

Supporting Information

Label-Free Electrochemical Biosensor Based on Au@MoS₂-PANI for *Escherichia coli* Detection

Pushap Raj ¹, Man Hwan Oh ², Kyudong Han ^{2,*} and Tae Yoon Lee ^{1,3,*}

¹ Department of Convergence System Engineering, Chungnam National University, Daejeon 34134, Korea; pushap143@gmail.com

² Department of Microbiology, College of Science & Technology, and Center for Bio-Medical Engineering Core Facility, Dankook University, Cheonan 31116, Korea; lty816@hotmail.com

³ Department of Technology Education and Department of Biomedical Engineering, Chungnam National University, Daejeon 34134, Korea

* Correspondence: jim97@dankook.ac.kr (K.H.); taeyoon.lee@cnu.ac.kr (T.Y.L.)

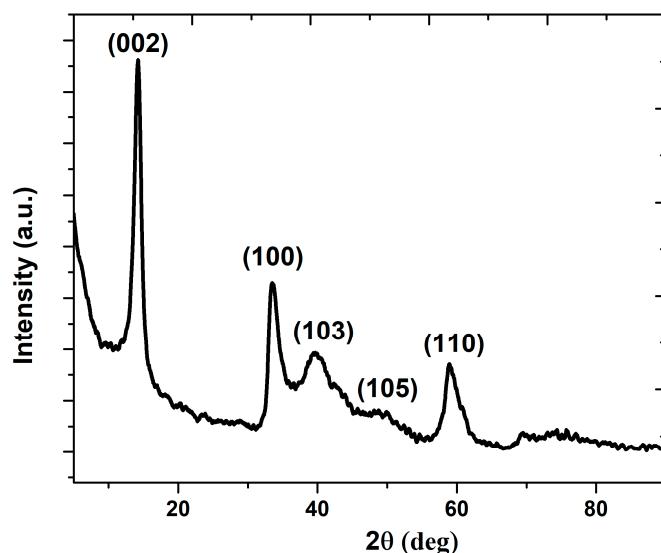


Figure S1. Powder XRD pattern of MoS₂ nanosheets.

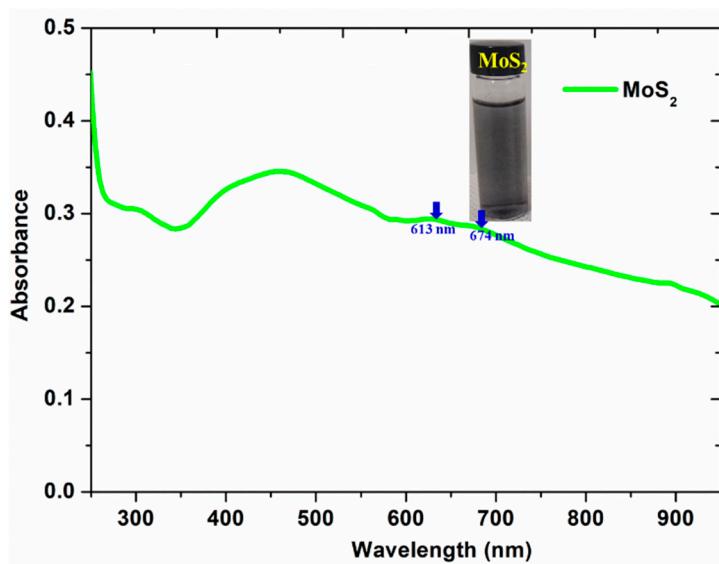


Figure S2. UV-visible absorption spectra of MoS₂ nanosheets dispersed in DI water, the inset showing a photograph of MoS₂ dispersed in DI water.

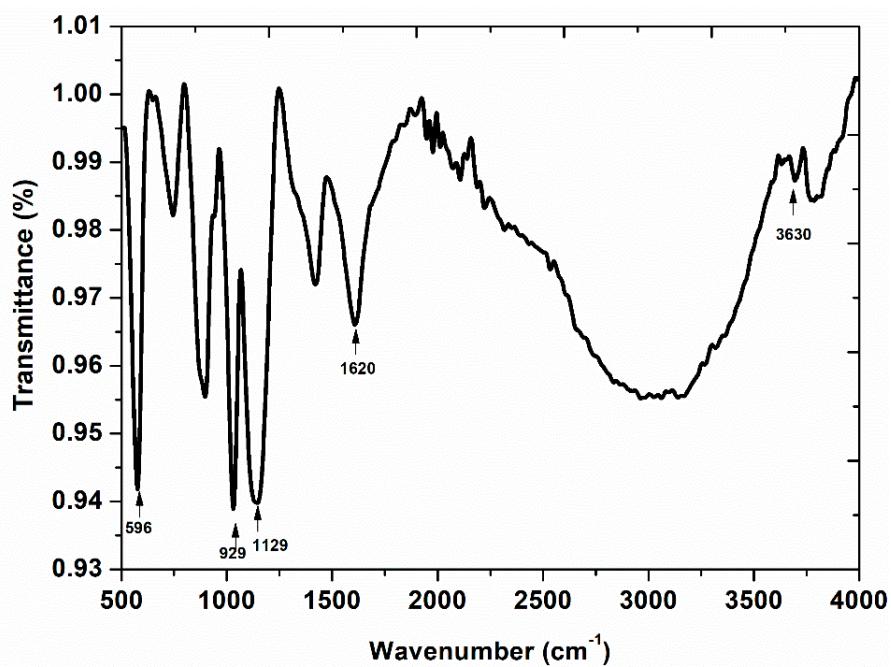


Figure S3. FT-IR spectra of MoS₂ nanosheets.

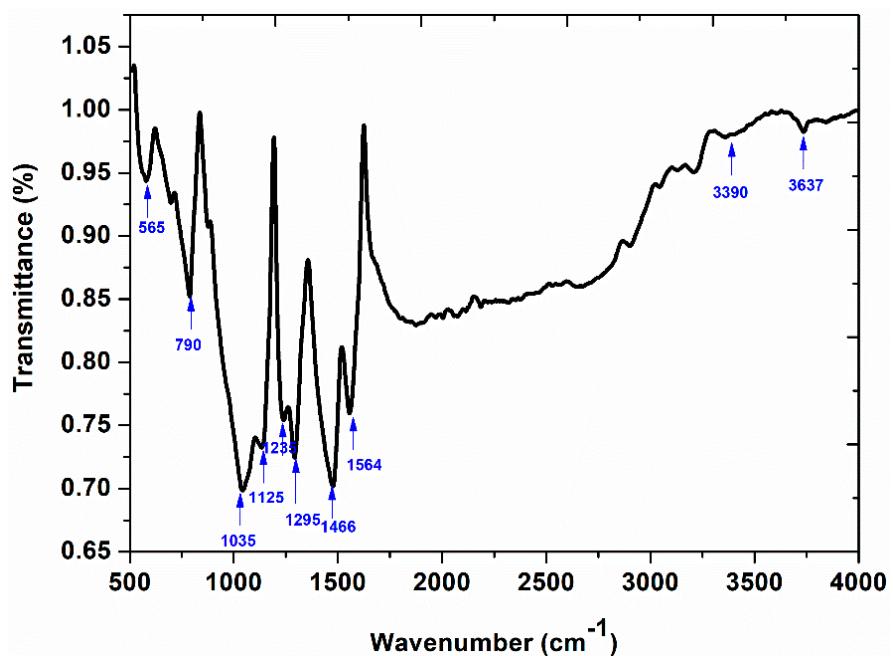


Figure S4. FT-IR spectra of MoS₂-PANI composites.

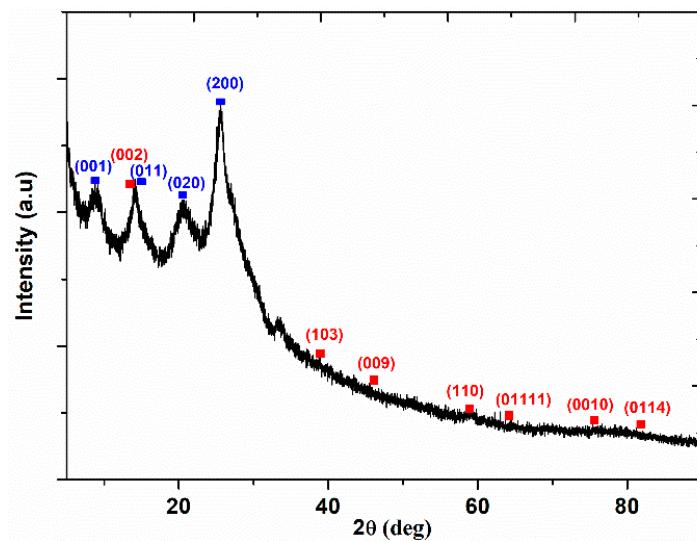


Figure S5. Powder XRD pattern of MoS₂-PANI composites.

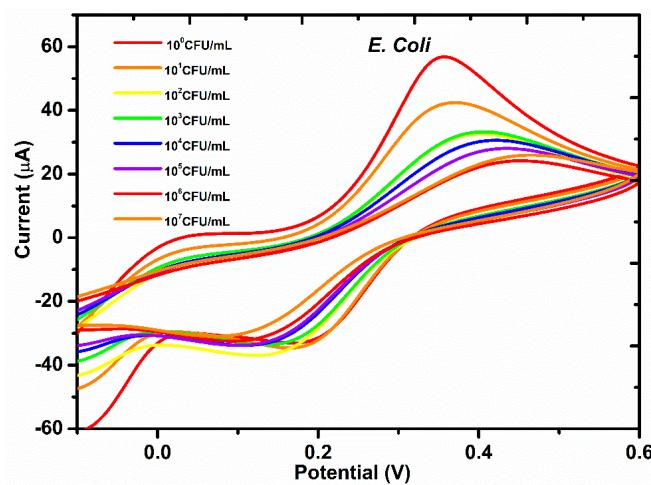


Figure S6. CV spectra of the biosensor in the presence of *E. coli* in 5 mM $[\text{Fe}(\text{CN})_6]^{3-/4-}$, 0.1 M KCl, and 0.1 M PBS buffer (pH = 7.4).

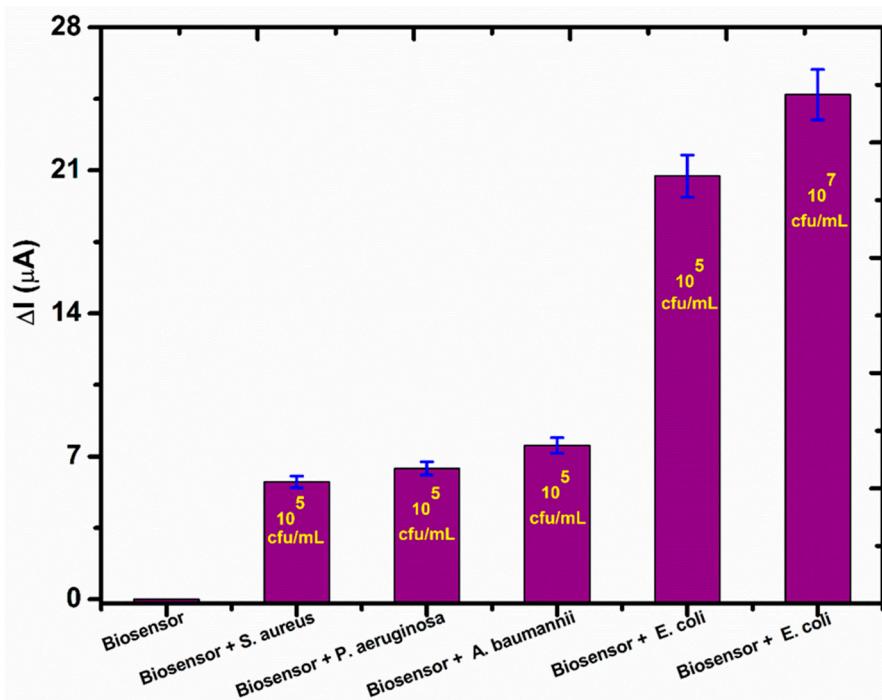


Figure S7. Change in the DPV current of the biosensor in the presence of different bacteria having a concentration of 10^5 CFU/mL. ($\Delta I = (I_0 - I)$, where I_0 is the current of biosensor in the absence of bacteria and I is the current of the biosensor in the presence of bacteria.).

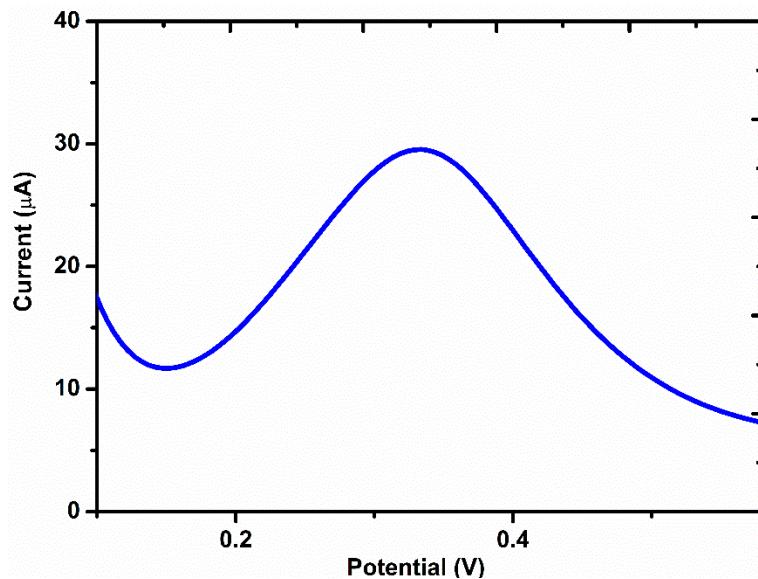


Figure S8. DPV spectra of the biosensor electrode after 21 days of storage at 4 °C in 5 mM [Fe (CN)₆]^{3-/4-}, 0.1 M KCl, and 0.1 M PBS buffer (pH = 7.4).

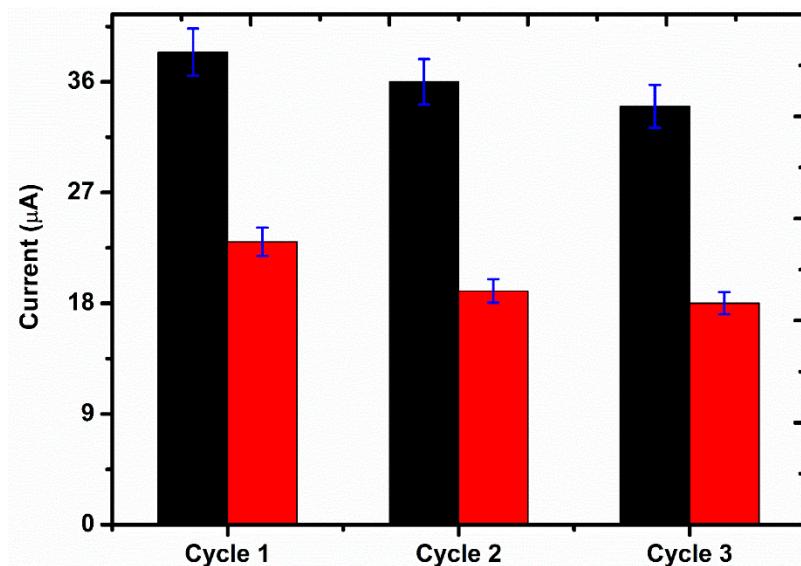


Figure S9. Effect of regeneration on the DPV peak current of the biosensor to 10⁴ CFU/mL of *E.coli* in 5 mM [Fe (CN)₆]^{3-/4-}, 0.1 M KCl, and 0.1 M of PBS buffer (pH 7.4).

Table S1. Comparison of literature-reported *E. coli* biosensors and the proposed biosensor.

Transducer	Materials Used	Detection Technique	LoD (CFU/mL)	Working Range (CFU/mL)	Analysis Time	Sample Analysis	Ref.
Au electrode	rGO-CysCu	EIS	3.8	10 – 10 ⁸	-	Water, juice and milk	S1
Graphene oxide paper	AuNPs	EIS	1.5 × 10 ²	1.5 × 10 ² – 1.5 × 10 ⁷	30 min	Food samples	S2
GCE	Au-SiO ₂	CV	15	3.2 × 10 ¹ – 3.2 × 10 ⁶	40 min	Stool samples	S3
Au electrode	Au-PANI	EIS	10 ²	10 ² –10 ⁷	10 min	-	S4
Au electrode	Reduced graphene oxide/poly(ethyl-enimine)	DPV	10	10–10 ⁸	-	Blood and urine samples	S5
Au-coated glass plates	Cysteine 3D-flower	CV and EIS	4.7	10–3 × 10 ⁹	5–40 min	-	S6
FTO	ZrO ₂ -Ag-G-SiO ₂ and In ₂ O ₃ -G-SiO ₂	CV	10	10–10 ¹⁰	30 min	-	S7
ITO/PET	benzaquinine	Colorimetry and CV	10 ³	10 ³ –10 ⁹	60 min	-	S8
SPE	SiO ₂ NPs	CV	10 ³	10 ⁶ –10 ⁹	5–30 min	-	S9
GCE	Au@MoS ₂ –PANI	CV, DPV and EIS	10	10–10 ⁷	30 min	urine sample	Current work

References:

- S1.** *Sens. Actuators B*, **238** (2017) 1060–1069.
- S2.** *Biosens. Bioelectron.*, **49** (2013) 492–498.
- S3.** *Biosens. Bioelectron.*, **49** (2013) 485–491.
- S4.** *Sens. Actuators B*, **171–172** (2012) 916–923.
- S5.** *Sens. Actuators B*, **260** (2018) 255–263.
- S6.** *Biosens. Bioelectron.*, **61** (2014) 328–33.
- S7.** *ACS Omega*, **5** (2020) 22719–22730.
- S8.** *Anal. Chem.* **91** (2019) 7524–7530.
- S9.** *Sens. Actuators B*, **292** (2019) 314–320.