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Application of Biosensor

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Abstract: In this paper, biosensors are the device in which there is a coupling of biological sensing element whit a detector system using a transducer. In comparison with any other currently available diagnostic device, biosensors are much higher in performance in terms of sensitivity and selectivity both. Biosensors have found potential application in the industrial processing and monitoring, environment pollution control, also in agriculture and food industries. Important features for commercialization of the biosensors are selectivity, sensitivity, stability, reproducibility and low cost. This article reviews the brief history, basic principle, and the various types of biosensors available.

Keywords: Biological sensing element, transducer, diagnostic device, industrial, environment pollution control, agriculture, food industries.

1. Introduction

These-days, especially, the attention is increasing in high technology of biosensors designed for various uses in biological matter, Biomedicine, drug improvement, security, nutrition safety and ecology monitoring and measuring. Bio sensors have a multi-disciplinary nature including biology, chemistry, physics, instrumentation, electronics, optics and market. It is well known in clinical chemical analysis application biosensors normally made of bio-recognition and bio-transducer component with electronic system that includes signal amplifier, processor and a display unit [1]

Fast analytical methods are highly needed in food industry for determination of specific chemical compounds in food products. A biosensor detects chemical and biological compounds in a living environment with the help of a specific biological reorganisation element whose property changes upon binding of the compound. This change is converted into signal that can be conditioned and quantified. Dr.Leland C Clark who is the father of Biosensor developed the ‘enzyme electrode’ in 1960 to measure the glucose level using immobilised glucose oxidise enzyme [2].

The issue of food safety has emerged as worldwide due to sub quality foods being linked with increased morbidity. The popular method is chromatographic analysis is constrained by the rigors of often elaborate sample preparation, and homogenization, clean up and then the analytical component of the test to determine a viable concentration. Consequently, the process often must be repeated multiple times, as many samples are needed to give an accurate result due to the number of interferences in the matrix extract. [3].

In medical field, biosensor placed a major path in detecting diagnosed cell. Cancer analysis is based on the feature of cells including mutations in DNA or RNA, changes in proteins and protein level as well as on comparing cell, properties like morphology, adhesion or elasticity. In biosensor two components are unavoidable: the transducer and the bio recognition element placed on the sensor surface. Transducer transforms the biochemical response to a measurable output signal. The bio recognition elements (bioreceptor) placed on the sensor ensures capturing the matching analyte from the solution sample. The detection of metabolic or biological components is also possible. [4]

The wireless sensor network (WSNs) in a wide range of applications, Security problems associated with them. Middleware is used as a intermediate layer between WSNs and the end user, but most of the existing middleware is unable to to protect data from malicious and unknown attacks during transmission. Secure wireless sensor network middleware (SWSNM) is called as the generative adversarial network algorithm which consists of two networks. A generator (G) network and the discriminator (D) network. [5]

The need for micro fluidics and micro electrochemical system based biosensors has been widely acknowledged. Because of increase in health care cost, there is an increasing need to remotely monitor the health condition of patients by point of care teasing. Harmful algal blooms in freshwater systems are increasingly common and present threats to drinking water systems, recreational water and ecosystems. Likewise the portable biosensor used in many forms of industries to regulate the machines, medical fields to regulate the biological disabilities. [6]

Now-a-days smart packaging is exponentially growing field in the food industry which detecting changes in the headspace and tracing products history. It ensuring the quality and safety of food product smart packing is built – in sensors and indicators that can detect the fresheners of meat products. Data collected from biosensors can be traced and monitored during production, distribution and consumption of fresh products to ensure their safety [7]. Among numerous emerging sensing technologies physical sensors have been successfully demonstrate in the field of biomedical application. Physical sensor responsive towards physical properties. Physical sensors are used in biomedical application such as blood pressure, muscle displacement, body temperature, bone growth and cerebrospinal fluid pressure measurement. Physical sensors are used in electronic device such as x-ray tomography, PET, ultrasonography, MRI, measurement of blood pressure and body temperature [8]. Methyl parathion is an organo phosphate insecticide which is used to product crops from insects. It causes many health problems in humans methyl parathion is classified as extremely toxic by world health organisation. Organo phosphate hydrolyses was discovered in soil microorganism which hydrolyses methyl parathion into P-nutro phenol which is non-toxic. Organo phosphate hydrolyses reported based on enzymatic and microbial biosensors for detection of methyl parathion patricide [9].

Biosensors are electronic device that are sensitive to convert bio-recognition processes into measurable signals through a physicochemical process. According to the type of transducers, biosensors are classified into three categories, namely electronic, optical and piezoelectric biosensors. According to the nature of biological recognition, biosensors are classified into cellulose and cellulose-based composite, enzyme-based biosensors, immunological biosensors, DNA-biosensors, microbial biosensors and grapheme based biosensors. The immunological biosensors are based on enzymes-linked immunosorbent assay with higher sensitivity and are classified into capture antigen. The microbial biosensors are analytical device that integrate microorganisms with a transducer to measure a generated single that is correlated to the analytics concentration. Several cellulose-based biosensors were designed such as gas sensors, humidity sensors, UV sensors, strain sensors as well as capacitive sensor. Submission is available from the conference website. [10]

2. Applications of Biosensors

These days, especially, the attention is increasing in highly technology of sensors designed for uses in biological matter, biomedicine, matter, biomedicine, ecology monitoring and measuring etc.

Biosensors have broad application in such as screening and monitoring of public and personal health, pathology, environmental monitoring, criminology, food industry for safety. Biosensor is made of bio recognition and bio-transducer component, with an electronic system that includes a signal amplifier, processor, and display unit. With a space of 6.35mm (0.25"Inch) between columns.

3. Biosensor in Food Industry

The basic biosensor framework includes a substrate such as silicon, glass or polymers such as polymethyl methacrylates, polydimethyl siloxane etc coated with a conductive layer like polysilicon, silicon dioxide, silicon nitrate, metal like gold and metal oxides and specific capture molecules like anti bodies, enzymes, DNA/RNA probes, phage-derived bio molecular recognition probes and the suitable detection system. Highly sensitive sensor can be fabricated using piezoelectric materials such as quartz crystal, potassium sodium tartar ate, lithium niobate, etc as a substrate, coupled with electromechanical detectors. Various researchers have developed and studied different types of biosensor for determination of particular compounds in foods. It is also called as an analytical device that combines a biologically sensitive recognition element (such as antibodies, nucleic acids, enzymes) immobilised on a physicochemical transducer, and connected to a detector to identify the presence of one or more specific analytes and kinetics in samples. In agriculture and food industries, early detection and sensitive analysis of potential contaminants and toxins is crucial and driven by a multiplicity of factors, such as the short shelf life of many fresh food products. in food analysis it address three board categories. Safety, quality and authenticity.

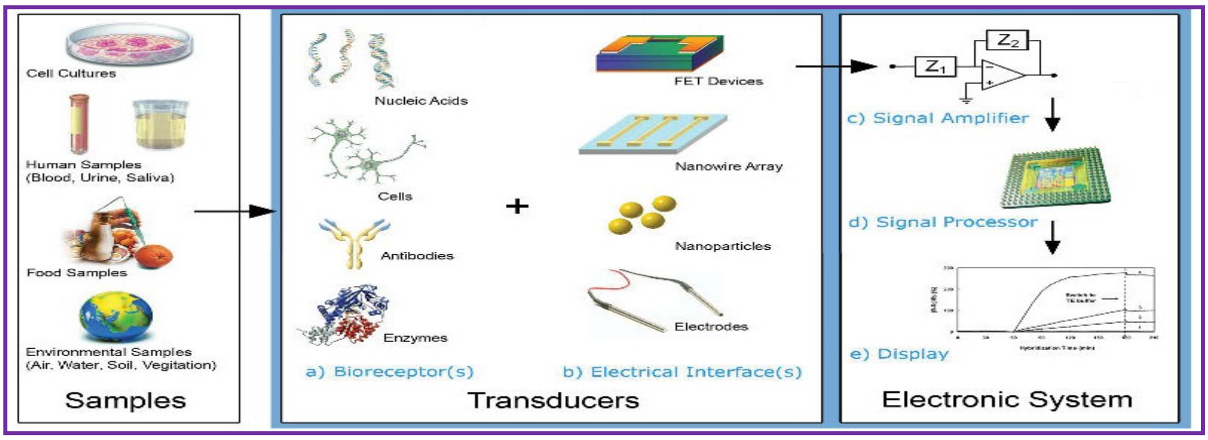

Figure 1. Biosensor-related elements from sample To electronic systems.

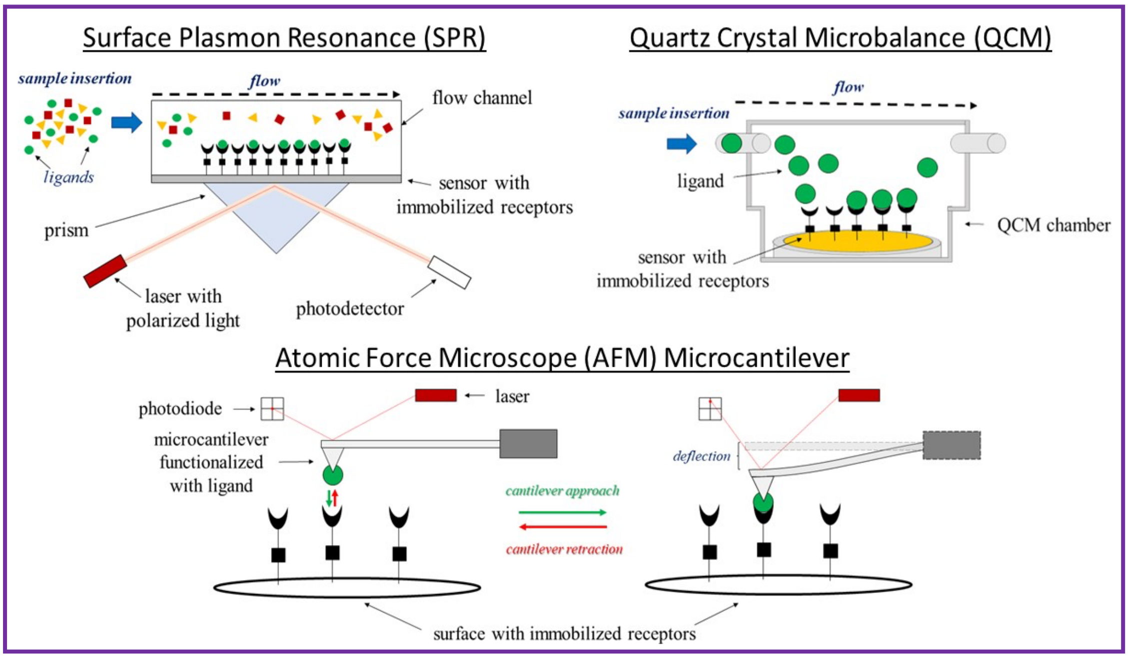

Figure 2. Biosensor in Cancer Research

Food safety screening focuses on the detection of undesirable contaminants in food, such as pesticide and antibiotic residues, allergen. Similar analysis is used to establish or confirm the nutritional value of a food product.

4. Biosensor in Cancer Research

Biosensor measurement methodology determines the type of detection. Label free or non label free. Label free detection is based on binding the original and unmodified analyte molecule directly to the bio reorganisation element, whereas in some methods (amperometric or fluorescent experiments) only the analyte molecules tagged with the label may be recognized by the bio recognition element to obtain an electro active signal(fluorophores, several nan oparticals and enzymes).Metal nanoparticals have a significant affinity for cancer cells, that is why they are frequently used in cancer research. Specific markers are often introduced into the tested compound using chemical synthesis is genetic engineering methods. Unfortunately, the attachment of the label may significantly alter the properties of the tested molecule, substance used as markers may attach to other molecules then the target, and when using living cells, they may interfere with their metabolism. Considering all the above, label free methods gain much more attention. Nowadays, popular label free methods are quartz crystal microbalance (QCM), surface Plasmon resonance (SPR). These techniques allow tracking and determining the kinetic/thermodynamic analysis of the interaction process of two complementally molecules in real time, where one molecule is immobilized on the surface and the second one is in flow.

Ecology monitoring and measuring etc., biosensors have broad application in such as screening and monitoring of public and personal health, pathology, environmental monitoring, criminology, food industry for safety. Biosensor is made of bio recognition and bio-transducer component, with an electronic system that includes a signal amplifier, processor, and display unit. with a space of 6.35mm (0.25"Inch) between columns.

5. Biosensor in Smart Packaging

In recent years we have witnessed numerous incidents of contamination of food products thought the world. In United States there were not outcomes of food borne illness caused by Escherichia coli, nor virus, listria and other pathogen in salmonella, tuna, chicken, dairy products etc., there is a growing consumer demand for developing technology to ensure the safety of food products. The quality of food is usually determined by the environment in which the products are packaged and delivered to the consumer. In order to determine the freshness of meat using indicator/sensors, it is imperative to understand the mechanism of meat spoilage.

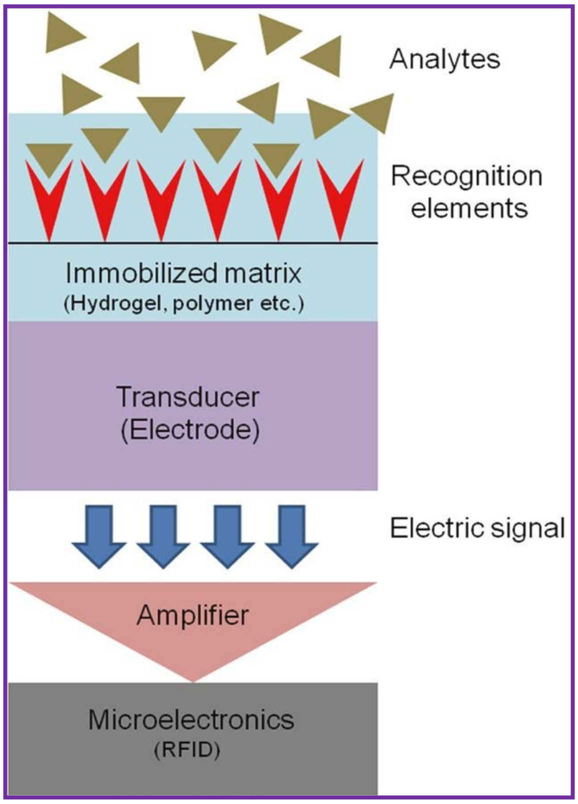

Figure 3. Biosensor in Smart Packaging

By incorporating indicator, sensors and radio frequency identification (RFID) into packaging, smart food packaging technology has enable better monitoring and communication of information about food quality. This technology has also allowed manufacturers and consumer to trace a products history thorough the critical points in the food supply chain. In order to monitor the integrity of food products, many types of indicators and sensors have been developed for smart packaging, such as time-temperature indicators and freshness indicator/sensors using quality-indicating parameters as analytics.

Figure shows the schematic drawing of a system that incorporates both a bioelectrical sensor and a RFID tag. ideally, a biological element is immobilized onto the surface of an electrode, which can mediate an electrochemical reaction and generate an electrical signal that is correlated to the concentration of the analytes. The signal will be amplified to create electron flow to operate a microelectronic device, such as an RFID tag. By the convergence of bio sensor and RFID techniques, data collected from the biosensor can be traced and monitored during the production, distribution, and consumption of fresh products to ensure their safety.

6. Biosensor in Biodegradation of Methyl Parathion

Methylparatheon is an argano phosphate insecticide which is being used in agriculture to protect the crops from insects. Methylparathon is produced by the reaction of O, O-dimethyl phosphorochloridothionate and the sodium salt of 4-nitrophenol in acetone solvent.

Methyl parathion kills pest by acting as a stomach poison and act as potent irreversible acetyl cholinesterase inhibition. It causes many health problems in humans. It is classified as catogory1 (extremely toxic) by the WHO. Organo phosphorus hydrolyses was discovered in soil micro organism and hydrolyses methyl parathion into p-nitro phenol and di methyl this phosphate. Hydrolysed product PNP can be detected by electrochemical and optical methods.

7. Review and Discussion

Although the biosensor displays clear advantages over traditional methods, the perfect biosensor does not as yet exist and there may be many obstacles in its development to overcome. Presently many biosensors are not easily implementable, if only because so few are currently available commercially. It is almost inevitable that the future of biosensor will involve partnership with the information communications technology to assist food producers, retailers, authorities and even consumers, in their decision making 108 by equipping them with the decision making process. This enables greater management of natural resource.

Cancer could develop at a very rapid pace, therefore the simplicity of measurements, quickness of the test and low cost are in request from the potential new methods that are to be applied. For this reason, biosensor techniques, especially those with label free detection, have gained massive attention recently. Their main assumption is the specific interaction occurring between the bio recognition element and the selected analyte Some of this measurements can be made on living or fixed cells and may deliver kinetic and thermodynamic analysis of the obtained interaction, as well as the information about the affinity, conformation of the created complex and even viscoelastic properties of the new appearing bio molecular surface. A wide variety of biosensor is available amount the transducer type and the bio recognition element alike.

8. Conclusions

Biosensors are equally effective for analysis of chemical components from vegetarian and non vegetarian foods. Selection and use of bioreceptor (eg:enzyme)is of key importance of identification of particular compounds. Biosensors are equally effective in estimation of food constituents as electronic gazettes in practice. It is faster, reliable and cheaper tool for determination of food constituents. Electrochemical biosensor has existed for nearly fifty years and seems to possess great potential for the future. This technology gains practical usefulness from the from the combination of selective biochemical recognition with the high sensitivity of electrochemical detection. Thanks to current technological progress, such biosensors profit from miniaturized electrochemical instrumentation and are the very advantages for some sophisticated application requiring portability, rapid measurement and use with a small volume of samples. Numerous commercial applications confirm the attractive advantages of electrochemical biosensor. The research is going on to increase the sensitivity of the biosensor for the effective application.

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