

Physicochemical properties of tungsten (VI) oxide photoanodes, fabricated by wet coating of soluble, particulate, and mixed precursors

In a process akin to how plants use sunlight, a PEC cell uses light to energize special materials like WO_3 , which then act like super cleaners, breaking down the harmful stuff in dirty water. One way to keep these super cleaners, or photocatalysts, working longer is by tweaking their structure or pairing them with other materials.

Authors

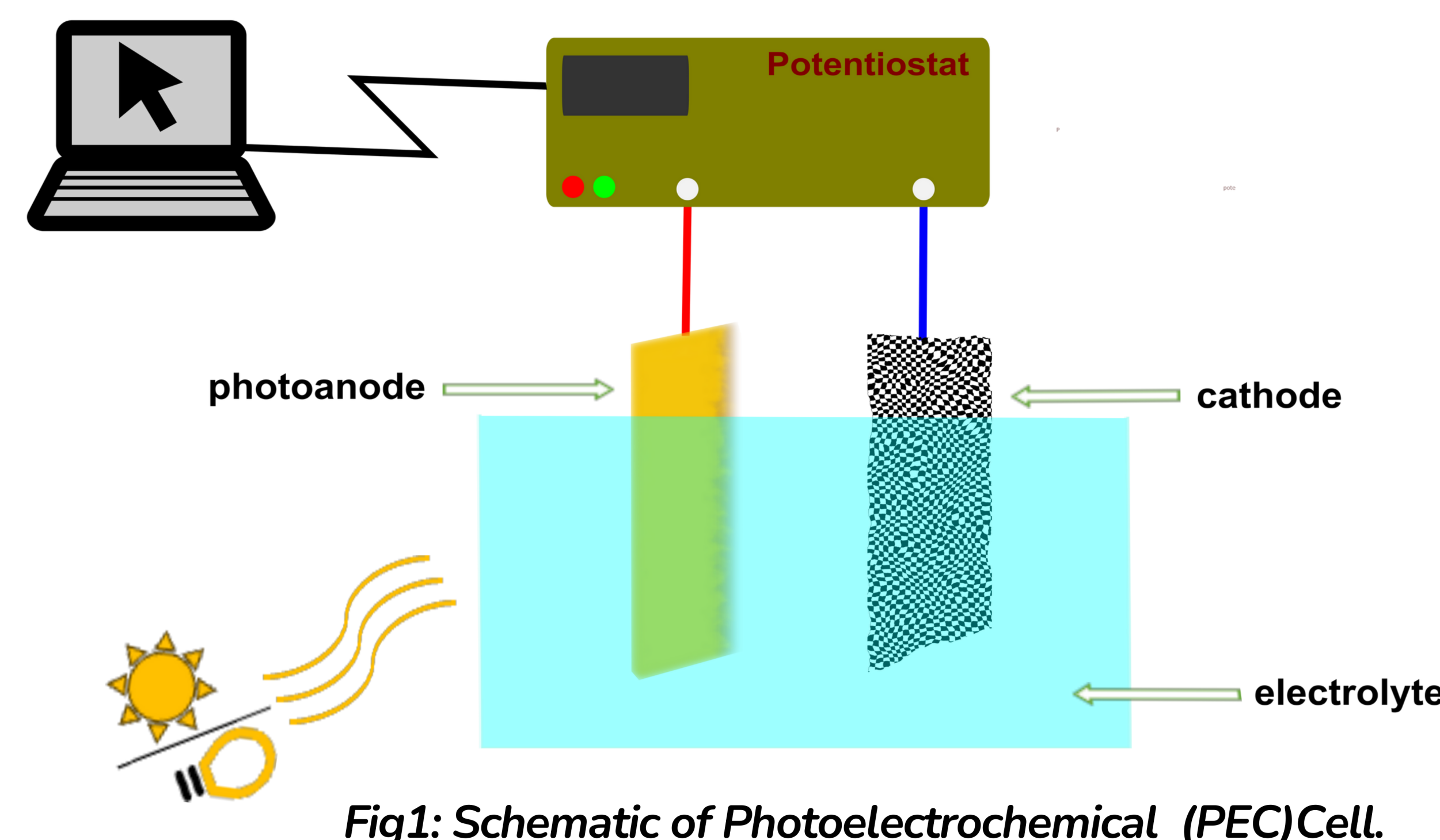
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- 01 Objective**
- Construct WO_3 photoanodes for wastewater treatment using various precursors.
 - We synthesized three distinct coating types, and subsequently utilized ball milling, the brick-and-mortar hypothesis, and the wet-coating (Meyer rod) deposition technique for fabrication.
 - The photocatalytic efficacy of the resulting compositions in tap water was evaluated. (Refer to fig1)



- 02 Methodology**
- WO_3 nanoparticle stock solution:** Ball milling of tungsten (VI) oxide powder in Isobutanol.
- APTA (acetylated peroxotungstic acid) stock solution:** sol-gel synthesis of peroxotungstic acid with acetic acid.
- WO_3 - APTA (mixture) stock solution:** The combination of both the particles (bricks) and APTA (mortar).

References

- Ochedi, F.O. et al., Environ. Chem. Lett. 2021, 19, 941–967.
- Peleyeju, M.G. et al., Journal of Water Process Engineering 2021, 40, 101930.
- Szeifert, J.M. et al., Chem. Mater. 2009, 21, 1260–1265.

- 03 Key Findings**
- The results of the mixture photoanode were confirmed using the brick-and-mortar strategy, as it exhibited photocurrents of **0.3 mA/cm^2 (Refer to fig 2(a)).**
 - The mixture photoanode demonstrated notable photocurrents when it was irradiated from the back side in tap water at **0.25 mA/cm^2 (Refer to fig 2(b and c)).**

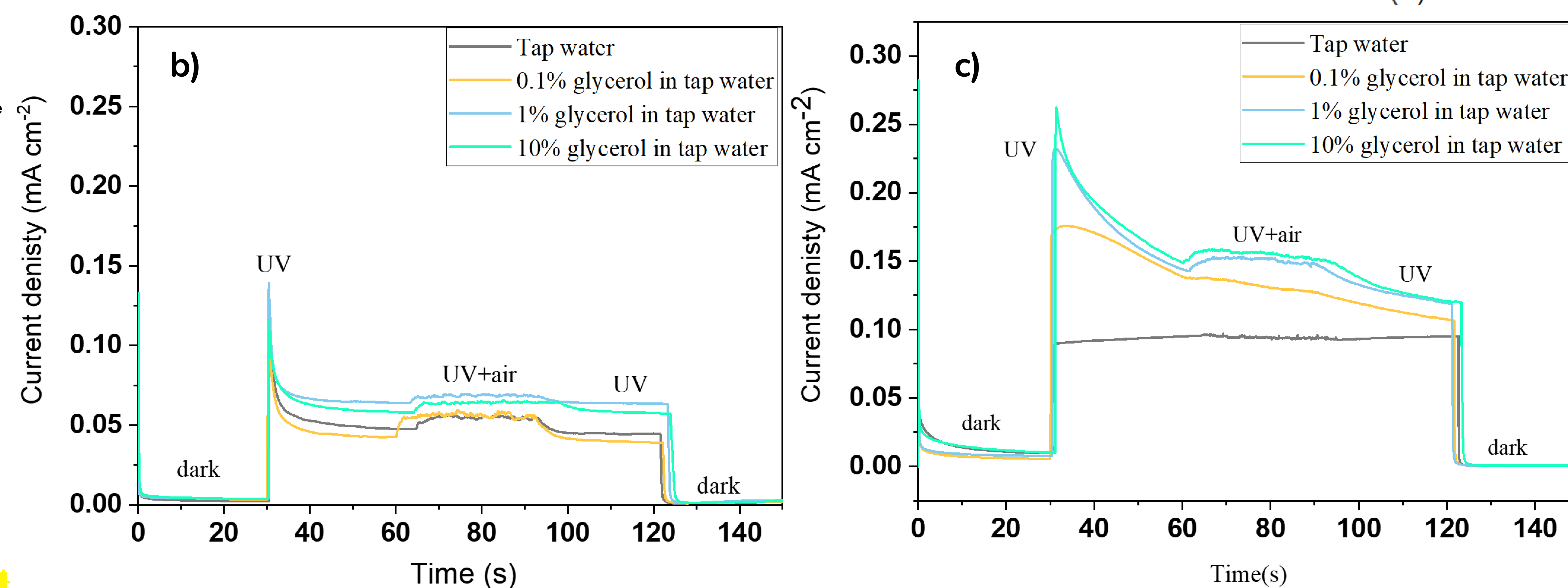


Fig 2: (a) Voltammetry of printed composition for particulate ink, soluble precursor (APTA), and mixture samples were measured in 0.1 M HClO_4 . The mixture photoanode is illuminated from both the (b) front side and (c) back side at a voltage of 1.5 volts with a carbon-Stainless Steel counter electrode in tap water with 0.1%, 1%, and 10% glycerol concentrations at a radiation intensity of 2 mW/cm^2 .

