Supporting Information

C entrapped Cu nanoparticles-infused polyaniline modified cellulose nanofibers for precise monitoring of xanthine in urine samples

Ahlam I. Al-Sulami[1], Ammara Fatiam[2], Fatimah Mohammad H. Al-Sulami[1], Abdul Sami[2], Reema H. Aldahiri[1], Maria Khan[2], Azza A. Al-Ghamdi[1], Naeem Akhtar[*], Waleed Ahmed El Said[**1,3]

[1]University of Jeddah, College of Science, Department of Chemistry, Jeddah 21589, Saudi Arabia

[2]Institute of Chemical Sciences, Bahauddin Zakariya University (BZU), Multan 60800, Pakistan

[3]Chemistry Department, Faculty of Science, Assiut University, Assiut, 71516, Egypt

Instrument details

Instruments used during this scientific work were Fourier transform infrared spectroscopy (FTIR) IRA affinity-1S spectrophotometer-USA to record FTIR spectra of cellulose acetate, polyaniline and cellulose acetate/polyaniline nanocomposite in the range of 400-4000 cm^{-1}. X-ray diffraction (XRD) was measured by Rigaku, Mini flex-II-Japan by means of Cu Kα. The chemical compositions and bond characters were characterized by XPS. X-Ray photoelectron spectroscopy was done at less than 10-8 torr on AXIS Ultra DLD spectrometer by Kratos Analytical. The surface morphological analyses of the synthesized materials were analyzed using scanning electron microscopy (SEM) at a Zeiss Evo 50 XVP equipped with energy dispersive X-ray (EDAX) (Oxford instruments INCA, X.act, S.No. 56756, UK). Raman spectra was obtained using in Via Raman Microscope by RENISHAW UK with excitation laser of 514nm (laser power: 100%, grating: 1800 I/mm) and laser exposure time of 10s. Electrospinning machine (TONG LI TECH CO LTD, China) was used for the formation of nanofibers of PCE composite. All the electrochemical investigations were carried out using Gamry interface (1010E) Potentio state. Th is Potentio state instrument contains three electrodes such as working electrode, reference electrode and auxiliary electrode. In this work, synthesized electrode C@Cu-NPs/PCE was used as working electrode, Ag/AgCl used as reference electrode and platinum wire used as auxiliary electrode.
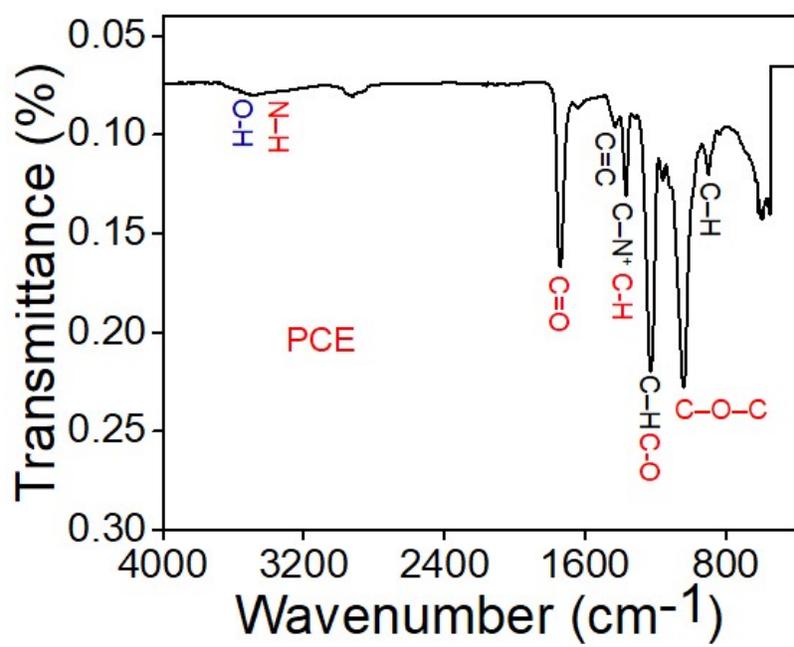
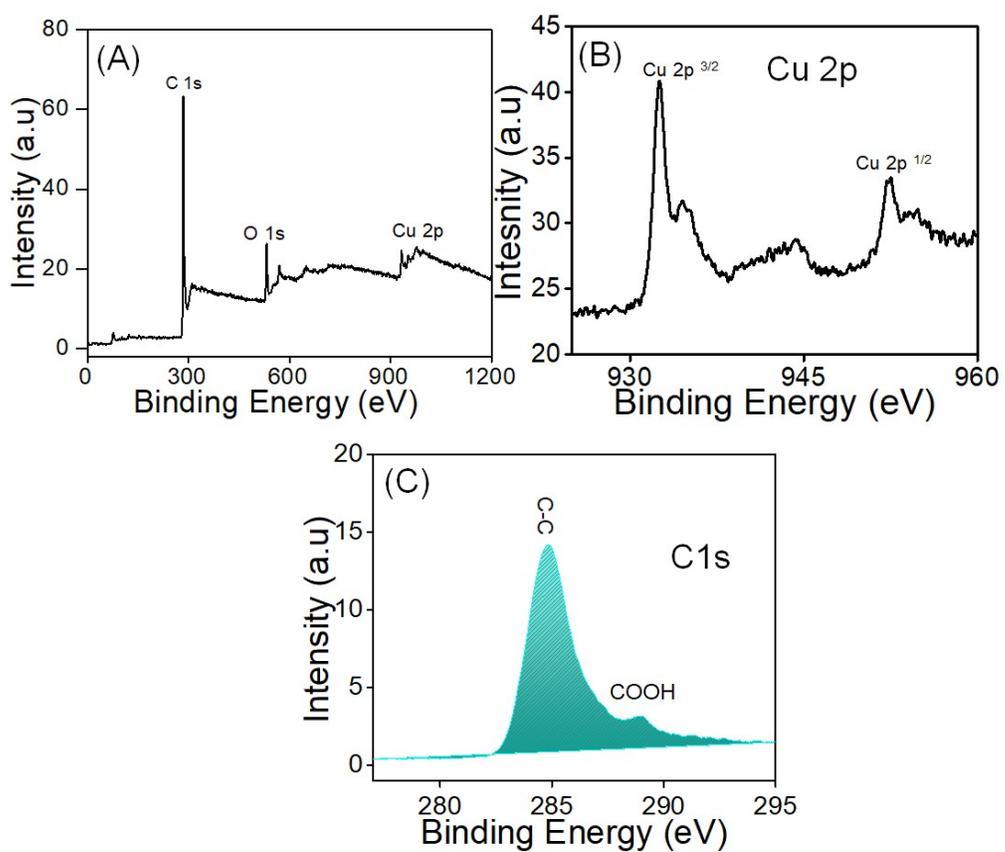**Figure S1**. FTIR spectra showing clear formation of PCE.

Figure S2. Shows XPS spectrum of C@Cu-NPs (A). High resolution spectrum of Cu 2p (B), and C 1s (C), respectively.
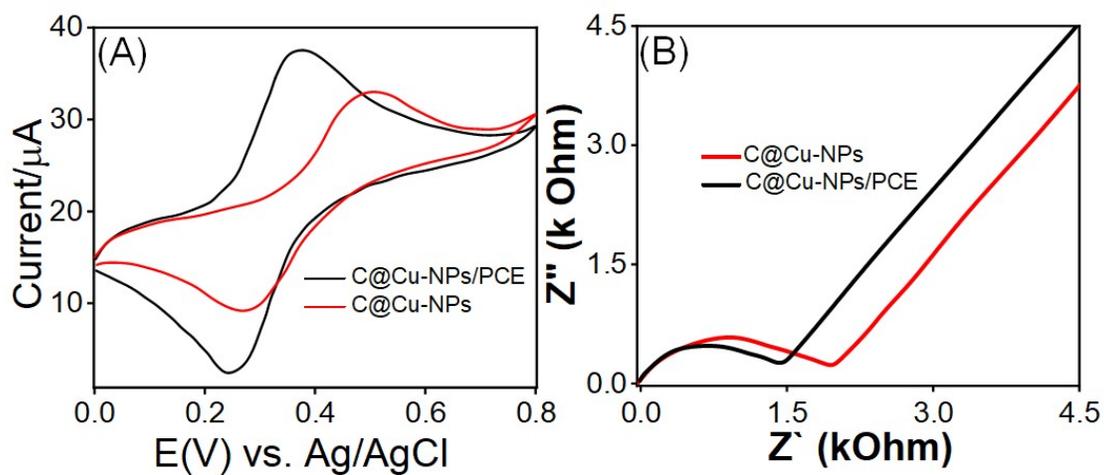
Figure S3. (A) CV of C@Cu-NPs/PCE and C@Cu-NPs in 0.1M PBS (pH:7) containing 2μM [Fe (CN)$_6$]$^{3-/4-}$ with potential window ranging from 0 to +0.8 V at a scan rate of 100mVs^{-1}. (B) EIS graph of C@Cu-NPs/PCE and C@Cu-NPs in 0.1M PBS (pH:7) containing 2μM [Fe(CN)$_6$] $^{3-/4-}$.
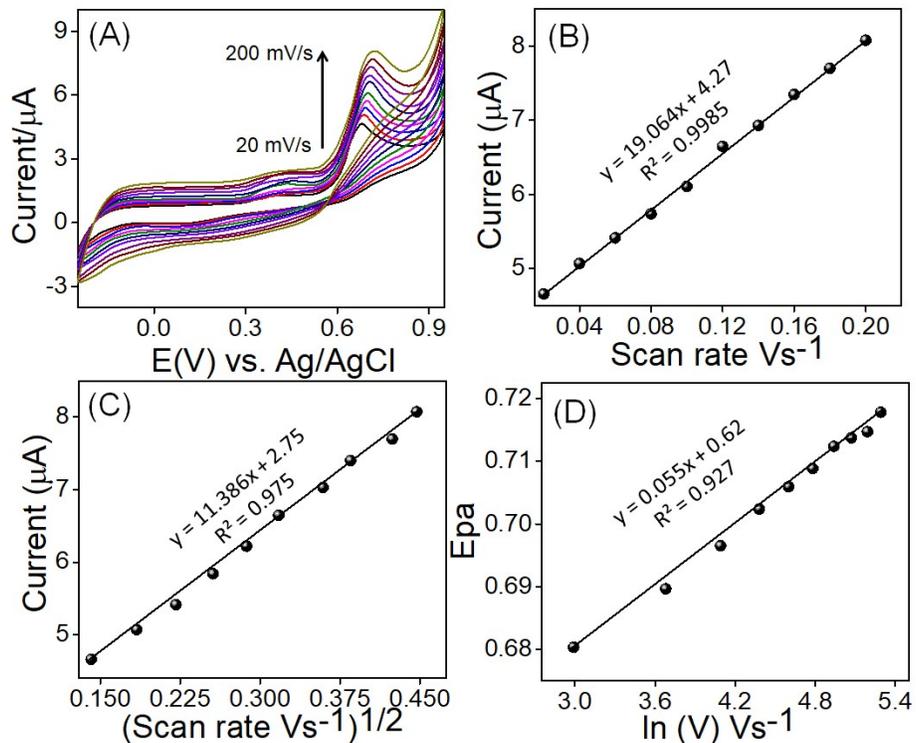
Figure S4. (A) CV patterns of C@Cu-NPs/PCE electrode towards 15 µM Xn in 0.1 M PBS with different scan rates (20-200 mV/s). Graph (B) and (C) shows relation between scan rate versus peak current and square root of scan rate versus peak current, respectively. Graph (D) shows the relation between natural log of scan rate versus natural log of peak current.
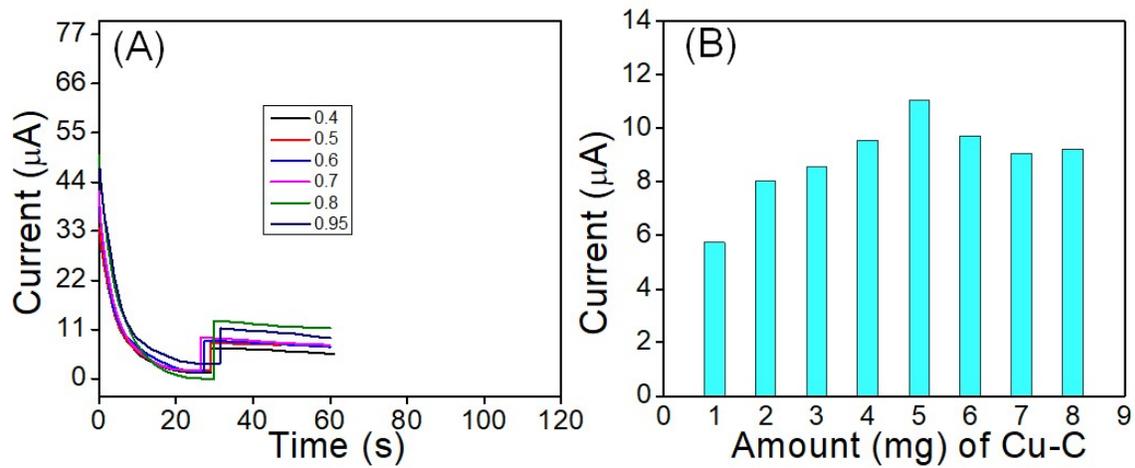
Figure S5. (A) Amperometric response of C@Cu-NPs/PCE at different potentials against 10 µM of Xn and (B) amperometric current response of designed electrode with different loading amount of Cu-C.

Table S1. Comparison of our developed electrode with the reported electrochemical sensors for the detection of Xn.

Sr. No	Electrode	Linear Range (µM)	Limit of Detection (LOD, µM)	Reference
1.	N-CQD@Fe_2O_3/MWCNT	0.5 – 177	0.092	[1]
2.	MWCNT-AuNP-CCE	2.5 – 275	0.063	[2]
3.	XOD/Co_3O_4 NPs/CH/GR/GCE	0.5 – 80	0.2	[3]
4.	GCE/PEDOT:PSS-AuNPs	0.05 – 10	0.03	[4]
5.	PdNPs:pBG/AmSWCNTs/PG	0.001 – 150	0.001	[5]
6.	4B-PGE	8 - 36	0.4	[6]
7.	NFO/GCE	0.5 – 30	0.129	[7]
8.	Pt−Pd/NGPs/GCE	0.1 – 0.012	3	[8]
9.	GCE/PDA-MWCNTs	–	0.05	[9]
10.	pPABSA/GCE	3 – 15	0.35	[10]
11.	Pt@MIL-101(Cr)/GCE	0.5 – 162	0.42	[11]
12.	PMo_6W_6/RGO-CeO_2@Pt	0.014	1.25 – 100	[12]
13.	Co/ZnO NPs/GCE	0.005 – 50	0.0017	[13]
14.	EPPGE	0.1 – 50	0.06	[14]
15.	Au/OMCS	0.10–20	0.006	[15]
16.	C@Cu-NPs/PCE	5-180	0.008	This Work

PPy = Polypyrrole

PGE = Pencil Graphite Electrode

CH = Chitosan

GR = Graphene

MWCNTs = Multi-walled Carbon Nanotubes

BQ = 1, 4-Benzoquinon

CCE = Carbon Ceramic Electrode

pBG = Poly-Bromocresol Green

amSWCNT = Amide Functionalized Single-Walled CNT

PG = Pyrolytic Graphite

NGP = Nanoporous Graphene Papers

PEDOT: PSS = Poly (3,4-ethylenedioxythiophene) Polystyrene Sulfonate

PDA = Polydopamine

pPABSA = para-Amino Benzene Sulfonic Acid

EPPGE = Edge Plane Pyrolytic Graphite Electrode

OMCS = Ordered Mesoporous Carbon/Silica

SPCE = Screen Printed Carbon Electrode

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