PRODUCT DESCRIPTION

HIV-1 is a protein (Tat protein) that sits in the virus coat of human immunodeficiency virus type 1 (HIV-1), which is the causative agent of the acquired immunodeficiency syndrome (AIDS). Therefore, a rapid, inexpensive and portable viral load monitoring tools such as electrolyte solution-gate field-effect transistor (SGFET) are of utmost importance. The SGFET is suitable to provide a higher signal-to-noise ratio, good signal stability, and highly sensitive for early detection of HIV-1 Tat protein. The potential of using MWCNTs/nanodiamonds (NDs) as a transducer via aptamer as ligand binding molecule has opened new avenues in the development of biosensors for point of care diagnostics.

INVENTION ADVANTAGES

- Stability & accuracy performance using APTAMER
- Handheld & portable device
- Lower the processing cost 5%
- Chemically resistant
- Biocompatible
- Reusable

NOVELTIES

- As early detection in one week of HIV-1 Tat protein
- Label-free detection in static and real time
- Rapid screening of HIV-1 Tat protein via APTAMER
- Highly sensitive, specific and selective
- Low cost fabrication of SGFET

COMMERCIAL POTENTIAL

- High potential to be in clinical sample testing
- A portable and in-situ viral monitoring tool

COLLABORATIONS

Universiti Malaysia Perlis

A BIOSENSOR TEST KIT FOR EARLY DETECTION OF HIV-1 TAT PROTEIN


An artificial oligonucleotide that have ability to bind to proteins, small molecules, recognize their targets.

Schematic on Early Detection of HIV-1 Tat Protein via Diamond SGFET biosensors

Fig. 1

75% of global electrical energy production involves fossil fuel combustion, resulting in the detrimental effects of CO₂, SO₂, and NOx emissions (Fig. 1). Obviating such effects and fossil fuel depletion are the main drivers for development of energy carriers that are:

- CLEAN
- RENEWABLE
- AVAILABLE

WHY HYDROGEN?

- Solar radiation is the ultimate source of energy on earth.
- Semiconductors with band-gap energies (Eg) matched ca. 2.5 eV to the solar spectrum may be used for harvest solar energy.
- (Fig.3) Semiconducting photo-anoede absorbs photons with energies, hv > Eg, promoting electrons into semiconductor's conduction band (D), leaving (electron) 'holes' in its valence band (VB).
- 'Holes' oxidise water: 2H₂O + 4e⁻ → O₂ + 4H⁺.
- Electrons, conducted to metal cathode, reduce water to hydrogen: 2H₂O + 2e⁻ → H₂ + 2OH⁻.

MAJOR ADVANTAGES/NOVELTY

- Reactor systems for generation of carbon-free hydrogen using only SUNLIGHT and WATER.
- Reactor behaviour on scale-up for industrial uses, transportation etc.
- Can be used with other metal oxides: Fe₂O₃, TiO₂

MATERIAL CHALLENGES

Ideally, photo-anoedes should:

- Be thermodynamically stable
- Have band gap energy matched the solar spectrum
- Require a potential bias of 1.23 eV
- Cheap and easily available

ECONOMIC EVALUATION

Current work obtained current density is 8 A/m². According to the Shockley-Queisser limit, best obtainable performance is 29% for a 1.1 eV bandgap semiconductor which correspond to a current density of 43 mA/cm². The ideal electrode potential to be used is the theoretical limit, 1.23 V vs. RHE.

A plant producing 100000 H₂ a day will cost roughly RM 33560 per day.

As a fuel 1000 kg H₂ can offset 4000 L gasoline which is equivalent to RM 12960 and offset 9200 kg CO₂ which will cost RM 25880 to remove.

SAVING (RM 42768 – RM 33560) = RM 9208 per day using H₂ as fuel.