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Biosensors

Koul S*

Restoration Hardware-Building D, 5735 Paradise Drive Corte Madera, CA 94925, United States

Biosensors

The IUPAC defines biosensors as are devices which use a biological recognition element retained in direct spatial contact with transduction system. Biosensors are comprised of a combination of biological units such as DNA, RNA, and enzymes to its electrochemical transducer in order to sense and observe various biological analytics [1]. They are available in several types that have been successfully applied in various fields such as environment, food industry, and biomedical to detect or observe certain contaminants. They also have devices associated with electronics or signal processors that enable the display of the result in a user-friendly way. This paper gives an overview of a biosensor, its working mechanisms, different types, and its application.

The first aspect of biosensor discussed is its working principles. When the biosensor is being applied, the specific enzymes or biological materials are deactivated and placed near the transducer. Specifically, materials such as proteins used in the receptors are heavily affected by the deactivation process. According to Elprocus (2019), the biological item is collected to provide electronic reaction for calculation to the analyte. In some applications, the analyte can be changed to devices that are either connected to gas discharge, electronic ions, heat or hydrogen ions. In this case, the transducer can alter the linked device and convert their emissions into electronic signals that can be calculated or changed [2]. Transducer electronic signal is frequently low and has to overlay on a fairly high baseline making the biosensor to have a comparatively slow reaction which helps to ease the electronic noise filtration problem [1]. The signal process phase of the biosensor involves deduction of position baseline signal acquired from the linked transducer without any biocatalyst covering. The design of the biosensor should consider the configuration of the bioanalyte, the accessibility of the reception sites, analyte working provision.

The classification of biosensors into different types is mostly done based on the biological material device incorporates and the sensor devices [3]. There are different types of biosensors; however, this piece discusses seven common types of sensors. A biosensor measures the electronic current and ionic charges carried by bio-electrodes. The functioning of this biosensor is based on the electrons that are generated by enzymatic catalytic reaction [4]. The second type of biosensor is the amperometric biosensor; this biosensor depends on movement electronics that pass through the electrodes as a voltage to cause an enzymatic reaction.

Enzymatic reaction needs to the production of substrate that causes the electrodes to at surface of the biosensor to transfer electrons that can be calculated. This process makes it possible for the measurement of the alternate current flow since the substrate concentration is proportional to the magnitude of the current [4]. The other important type of biosensor is the blood glucose biosensor. The biosensor has a single use-disposable electrode and converts electrodes with the help of hydrophilic mesh. The potentiometric biosensor is a biosensor that provides logarithmic reply through a high energetic range. The ionic concentration changes in this type of biosensor are determined by the ion-selective electrodes [5]. The ionic concentrations that the potentiometric biosensor is more sensitive to are H^+ and NH^{+4} [4].

The thermometric biosensors are classified as electrochemical biosensers and are normally applied in the measurement of serum cholesterol and related tests. Since this biosensor is associated with the invention of heat at its base, it allows the heat that is produced when cholesterol obtains oxidized to be calculated [6]. This process can also be applied in the assessments of glucose, urea, penicillin G and uric acid. The optical biosensor is a device that utilizes optical measurement principals like absorbance [1]. This type of biosensor is normally used for non-electoral sensing materials with the transducer element of the optical biosensor being enzymes and antibodies. The benefit of this sensor is that it does not require a reference sensor since a sampling sensor can be a similar light source [7]. The last type of biosensor discussed is the wearable biosensor; this is a digital device that is attached to the human body through different wearable systems such as smart shirts, smart watches, and tattoos that monitor levels of different elements of the human body [1]. They are normally used to observe blood glucose, blood pressure, and the heartbeat rate which helps humans in premature recognition of health actions.

The biosensor has been a developing field in recent years and its application has strongly continued to be applied in different fields. The most basic field that biosensor application is involved includes biomedicine, tissue engineering, food industry, and environment. In biomedical applications, biosensors in the past six years have been able to establish the phenomenal of molecular interaction that is employed in different scales to especially the enzyme-substrate sensors [1]. With the increasing number of individuals being affected by diabetes mellitus, biosensors have become essential in the glucose sensing technology.

Since the detection of diabetes mellitus is highly related with enzymes of glucose oxide and glucose dehydrogenases, the biosensors have proved to be the best option in the biomedical field that can be able to sense the presence of these enzymes effectively. When it comes to tissue engineering, biosensors play a significant role to enhance the applicability of different functions. Biosensors are applied in the manufacturing of "organ-specific onchiops", maintaining the 3-D integrity and cell culture configuration [1]. Electrical, optical, and electrochemical biosensor methods are also used to detect DNA concentration up to 10-8. Biosensors in the tissue engineering field are

***Corresponding author:** Sunil Koul, Sr. Leader of Engineering, Restoration Hardware-Building D Senior Leader Engineering, 5735 Paradise Drive Corte Madera, CA 94925 United States, Tel: 1-9493740552; E-mail: koul_sunil@hotmail.com

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also used in the measurement of Hydrogen peroxide in both human and plant cells.

In the food industry, biosensors play an important role when it comes to monitoring of nutrients and screening off biological and chemical contaminants. Biosensor can be used in the food preservation industry in process of fermentation; it can also be used to detect toxic metals in food, and can also be applied in the pesticides detection in juices and wine [8]. Lastly, the biosensors have proved to be important in monitoring harmful environmental agents that cause health hazards to the ecosystem and humans [9]. Some of the biosensors such as bacteria-based cell biosensors and enzyme-based biosensors have been used in the detection of heavy metals in the environment; immunological biosensors have been able to detect polychlorinated biphenyls (PCBs) that are consumed by humans through plants causing cancerous diseases; biosensor is also used to monitor Biochemical Oxygen Demand (BOD) levels, dioxins, nitrates, and airborne contaminants compounds [10].

In conclusion, with the evolution of technology, biosensors can be improved and applied in more fields. Through the enhancement of biosensors, the detection of dangerous diseases can be easily achieved. From the discussion, the extent to which biosensors are essential to human health and the ecosystem is quite evident.

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