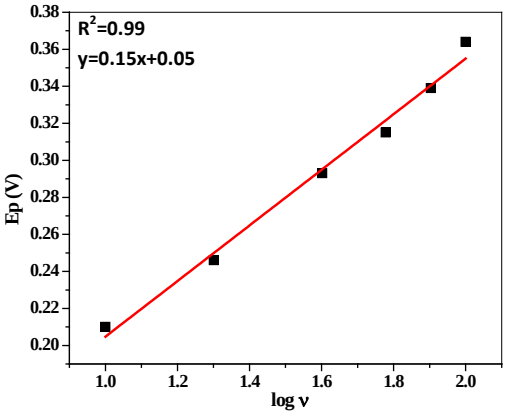


Figure S4 (i)

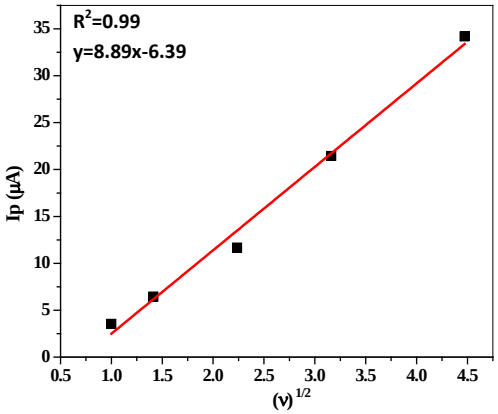
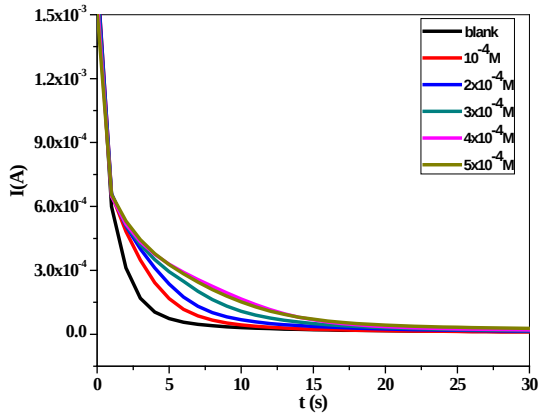


Figure S4 (ii)

Figure S4: Cyclic voltammograms of oxidation of catechol (10^{-4} M) at various scan rates (1 to 100mV/s) at bare gold electrode, Figure S4 (i): Plot of Ep Vs log ν, Figure S4 (ii): Plot of Ip Vs $\nu^{0.5}$



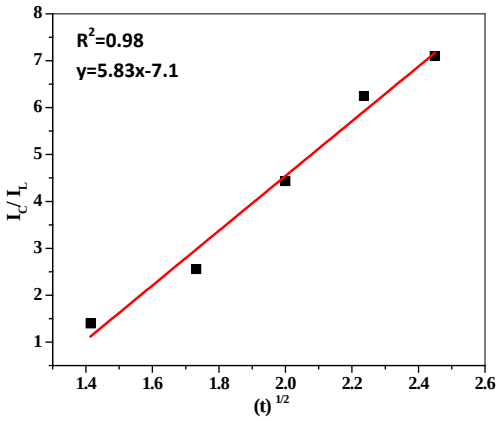
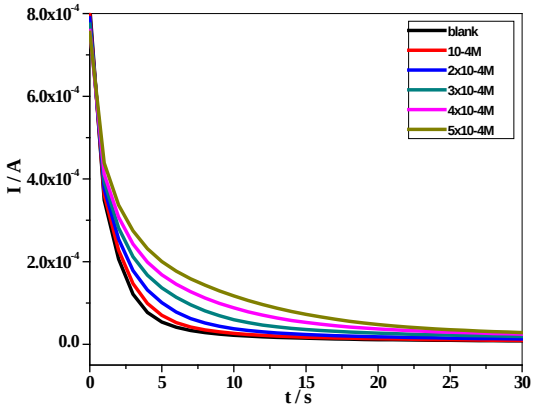


Figure S5 **Figure S5 (i)**

Figure S5: Current–time curves of AuAC/PEDOT nanocomposite electrode absence and presence of 10^{-4}, 2×10^{-4} , 3×10^{-4} , 4×10^{-4} and 5×10^{-4} M of catechol in 0.1M acetate buffer (pH=6.8) and 5mM Cu(II), Figure S5(i): Dependence of I_C/I_L on (time) $^{0.5}$



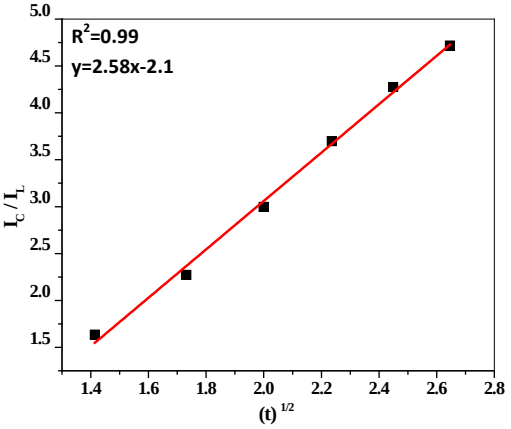
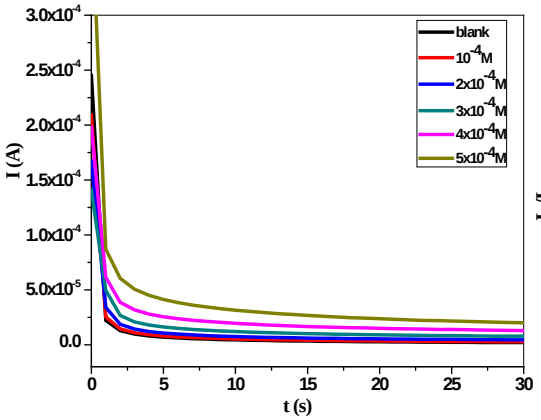


Figure S6 **Figure S6 (i)**

Figure S6: Current–time curves of PEDOT/Au electrode absence and presence of 10^{-4}, 2×10^{-4} , 3×10^{-4} , 4×10^{-4} and 5×10^{-4} M of catechol in 0.1M acetate buffer (pH=6.8) and 5mM Cu(II), Figure S6(i): Dependence of I_C/I_L on (time) $^{0.5}$



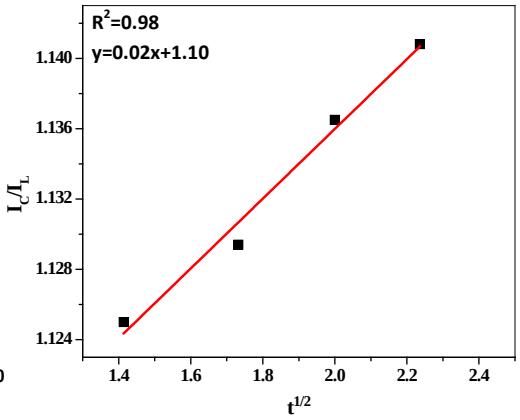


Figure S7 **Figure S7 (i)**

Figure S7: Current–time curves of bare gold electrode absence and presence of 10^{-4}, 2×10^{-4} , 3×10^{-4} , 4×10^{-4} and 5×10^{-4} M of catechol in 0.1M acetate buffer (pH=6.8) and 5mM Cu(II), Figure S7(i): Dependence of I_C/I_L on (time) $^{0.5}$

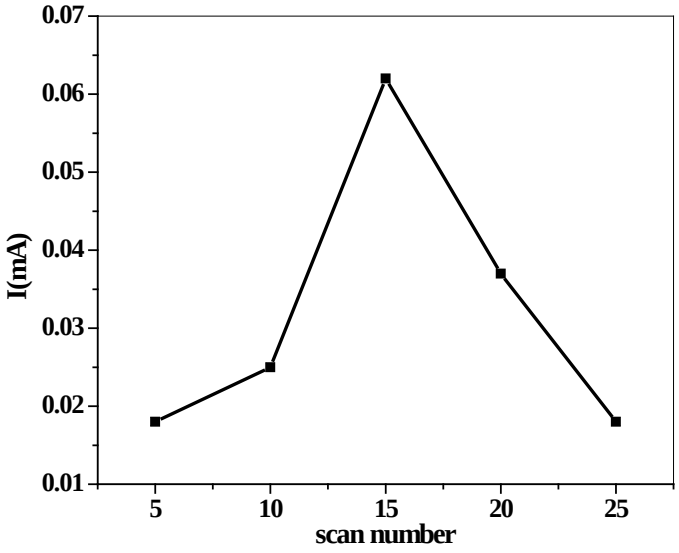


Figure S8: Effect of scan number of PEDOT film formation on the peak current of catechol (10^{-6}M)

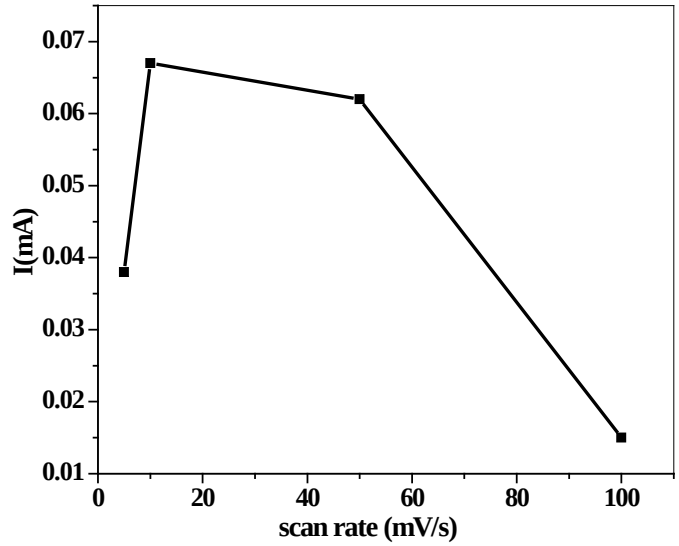


Figure S9: Effect of scan rate during PEDOT film formation on the peak current of catechol (10^{-6}M)

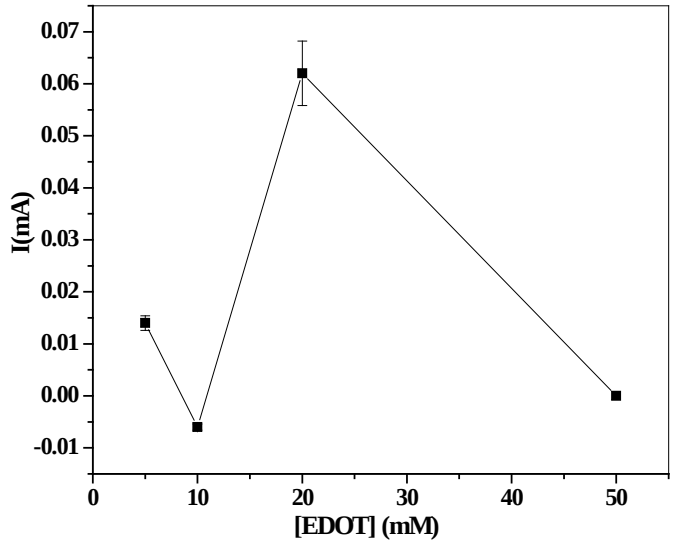


Figure S10: The effect of EDOT concentration on the peak current of catechol (10^{-6}M)

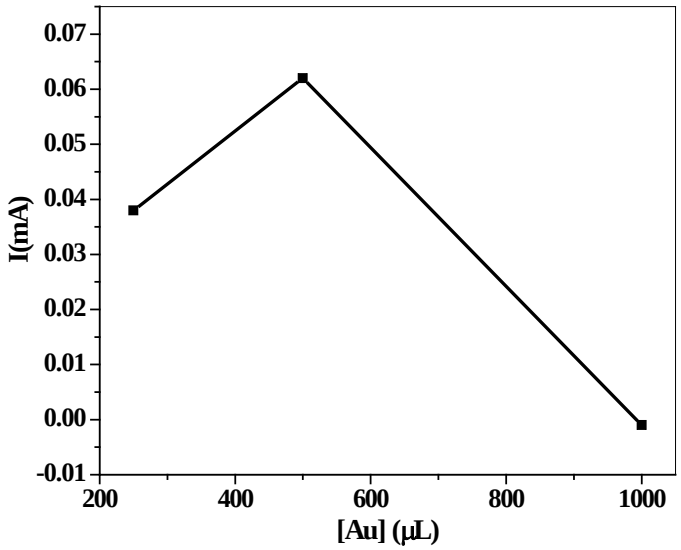


Figure S11: The effect of AuAC concentration on the peak current of catechol (10^{-6}M)

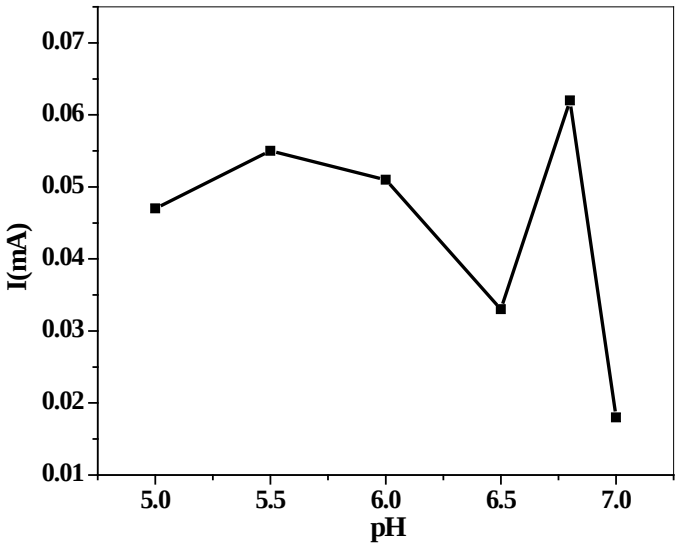


Figure S12: The effect of solution pH on the peak current of catechol (10^{-6}M)

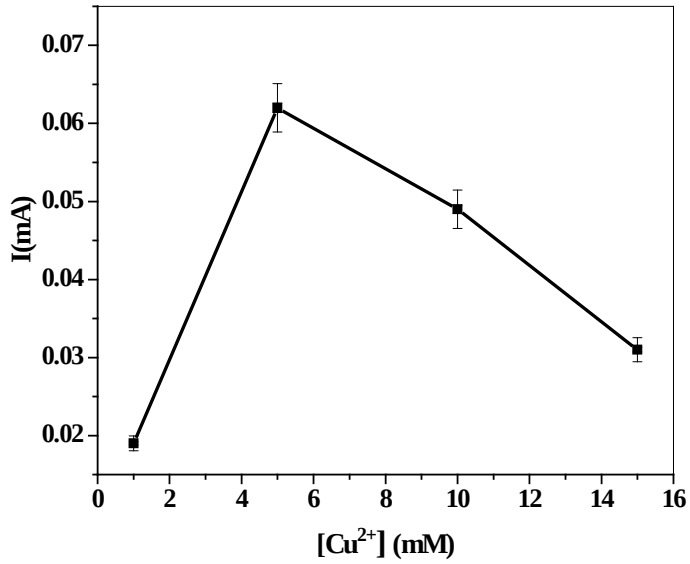


Figure S13: The effect of Cu^{2+} concentration on the peak current of catechol (10^{-6}M)

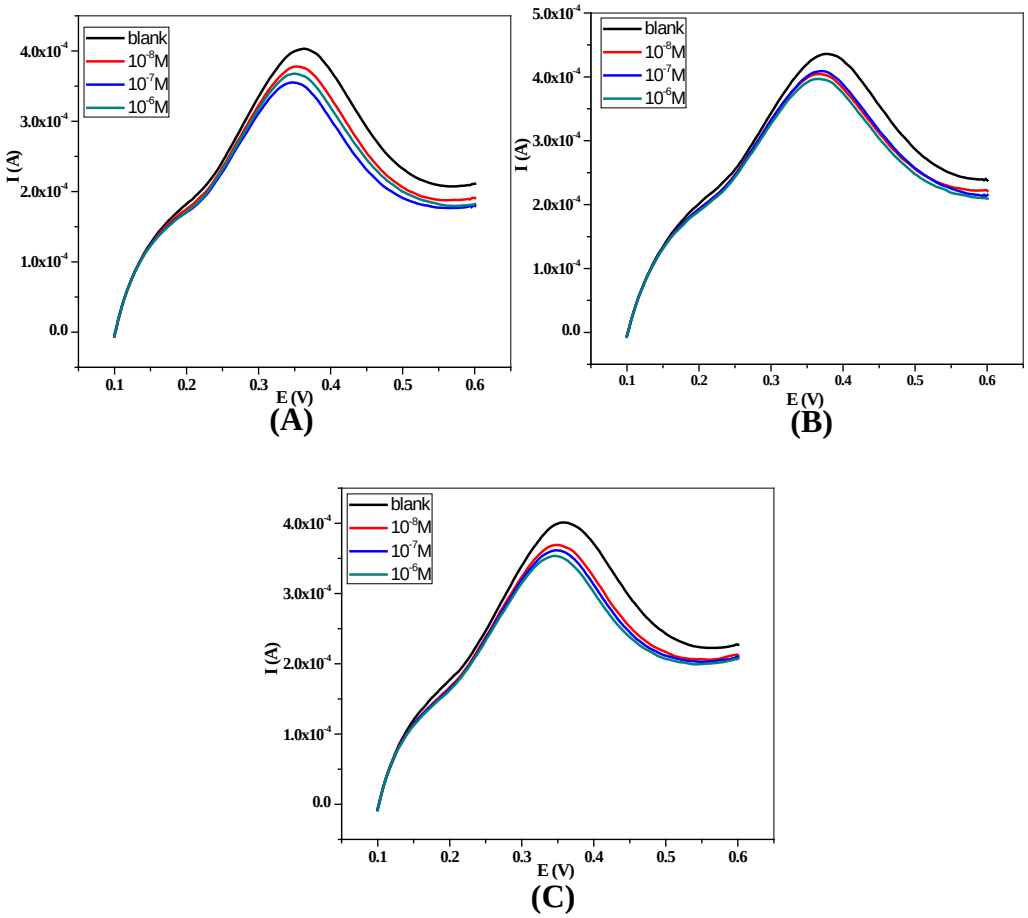


Figure S14: Linear sweep voltammograms for real sample analysis A) well water B) river water C) tap water of blank, 10^{-8}M, 10^{-7}M and 10^{-6}M concentrations of catechol.

Table S1: Investigated and optimized conditions for the formation of AuAC/PEDOT nanocomposite modified electrode

Parameters	Investigated range	Optimal conditions
EDOT concentration (mM)	5 to 50	20
Scan number	5 to 25	15
Gold cluster concentration (mL)	0.25 to 1	0.5
Scan rate (mV/s)	10 to 100	50

Table S2: Sequential optimization of analytical parameters for catechol determination

Analytical parameters	Tested range	Optimal condition
A. Chemical		
(i) Supporting electrolyte		0.1M CH_3COONa
(ii) pH	5–7	6.8
(iii) Copper ion concentration (mM)	1–15	5
B. Instrumental		
(iv) Scan rate (mV/s)	10–100	50
(v) Cathodic potential scan limit (V)	0.05–0.2	0.1
(vi) Anodic potential scan limit (V)	0.5–0.7	0.6

Table S3: Comparison with reported electrochemical sensors for the determination of catechol

Electrochemical technique	Electrode modification	Calibration range (μM)	Limit of detection (μM)	References
DPV	PEDOP/MWCNTs–Pd/GCE	0.01–6000	0.026	[40]
DPV	carbon nanofibers/gold nanoparticles/Au	5.0–350	0.36	[41]
DPV	poly(glutamic acid) Modified GC Electrode	1–80	0.8	[42]
SWV	screen printed graphite electrode	1–100	0.29	[43]
Amperometry	Au/TiO2 nanorod composites-modified BDD electrodes	5–200	1.4	[44]
Amperometry	DeniLite laccase immobilized Pt electrode	0–58	0.07	[45]
CV	AuNP–SAMs/Au	4–20	4	[46]
CV	Molecularly Imprinted Conducting Polymer/Au	0.228–144	0.228	[32]
Amperometry	CNT–Tyr composite	0–150	10	[47]
CV	MIP/Au	0–100	0.029	[33]
Amperometry	poly(aniline–co–p–aminophenol) film	5–500	0.8	[48]
Amperometry	montmorillonite modified graphite electrode	10–1000	1.13	[49]
DPV	β–cyclodextrin–cobalt ferrite nanocomposite	1–200	0.12	[50]
DPV	Bis(1,10–phenanthroline)copper(II)bis(tetracyanoquinodimethanide) in poly–L–lysine film	0.01–20	0.003	[51]
DPV	(PEDOT)/graphene oxide (GO) hybrid film	2 to 400	1.6	[52]
LSV	AuAC/PEDOT/Au	1×10^{-4}–10	6.3×10^{-6}	Present method

(CV: Cyclic voltammetry, SWV: Square wave voltammetry, DPV: Differential pulse voltammetry).