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Mini Review

Applications of biosensors - A short review

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ABSTRACT

Enzyme-based, tissue-based, immunosensors, DNA biosensors, thermal and piezoelectric biosensors are explored here, revealing applications in medical fields to distinguish between natural and man-made substances. Some industries have implemented the use of biosensors, such as the food industry. Biosensors are used in metabolic engineering to enable in vivo monitoring of cell metabolism, in order to obtain accurate glucose concentrations, in fermentation industries and in saccharification processes to control its quality and safety. Biosensors and their role in medicine, including early detection of human interleukin 10, which causes heart disease, and rapid detection of human papillomavirus (HPV). It's an important aspect. Fluorescent biosensors play an important role in drug discovery and cancer diagnosis. Biosensing applications are widely used to find missing links in metabolic processes. Basically, biosensors serve as inexpensive and highly efficient devices for these purposes in addition to other routine applications.

1. Introduction

The history of biosensors began in 1962 with the development of enzyme electrodes by scientist Leland C. Clark. Since then, a vast research community in physics, chemistry, materials science and more has come together to develop more sophisticated, accurate, reliable and sophisticated biosensing devices. Applications for these devices are in the medical, agricultural, biotechnology, military, and bioterrorism detection and prevention fields. Biosensors are also known as immunosensors, optrodes, chemical canaries, resonant mirrors, glucometers, biochips, and biocomputers. Higson and D.M. Frazer, two definitions often cited by S.P.J. "Biosensors are chemical sensing devices that have been developed" and "Biosensors combine specific-biological (generating recognition events) and physical (transducing recognition events)".[1]

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2. Basic Concept

The basic concept of biosensors is that any signal in any form produced in any living cell can be detected by applying any suitable biosensor. Biosensors can be enzyme-based, antigen- or antibody-based, fluorescence-based, electrode-based, etc., or can be a combination of two or more.

As depicted in the above schematic flowchart a biosensor consist of a bioelement and a sensor element. Bioelement can be a enzyme, living cell, antibody, serum sample, tissue sample etc. The sensing element can be electric current, electric potential, and so on.[2]

3. Applications of Biosensors

Biosensors have been applied in many fields namely medical field, food industry marine sector etc. They also have provide better stability and sensitivity when compared to traditional methods.

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3.1. Medical field

The use of biosensors is rapidly increasing in the medical field. Glucose biosensors are widely used in clinical applications to diagnose type 2 diabetes, which requires precise control of blood glucose levels. Also, the home use of blood glucose biosensors accounts for 85% of the vast global market.[3] The biggest dilemma facing us today is heart failure, which affects about 1 million people. Technologies to detect cardiovascular disease include immunoaffinity column assays, fluorescence and enzyme-linked immunosorbent assays.[4] Various other diseases to which biosensors are applied Urinary tract infection, end-stage heart disease - Hafnium oxide (HfO2) is clinically useful in IL-10, end-stage renal disease, cardiac markers in undiluted serum, and acute leukemia. Immunosensor array for immunophenotyping, used to detect histone deacylases (HDACs). Inhibitor assays such as by resonance energy transfer.

3.2. Metabolic engineering

The need for a sustainable bioeconomy is the time need to save the environment from the slowly expanding petrochemical industry. Researchers see metabolic engineering as a key technology for a sustainable bioeconomy. Their vision is that fuels, basic chemicals and medicines are largely synthesized from renewable materials by studying microbes rather than relying on refining petroleum or extracting them from plants. Previous methods were spectroscopic-based enzymatic assays, but had limited throughput. To overcome this obstacle, genetically encoded biosensors have been developed that enable in vivo monitoring of cell metabolism, and high-throughput screening and screening using fluorescence-activated cell sorting (FACS) and cell survival, respectively. Provides selection possibilities.[5]

3.3. In fermentation processes and food industry

In both industries, product quality is extremely important. During the fermentation process, saccharification was monitored by the traditional fehing method. Since this method involves titration of reducing sugars, the results were imprecise. However, since the introduction of glucose biosensors in 1975, the fermentation industry has benefited. Currently, the factory uses glucose biosensors to control production in saccharification and fermentation workshops to produce glucose using bioenzymatic methods. Ion-exchange recovery experiments of isoelectric liquid glutamate supernatant were performed using the glutamate biosensor. Fermentation processes are Byzantine processes with several key variables, most of which are difficult to measure in real time. Online monitoring of key metabolites is essential to enable rapid optimization and control of biological processes. In recent years, biosensors have gained much attention in online monitoring of fermentation processes due to their simplicity and rapid response.[6]

The food processing industry concerns food quality and safety, maintenance, and processing is traditional techniques for conducting chemical experiments and spectroscopy suffer from human fatigue, are costly and time consuming. The food industry wants an alternative to food certification and monitoring that objectively and consistently measures food in a cost-effective manner. Therefore, the development of biosensors to meet the demand for simple, real-time, selective, and low-cost technology seems an opportunity.[7]

The various other industries where it is used are in Plant Biology, Biodefensing, in genetic engineering etc.

4. Future Scope for Biosensors

Ex vivo or in vivo genetically engineered proteins are used in cells and tissue-based biosensors injected into cells, allowing researchers to continuously and noninvasively sense levels of hormones, drugs, or toxins increase. The scope in this regard can be of value for research into aging, cancer, and genetic diseases. The Biosensor is used in marine applications to detect eutrophication with nitrite and nitrate sensors. Various sensors based on the detection of nucleic acid hybridization have been developed for the detection of organisms. The Environmental Sample Processor was developed at the Monterey Bay Aquarium Research Institute for the automated detection of toxic algae in situ from baths using ribosomal RNA probes. This is a promising development in this area.

One of the main goals is to use biosensors to detect pollutants, heavy metals and pesticides in water and air. A new generation of biosensors has great potential through the application of nanomaterials in biosensor technology. They improve the mechanical, electrochemical, optical and magnetic properties of biosensors. They are evolving into single-molecule biosensors with high-throughput biosensor arrays.

Biomolecules have specific structures and functions, and these molecules take full advantage of the structures and functions of immaterial and biomolecules to fabricate multifunctional single-molecule nanocomposites, nanofilms, and nanoelectrodes. Decide how to what is the other big challenge? Processing, characterization, interfacial issues, availability of high-quality nanomaterials, tuning of nanomaterials, and the mechanisms governing the behavior of these nanoscale composites on electrode surfaces also affect the current state of technology. It's a major challenge.

The future of biosensors will focus on elucidating the mechanisms involving interactions between nanomaterials and biomolecules on the surface of electrodes or nanofilms, and new properties will need to be exploited to fabricate a new generation of biosensors.

Nevertheless, in the modern era of clinical diagnostics, nano-material based biosensors present very attractive prospects and will find wide acceptance in clinical diagnostics and help improve health. It will also be useful in food analysis, process control and environmental monitoring in the near future.

5. Conflict of Interest

The author has none conflict of interest to declare.

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