

Electronic Supplementary Information (ESI)

A sensitive Non-Enzymatic Electrochemical Glucose Sensor based on ZnO/Co₃O₄/Reduced Graphene Oxide nanocomposite

Beshir A Hussein ^{*a}, Abebaw A. Tsegaye^b, Getabalew Shifera ^c and Abi M. Tadesse^d

^aDepartment of Chemistry, Mekdela Amba University, P.O.BOX 32 Mekansalam, Ethiopia.
Email beshir45@gmail.com

^bDepartment of Chemistry, Bahir Dar University, P.O.BOX 79, Bahir Dar, Ethiopia

^cDepartment of Chemistry, Mettu University, P.O.BOX 287 Mettu, Ethiopia

^dDepartment of Chemistry, Haramaya University, P.O.BOX, 131 Dire Dawa, Ethiopia

Table S1. Absorbance, maximum wavelengths and band gaps of as synthesized sensors .

| Samples | Absorbance | Maximum Wavelength (nm) | Band gap (E _g) (eV) |
|---|------------|-------------------------|---------------------------------|
| Co ₃ O ₄ | 1.83 | 358 | 3.46 |
| ZnO | 2.25 | 378 | 3.28 |
| Co ₃ O ₄ /ZnO | 2.27 | 406 | 3.05 |
| Co ₃ O ₄ /ZnO/rGO | 2.30 | 495 | 2.50 |

Table S2. Average crystallite size (D) of the as-synthesized nanoparticles

| Sample | 2θ (Degree) | β (Radians) | D (nm) |
|---|-------------|-------------|--------|
| Co ₃ O ₄ | 37.31 | 0.003142 | 44.9 |
| ZnO NPs | 36.27 | 0.008378 | 21.9 |
| ZnO/Co ₃ O ₄ | 36.37 | 0.006981 | 25.2 |
| ZnO/Co ₃ O ₄ /rGO | 36.36 | 0.010123 | 17.5 |

Order of average crystallite size (D) of as-synthesized sensors is: Co₃O₄ < ZnO/Co₃O₄ < ZnO NPs < ZnO/Co₃O₄/rGO

Table S3. Summary of electrochemical Parameters of modified electrodes in 2mM of K₃Fe(CN)₆ at a scan rate of 50 mV s⁻¹

| Electrodes | i _{pa} (μA) | E _{pa} (mV) | i _{pc} (μA) | E _{pc} (mv) | i _{pa} /i _{pc} (A) | ΔE _p (mv) | E _o (mV) |
|--------------------------------|----------------------|----------------------|----------------------|----------------------|--------------------------------------|----------------------|---------------------|
| Bare GCE | 6.08 | 250.93 | -6.5 | 160.23 | 0.935 | 90.7 | 220.58 |
| Co ₃ O ₄ | 10.67 | 255.4 | -11.6 | 167.8 | 0.920 | 87.6 | 216.55 |

| | | | | | | | |
|---|-------|--------|--------|-------|-------|-------|---------|
| ZnO | 15.63 | 262.99 | -16.6 | 170.8 | 0.942 | 92.19 | 223.89 |
| ZnO/Co ₃ O ₄ | 21.4 | 265.29 | -20.96 | 177.7 | 1.021 | 87.59 | 216.545 |
| ZnO/Co ₃ O ₄ /rGO | 24.6 | 270.34 | -24.56 | 184.8 | 1.002 | 85.54 | 220.34 |

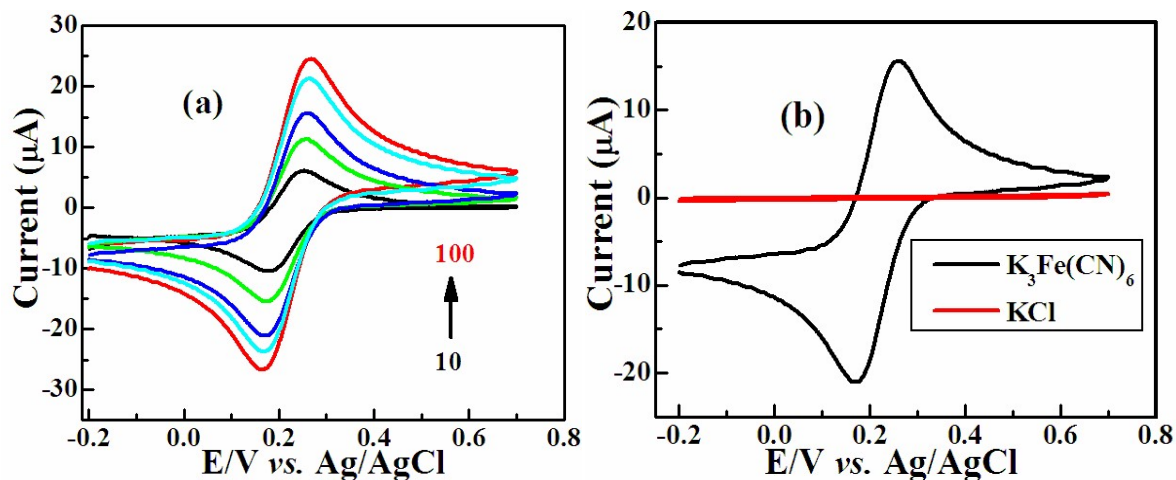


Figure S1. Cyclic Voltammograms of (a) 2mM $K_3Fe(CN)_6$ in 0.1 M KCl on glassy carbon electrode at scan rates 10, 25, 50, 75 and 100 mVs^{-1} , (b) CV of supporting electrolyte 0.1 M KCl and 2 mM $K_3[Fe(CN)_6]/0.1M$ KCl at scan rate of 50 mVs^{-1} .

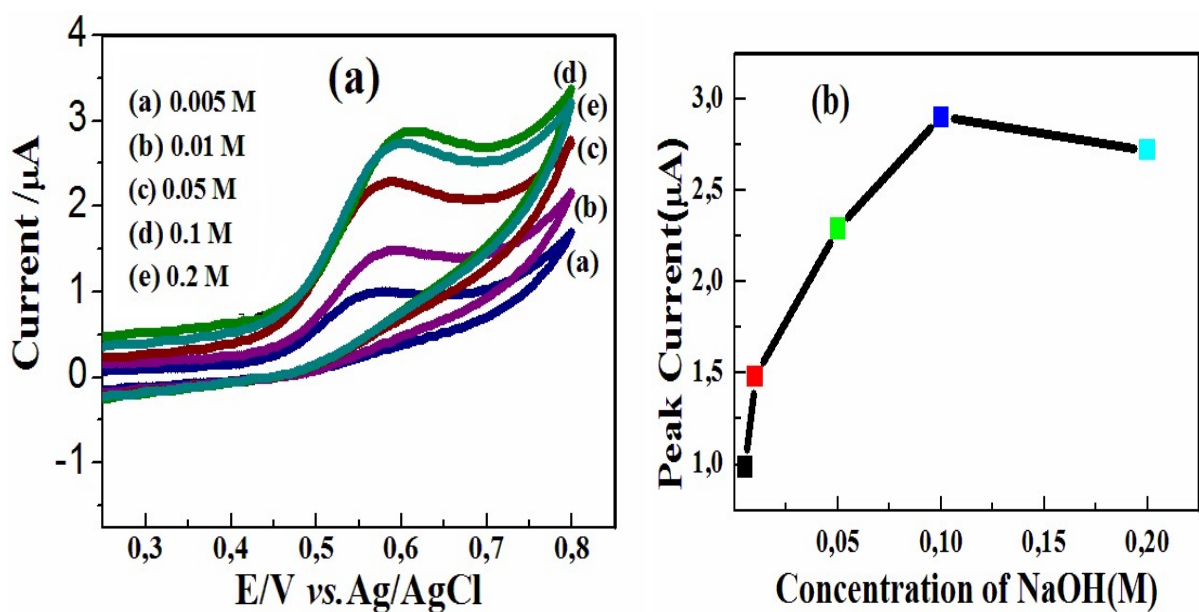


Figure. S2 Anodic current of ZnO/Co₃O₄/GCE (a) at different concentration of NaOH (0.005M up to 0.2M) upon addition of 2 mM glucose at scan rate of 50 mVs^{-1} (b) the plot of peak current versus respective concentration of NaOH.

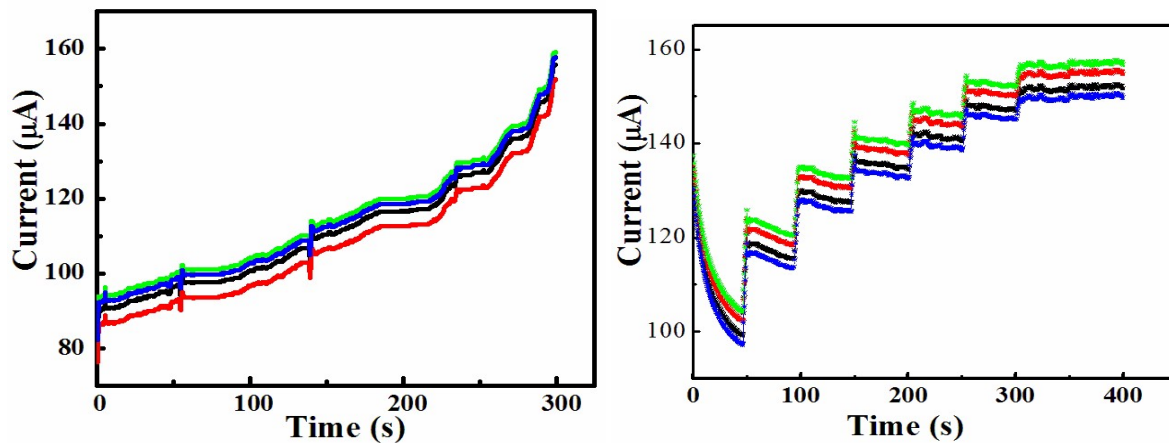


Figure S3. Current –time graph of (A) the repeatability four different measurement of a same sensor by injection of 0.5 mM glucose in 100 s interval (B) the reproducibility of the sensor by injection of 2mM glucose at 50 s interval.

Table S4. Repeatability and reproducibility of the ZnO/Co₃O₄/rGO nanocomposite sensor

| 2 mM glucose | Response current (μA) |
|--------------|-----------------------|
| 1 | 109.86 |
| 2 | 105.86 |
| 3 | 113.238 |
| 4 | 111.86 |
| Mean | 110.2045 |
| RSD | 2.91% |

| Sensor | Response current (μA) |
|--------|-----------------------|
| 1 | 149.54 |
| 2 | 154.58 |
| 3 | 158.58 |
| 4 | 147.58 |
| Mean | 152.57 |
| RSD | 3.26% |

Table S5. The current response of different concentration of glucose using ZnO/Co₃O₄ /rGO electrode

| Concentration (mM) | Response current (μA) |
|--------------------|------------------------------|
| 0.0001 | 10 |
| 0.05 | 15 |
| 0.01 | 21 |
| 0.1 | 36 |
| 0.5 | 85 |
| 0.8 | 120 |
| 1.5 | 175 |
| 3 | 290 |
| 6 | 530 |
| 10 | 890 |