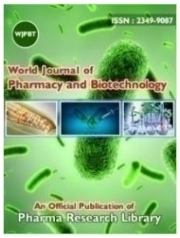

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Nanobiosensors and their Usage in Drug Analysis

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A B S T R A C T

This review focuses on the advantages and applications of Nanobiosensors and their usage in Drug analysis for the development of sensors and biosensors. Nanobiosensors have been used and developed for a broad range of applications including all types of biosensors for food safety, optical sensors for viral detection especially the current outbreak of novel coronavirus disease. Nanotechnology has bestowed some highly concentrated ingredients for the improvement of phenomenon of sensing. This paper highlights some different types of nanobiosensors based on the mechanism, usage and applications. Used for the fastest detection and its reproducibility in a much better way, for applications as diverse as the diagnosis of clinical and metabolic complications, diverse as food quality estimation. The lack of effective methods of early analysis and detecting accurate may results in causing severe infections, mortality. Nanotechnology based biosensors are searching for many applications in biological detection, military applications, agricultural applications. All these representative studies demonstrated for appealing the performance as biosensors as clinical diagnosis.

Keywords: Nanobiosensors, biosensors, nanotechnology, biotechnology, amperometry, potentiometry, conductometry, mortality, analyte, accuracy, biomedicals, serological, agglutination assays.

A R T I C L E I N F O

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1. Introduction

A biosensor can be defined as an analytical device which incorporates biologically active element with an appropriate physical transducer to generate a measurable signal proportional to the concentration of chemical species in any type of sample.Nano biosensors demonstrate the ability to detect and analyze drugs at very low concentration 1.1 Characteristics:

Biosensors characteristics are:

Sensitivity:

It shows the minimal concentration or amount of analyte that can be detected.

Selectivity: It detects a certain analyte and does not change the admixtures and contaminants

Accuracy: It is usually differentiated in terms of the deviation of the measurements. This device makes quantitative measurements.Working range: Working range of analyte concentrations, this sensor can also be operated.

Regeneration time: The time required for assay to analyte.

Number of cycles:

The no. of times this sensor can be operated.It is a device that measures biological or chemical reactions by generating signals proportional to concentration of an analytical in the reaction.LELAND CLARK [1918-2005] who introduced the first description of a biosensor of an amperometry enzyme electrode, and he is the father of biosensor.

The number of false positive and false negative results should be low, ideally zero. It exhibits rapid responses combined with very high sensitivities.A biosensor has to meet the basic characteristics of the commercial sensors like sensitivity, selectivity, accuracy, working range, regeneration time, number of cycles.The rapid advancement of biosensors can be due to their characteristics of the simplicity of manufacture, easy handling, low costs, high sensitivity.

2. Types of nanobiosensors

They are different types of nano biosensors:

Based on the usage and biosensors are majorly divided into four types, they are

1.Optical biosensors

2.Electrical biosensors

3.Electrochemical biosensors

4.Nanowire field effect biosensors

Optical biosensors:

A sensor that uses the light to detect the effect of a chemical on a biological system. The small size of the optical fibres allows sensing intracellular and intercellular physiological and biological parameters in micro environment.

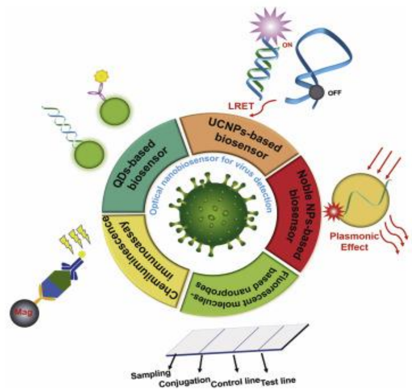

Fig. 1. Optical biosensor

Mechanism of action: Optical biosensors measure changes in a particular characteristic of light, coupled to changes linked to binding at the sensor surface ok by making use of the electromagnetic evanescent wave formed at the gold interface of the sensor chip surface.

Uses: Optical biosensors are applied in healthcare, environmental analyses, and the biotechnology.

Electrical biosensors:

Example is Piezo-electric biosensor

Some piezo-electric devices utilize crystals, such as quartz, which vibrate under the influence of an electric field. The frequency of this oscillation depends on their thickness and cut. It detects the oxidation and reduction reaction of potential / gradient associated enzyme / metabolites and conveys an EC signal to electrodes for the detection of the concentration of that solute.

Mechanism of action:

Sensors that consist of 3 parts; sensing element to detect the physical and chemical quantity, transducer to convert the detected parameter to an electrical signal, readout device such as computer that is used to read and interpret the converted signal.

Uses: It provides a low cost and convenient solution for the detection of variable analytes, widely used for in agriculture, in food and oil industries, as well as in environmental, used in biomedicals.

Electrochemical biosensors:

Amperometry for applied current: current movement of redox reactions detected when a potential is applied between two electrodes.Potentiometry for voltage: change in distribution of charge is detected when using ion-selective electrodes.

Conductometric for impedence:

Mechanism of action: The electrochemical biosensor is one of the typical sensing devices based on transducing the biochemical events to electrical signals. In this type of sensor, an electrode is a key component that is employed as a solid support for immobilization of biomolecules and electron movement.

Uses: Short response time, these are wearable, portable and implantable devices to enable point of care diagnostics and health monitoring.

Nanowire field effect nano biosensor:

Semiconductor channel (nanowire) of the transistor. The semiconductor channel is a fabricated using nanomaterials such as carbon nanotubes, metal oxide nanowires or nanowires. Very high surface to volume radio and very large portion of the atoms are located on the surface. Extremely sensitive to environment.

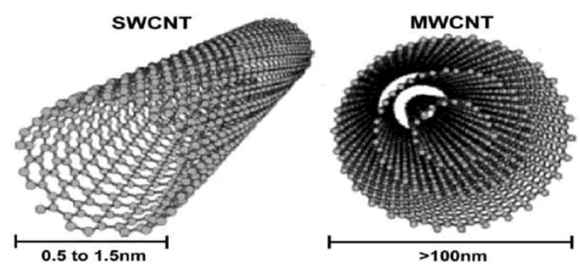

Fig. 2.

Mechanism of action: The mechanism of their sensing process is due to the variation in their charge density that leads to changes in the electric field at the surface of the Silicon nanowires.

Uses: These are used as connectors for the transportation of electrons. They don’t conduct as electricity as bulkier electronics, and also used as one -dimensional nanowires.

3. Applications

Applications of nano biosensors: These are extensively utilized and intensively studied in the various applications are:

Biological applications:

DNA sensors: Disease and genetic monitoring.

Immunosensors: HIV, Hepatitis, other viral disease, drug testing, environmental monitoring.

Bacteria sensors: Medicine, food industry, environmental.

Point of care sensors: Blood, urine, electrolytes, gases, steroids, hormones, proteins, drugs.

Cell based sensors: Functional sensors, drug testing.

Enzyme sensors: Drug testing, diabetics.

The nano biosensors provide understanding into a person health status through non-invasive detecting of clinically relevant biomarkers in several biofluids such as tears, saliva, sweat without sampling, complex manipulation, and treatment steps.

Environmental applications: Detection of environmental pollution and toxicity. Agricultural monitoring, Ground water screening, ocean monitoring.

Military applications: Battle suit using nanocomposite, invisibility cloak, hypersthelth technology, waterproof and bulletproof vests.

Proteomics-Based protocols for viral Detection:

SPR Based Analysis of Coronavirus Protease Inhibitors:

Coronavirus are emerging at a fast pace, it attaining the pandemic proportions in no time. It was a highly contagious infection, affecting around 8500 people and killing around 850 globally. Severe acute respiratory syndrome (SARS) is a fatal respiratory illness caused by CoV, SARS-CoV. In 2012, a new CoV emerged as Middle East respiratory syndrome coronavirus (MERS-CoV), causing large-scale death in Asia. SARS-CoV is an RNA virus sharing very little homology with other CoVs. Two proteases in SARS-CoV, namely 3-chymotrypsin-like protease and papain- like protease are conserved across the CoV genera and serves as a crucial antiviral target as they are cleaved to generate mature active proteins. The study shows polyphenols from Broussonetia papyrifera have inhibitory activity against CoV proteases. This inhibitory action stems from the number of phenyl groups present in the polyphenol The SPR based investigation identified the most potent anti-CoV agent.

Human SAMD9 Interaction with M062:

Deleterious mutation in human sterile alpha motif domain protein 9 (SAMD9) Gene may lead to cancer, inflammation, attenuated immune response and development arrest. By using the SPR, In-vitro kinetics of interaction between SAMD9. A crucial host range from myxoma virus (MYXV) is found to be antagonistic to the human SAMD9. An infection assay revealed that exogenously expressed that N-SAMD9 inhibits the wild type MYXV infection. It results and provides the molecular insight into the mechanism that leads to the suppression of antiviral function of SAMD9.

Vaccines

SPR Aided Vaccine design

This design enveloped the designs such as HIV and influenza virus are studied. The non-enveloped viruses are studied with respect to the neutralizing antibody response. With the respect to the binding of two neutralizing antibodies of Reo virus with attachments to protein sigma 1 reovirus. These vaccines studied and revealed resulting that the mechanism of action to block the viral infection, vulnerable sites for the neutralization of viral infections, it also confirms that adopted during viral cell entry. In the process of cell entering, protein sigma-1 attached to the glycan receptors and also with the junctional adhesion molecule-A. It concludes that the SPR and cell binding assayed that the tested antibodies are interfere with JAM-A attaches through the steric hindrance.

4. Conclusion

Various analytical methods are used for the infections like viral infections to detect and analyse, nano-biosensors demonstrate the ability to detect and analyse drugs at very low concentrations. Concludes that the timely diagnosis of viral infections is very difficult to predict the outbreak of disease before it assumes the pandemic and endemic proportion. Rapid evolution of virus has released the conventional surveillance protocols such as serological and agglutination assays, antigenic, simplicity, shelf life, robustness lacks, reproducibility. This will maximize its advantages in the nanowire field-based diagnostics applications in remote areas to improve the reliable diagnostics tools for the most common man other than being an ultra-sophisticated devices along with the confines of laboratory accessible for the few academic elites. Around 2020s corona virus without any hesitations and undoubtedly redoubles the research interest in the rapid viral diagnostics techniques. Developing biosensors with high-sensitivity, fast response, less time consuming. Carbon nano tube-based devices plays a major role in many of the responses to these challenges.

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