Supporting Information

Cobalt Molybdenum Oxide Nanorod Decorated Carbon Yarn for Non-enzymatic Electrochemical Detection of Epinephrine

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Amount of Reagents (in mmol) Used in 20 mL of Solvent			Sample code
Cobalt nitrate (in water)	**Ammonium molybdate (in water)**	**Urea (in n-butanol)**	
0.5	0.5	12	CM-A
1	1	12	CM-B
2	2	12	CM-C

Table S1: Experimental details of the interface-assisted synthesis of CMO with their corresponding product code.

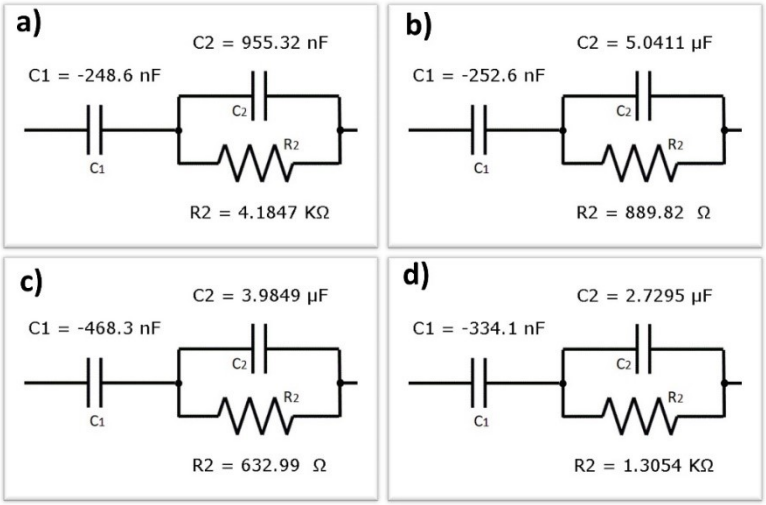

Figure S1: EIS Equivalent circuits of (a) Bare CY, (b) CM-A/CY, (c) CM-B/CY, and (d) CM-C/CY.

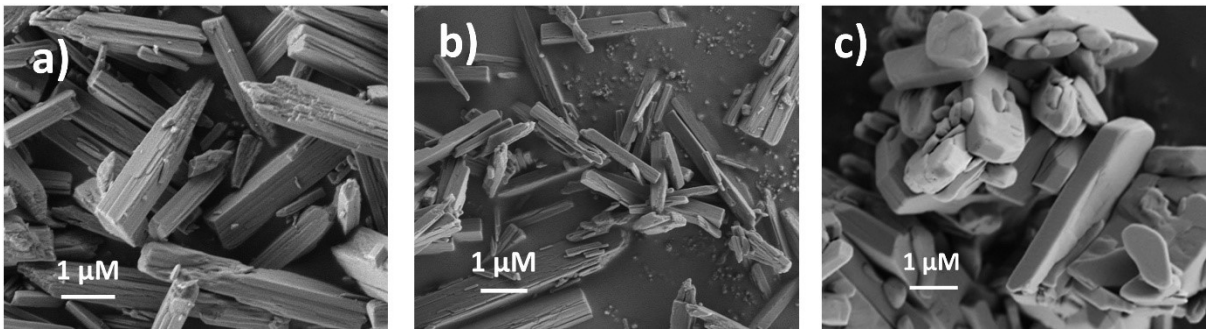

Figure S2: SEM images of CM-A (a), CM-B (b), and CM-C.

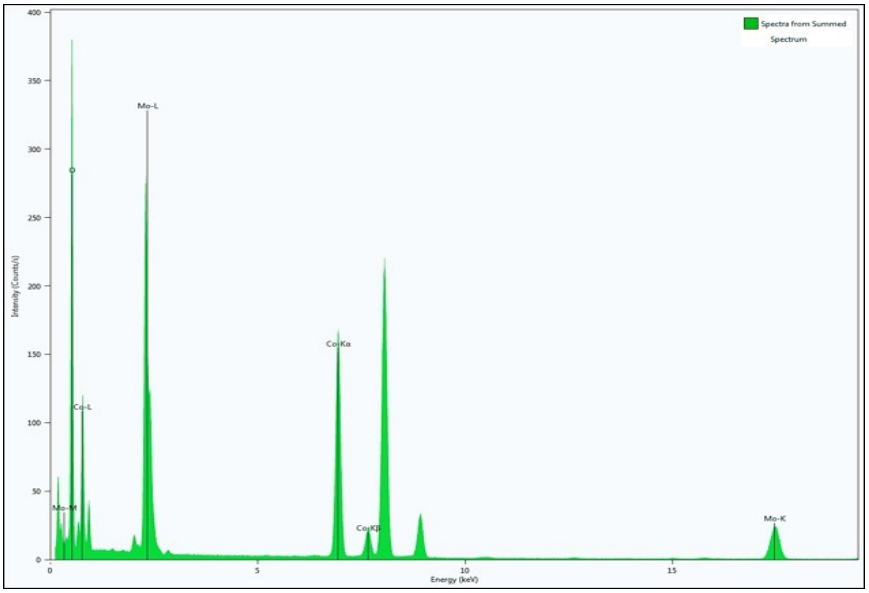

Figure S3: EDS spectra of CM-B.

Material	Method of detection	LOD	Linear range	Real sample	Ref.
Mn_2O_3	DPV	0.13 µM	500 nM–325 µM	Human urine, Human serum	[1]
Nb_2C MXene/COF	DPV	1.09 µM	1- 10 µM	Human urine, Human serum	[2]
CD@Tb	Ratiometric PL	0.0012 µM	0- 0.1µM	Human serum	[3]
GNRs	DPV	2.1 µM	6.4-100 µM	pharmaceutical product	[4]
OMC-NiO	DPV	85 nM	0.8- 50 µM	EP injection, Human serum	[5]

CNF-AuNPs	SWV	1.5 µM	50- 1000 µM	human serum	[6]
ZnO/MWCNTs	DPV	0.016 µM	0.4- 2.4 µM	EP injection, Human serum	[7]
MoS_2/N-rGO	CV	3.9 µM	2– 63 µM	Spiked water samples	[8]
EDDPT/GO/CPE	DPV	0.65 µM	1.5–600.0 µM	Drug samples, human serum	[9]
TiO_2-rGO NFs	DPV	0.00811 µM	0.01– 0.1 µM	EP injection, Human serum	[10]
$CoMoO_4.nH_2O$	DPV	0.00214 µM	0.2-1 µM	EP injection Artificial sweat	**This work**

Table S2: Comparison of electrochemical sensors for Epinephrine detection.

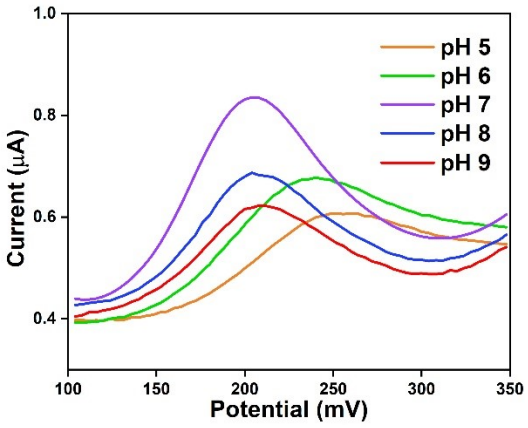

Figure S4: DPV of CM-B/CY at different pH.

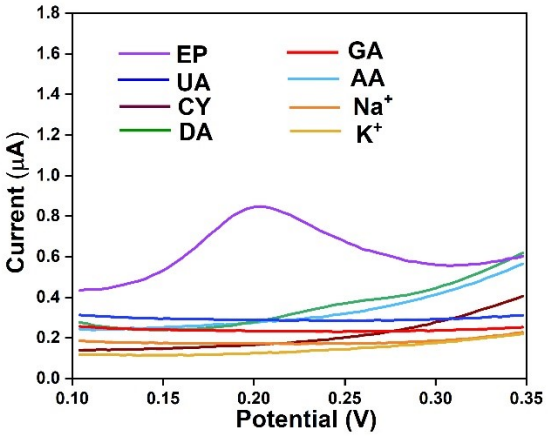

Figure S5: DPV of EP (1 µM) and interfering agents (100 µM).

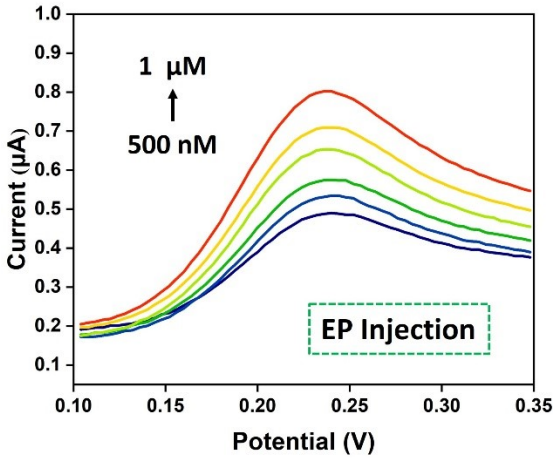

Figure S6: DPV of EP injection at different additions of standard EP (500 nM-1µM).

Sl. No.	Added concentration (µM)	Output cathodic current in std solution (µA)	Output current in EP injection (µA)	Recovery Concentration (µM)	% Recovery	RSD (%)
1	500	0.52	0.48	435	87.00	9.83
2	600	0.58	0.53	524	87.33	9.56
3	700	0.64	0.57	585	83.57	12.65
4	800	0.69	0.64	691	86.37	10.33
5	900	0.75	0.71	802	89.11	8.14
6	1000	0.84	0.80	943	94.30	4.15

Table S3: Recovery results of EP in EP injection.

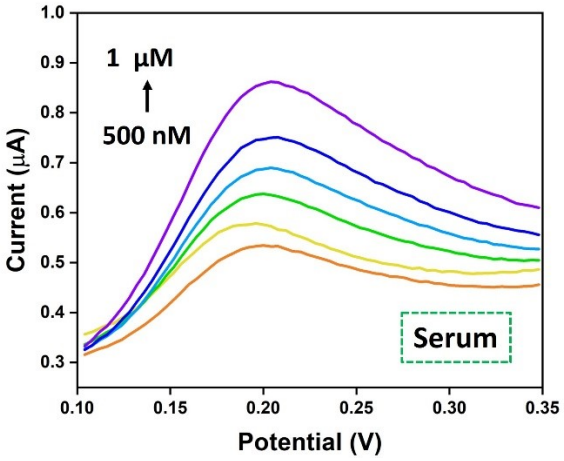

Figure S7: DPV of serum at different additions of standard EP (500 nM-1µM).

Sl. No.	Added concentration (µM)	Output cathodic current in std solution (µA)	Output current in Serum (µA)	Recovery Concentration (µM)	% Recovery	RSD (%)
1	500	0.52	0.53	521	104.2	2.91
2	600	0.58	0.585	605	100.83	0.58
3	700	0.64	0.63	681	97.28	1.94
4	800	0.69	0.68	757	94.62	3.90
5	900	0.75	0.74	849	94.33	4.12
6	1000	0.84	0.86	1031	103.1	2.16

Table S4: Recovery results of EP in serum.

References

(1) Rehman, S. U.; Babulal, S. M.; Wu, H. Oxygen-Deficient Mn 2 O 3 Nanosheets for Dual Colorimetric and Electrochemical Detection of Epinephrine. *ACS Appl. Nano Mater.* **2024**.

(2) Punniyamoorthy, M.; Soosaimanickam, C.; Kathiresan, M.; Alwarappan, S. 2D Nb 2 C

MXene/COF Composite as Electrochemical Platform for the Stress Marker Epinephrine Detection. *ACS Appl. Nano Mater.* **2025**.

(3) Mohapatro, U.; Senapati, P. K.; Bhutia, S. K.; Mohapatra, S. Carbon Dot Fluorescent Nanoprobe for Dual-Channel Detection of Epinephrine and Pyrophosphate in Live Cells. *Anal. Chem.* **2025**.

(4) Sainz, R.; Pozo, M.; Varela, M. V.; Esteban, J. C.; Corral, M. P.; Vázquez, L.; Blanco, E.; Peña, D.; Gago, J. A. M.; Ellis, G. J.; Dolores, M.; Domínguez, P.; Quintana, C.; Casero, E. Chemically Synthesized Chevron - like Graphene Nanoribbons for Electrochemical Sensors Development : Determination of Epinephrine. *Sci. Rep.* **2020**, 1–11.

(5) Yang, X.; Zhao, P.; Xie, Z.; Ni, M.; Wang, C.; Yang, P.; Xie, Y.; Fei, J. Selective Determination of Epinephrine Using Electrochemical Sensor Based on Ordered Mesoporous Carbon / Nickel Oxide Nanocomposite. *Talanta* **2021**, *233*.

(6) Sipuka, D. S.; Sebokolodi, T. I.; Olorundare, F. O. G.; Muzenda, C. Electrochemical Sensing of Epinephrine on a Carbon Nanofibers and Gold Nanoparticle - Modified Electrode. *Electrocatalysis* **2023**, 9–17.

(7) Shaikshavali, P.; Reddy, T. M.; Gopal, T. V.; Venkataprasad, G.; Kotakadi, V. S.; Palakollu, V. N.; Karpoormath, R. A Simple Sonochemical Assisted Synthesis of Nanocomposite (ZnO / MWCNTs) for Electrochemical Sensing of Epinephrine in Human Serum and Pharmaceutical Formulation. *Colloids Surfaces A* **2020**, *584*, 124038.

(8) Kumar, S.; Singh, D.; Pathania, D.; Awasthi, A.; Singh, K. Molybdenum Disulphide-Nitrogen Doped Reduced Graphene Oxide Heterostructure Based Electrochemical Sensing of Epinephrine. *Mater. Chem. Phys.* **2023**, *297* (October 2022), 127446.

(9) Tezerjani, M. D.; Benvidi, A.; Firouzabadi, A. D.; Mazloum-ardakani, M.; Akbari, A. Epinephrine Electrochemical Sensor Based on a Carbon Paste Electrode Modified with Hydroquinone Derivative and Graphene Oxide Nano- Sheets : Simultaneous Determination of Epinephrine , Acetaminophen and Dopamine. *Measurement* **2017**, *101*, 183–189.

(10) Kiranmai, S.; Kuchi, C.; Sravani, B.; Łuczak, T.; Jong, M.; Madhavi, G.; Manohara, Y.

V. Construction of Ultrasensitive Electrochemical Sensor Using TiO 2- Reduced Graphene Oxide Nanofibers Nanocomposite for Epinephrine Detection. *Surfaces and Interfaces* **2022**, *35*, 102455.