University Research Resource Journal
ISSN : 2581-3730
JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR
Volume 6, Issue 4 (October to December, 2023)

Recent Advancements in Biosensors as an overview

JV'n Anuradha1, JV'n Santosh2, JV'n Laxmi3
Faculty of Pharmaceutical Sciences, Jayoti Vidyapeeth Women's University, Jaipur

Abstract :

Biosensors is a sensitive detector and a biological system Also called integrated receptor-transducer device. It converts biological response into an electrical signals ,by various physical, chemical and biological technology it detects microbiological signals. Types of biosensors are optical , resonant, thermal, ion selective, electrochemical biosensors etc. It is an high-sensitivity , analytical rapid tool in pharmaceutical and health care applications. Biosensors used for testing purposes in the medical industry, it detect pathogen, tracing or detection of gas, detection of toxic metabolites, in monitoring of glucose, for measurement of cholesterol testing, vitamin, biotin and folic acid, for monitoring different kinds of chemical properties in Biotech and Agricultural industries.

Keywords : Biosensors, Analyte, Bioreceptor, Optical Biosensor

1. Introduction

Biosensors : Biosensors are sensitive and fast devices in whichbioelement interacts with the analyte being tested and the Transducer is converts the biological response into an electrical signal . biosensors are also known as immunosensors, resonant mirrors, optrodes, biochips, chemical canaries, biocomputers and glucometers. Biosensors used for biological applications. It detect different parameters such as temperature, pH, Pressure , Ca2+, etc. Also, they can be utilized for the detection of biological elements such as enzymes, antigens, antibodies and micro organisms. The aim of biosensors is to improve the quality of life. This range covers their use for environmental monitoring, food safety, disease detection, drug discovery, defence, forensics biomedical research ,and many more.

Examples of biosensors- Glucose biosensor

2. Elements of Biosensors

1. **Analyte :** A substance which is detected For example glucose is an 'analyte' in a biosensor it design to detect blood glucose.
2. **Bioreceptor :** A molecule which bind with analyte is known as a bioreceptor.Examples of bioreceptors are Enzymes, cells, deoxyribonucleic acid (DNA) and antibodies etc.
3. **Transducer :** A element which converts one form of energy into another is known as transducer. Conversion of bio-recognition event into a measurable signal is main role of Transducer. In this process Conversion of energy is termed as signalisation.
4. **Electronics :** Electronics is the part of a biosensor processes The main role of electronics is processes the transduced signal and prepares it for display.
5. **Display**

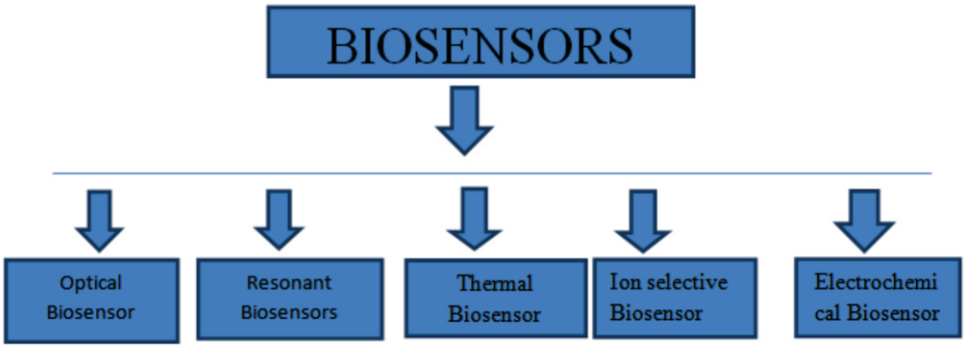
University Research Resource Journal
ISSN : 2581-3730
JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR
Volume 6, Issue 4 (October to December, 2023)

3. History of Biosensors

1.	1916	First report on immobilization of protein
2.	1922	First glass pH electrode
3.	1969	First potentiometric biosensors
4.	1975	First microbes based biosensors
5.	1982	First fibre optic -based biosensor for glucose

4. Types of biosensors

There are 5 types of biosensors according to their mechanism of transduction



1.Optical Biosensor

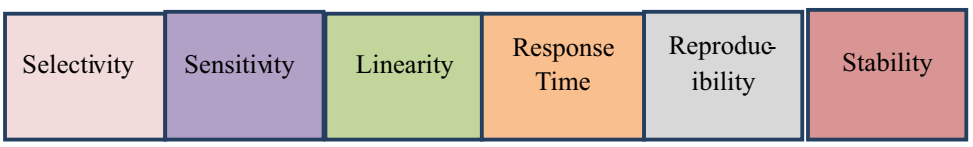
Optical biosensors principle is utilize the opticle measurements. It measures those signals which measures light. Optical biosensors mainly used in bacterial identification .optical fiber plays an essential role in optical biosensors. This opticle biosensor uses in different biological material like antigens, antibody, receptor, nucleic acids, tissues & whole cells as biorecognition elements.

Types of optical biosensors

a. Surface plasmon resonance

b. piezoelectric biosensors

5. Characteristics of Biosensors



6. Advantages of Biosensors

a. Biosensors are Rapid and continuous measurement

b. It have Good specificity

c. Calibration is possible in biosensors with a very small quantity of reagent.

University Research Resource Journal
ISSN : 2581-3730
JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR
Volume 6, Issue 4 (October to December, 2023)

d. In biosensors Measurement of non-polar molecules that are inaccessible to other instruments

e. It is Highly accurate sensitivity, selectivity, and processing

7. Applications of Biosensors.

a. Biosensors are used for testing purposes in the medical industry.

b. some kind of biosensors is used to detect pathogens

c. Biosensors are used for environmental monitoring and water treatment like tracing or detection of gas.

d. Biosensors are used to detect toxic metabolites.

e. In the monitoring of glucose in human body Blood glucose type biosensor is used

f. Biosensor is used for measurement of cholesterol testing, vitamin, biotin and folic acid.

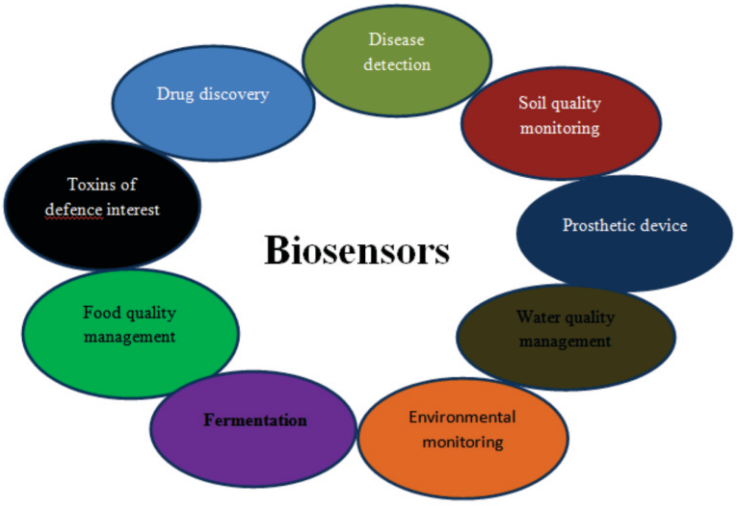
g. It is used for monitoring different kinds of chemical properties in Biotech and Agricultural industries.

h. Also used in determination of the antibiotics, vitamins B complex, pesticides,fatty acids and proteins levels found in foods

i. Biosensors are also used to detect toxic chemicals in nutraceuticals or food supplements etc.

j. Biosensors are used for determination of water ,food, etc in microorganism.

k..Biosensors can detect diseases like cancer..



A. Clinical and Diagnostic Applications :

There are so many applications of biosensors, the primary application is in the field of medical diagnostics. Now in clinical biochemistry laboratories the electrochemical variety is used for measuring of lactic acid and glucose. One of the keynote of this is the ability for direct measurement on undiluted blood samples. The another important area of clinical medicine are Consumer self-testing, especially self-monitoring of blood components and healthcare to be influence by commercial biosensors. At a

University Research Resource Journal
ISSN : 2581-3730
JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR
Volume 6, Issue 4 (October to December, 2023)

time reusable sensors also allow calibration and quality control far from the present disposable sticks where only one measurement can be fulfilled.

Similar testing will improve the ability of patient care, labour intensive present tests and replacing the often slow. These biosensors will bring clinical medicine closer to bedside, facilitating and rapid clinical decision-making.

B. Industrial Applications:

By large-scale bacterial and eukaryotes cell culture many new products are being produced. For minimizing the costs of production the monitoring of these delicate and expensive processes is essential For measurent of the generation of a fermentation product specific biosensors can be designed.

C. Environmental Monitoring:

Whole cell biosensors may have substantial advantages in Environmental water monitoring area . It is used for combating the increasing number of pollutants finding their way into the groundwater systems and hence into drinking water. The main role of biosensor include anionic pollutants such as phosphates and nitrates.

d. Agricultural Industry : Enzyme biosensors are used in agricultural industry.It is used to detect traces of carbamates and organophosphates from pesticides.

e. Food Industry : For the measurement of carbohydrates, acids and alcohols biosensors are commercially available. Biosensors are mostly used in quality assurance laboratories. Food quality control include measurement of amines, amides, amino acids, heterocyclic compounds, carboxylic acids, carbohydrates, gases, alcohols, phenols, cofactors,and inorganic ions the enzyme based biosensors are used. Immunosensors haveplay important role in ensuring food safety .

7. Future scope

These are used in marine application like eutrophication detection using nitrite and nitrates sensors.

Cell and tissue based are important because it consist genetically engineered proteins which infused into cells ex in vivo or vivo. These biosensors allow the researcher to sense levels of drugs, hormones or toxins, etc

8. Conclusion

Biosensors converts' biological response into an electrical signals by various physical, chemical and biological technology.It have many applications in medical and non medical field. There are different biosensors which have different applications . There are also future scope in biosensors like marine applications

University Research Resource Journal
ISSN : 2581-3730
JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR
Volume 6, Issue 4 (October to December, 2023)

9.Reference :

1. Arya SK, Park MK. 4-Fluoro-3-nitrophenyl grafted gold electrode-based platform for label free electrochemical detection of interleukin-2 protein. BiosensorBio electron. 2014;61:260-5.
2. Bhalla N., Jolly P., Formisano N., Estrela P. Introduction to biosensors. Essays Biochem. 2016;60:1-8. [PMC free article] [PubMed] [Google Scholar
3. Chen Z, Sun M, Luo F, Xu K, Lin Z, Zhang L. Stimulus-response click chemistrybased aptamer-functionalized mesoporous silica nanoparticles for fluorescence detection of thrombin. Talanta. 2018;178:563-8.
4. Clemens A.H., Chang P.H., Myers R.W. The development of bio stator, a glucose controller insulin infusion system (GCIIS) Horm. Metab. Res. Suppl. 1977;7:22-23. [PubMed] [Google Scholar]
5. Contreras-Naranjo JE, Aguilar O. Suppressing Non-Specific Binding of Proteins onto Electrode Surfaces in the Development of Electrochemical Immunosensors. Biosensors. 2019;9(1):15
6. Despande, S.S.; Rocco, R.M. Biosensors and Their Potential Use in Food Quality Control. Food Technol. 1994, 48 (6), 146-150
7. Du H, Strohsahl CM, Camera J, Miller BL, Krauss TD. Sensitivity and Specificity of Metal Surface-Immobilized "Molecular Beacon" Biosensors. J Amn Chem Soc. 2005;127(21):7932-40.
8. D'Orazio P. Biosensors in clinical chemistry. Clin/. Chim. Acta. 2003;334:41-69. doi: 10.1016/S0009-8981(03)00241-9. [PubMed] [CrossRef] [Google Scholar
9. Ensafi A.A. An introduction to sensors and biosensors. In: Ensafi A.A., editor. Electrochemical Biosensors. 1st ed. Elsevier; Cambridge, MA, USA: 2019. pp. 1-10. [Google Scholar]
10. Kress-Rogers, E. Instrumentation and Sensors for the Food Industry; Woodhead Publishing Lmtd.: Cambridge, England, 1998.
11. Liu Q, Wu C, Cai H, Hu N, Zhou J, Wang P. Cell-based biosensors and their application in biomedicine. Chem Rev. 2014;114(12):6423-61. 18. Akshay P, et al. Pharmaceutical Biotechnology. PV Publication. 2020
12. Newman J.D., Turner A.P.F. Home blood glucose biosensors: A commercial perspective. Biosens. Bioelectron. 2005;20:2435-2453. doi: 10.1016/j.bios.2004.11.012. [PubMed] [CrossRef] [Google Scholar]
13. S. Chauhan, V. Rai and H. B. Singh, "Biosensors," Biosensor, 2004, pp. 33-44.
14. S. P. Mohanty and E. Kougianos, "Biosensosrs: A Tutorial Review," IEEE Potentials, Vol. 25, No. 2, 2006, pp. 35-40. doi:10.1109/MP.2006.1649009 [Citation Time(s):1]
15. Suzuki S., Takahashi F., Satoh I., Sonobe N. Ethanol and lactic acid sensors using electrodes coated with dehydrogenase-collagen membranes. Bull. Chem. Soc. Jap. 1975;48:3246-3249. doi: 10.1246/bcsj.48.3246. [CrossRef] [Google Scholar
16. Wittman, C.; Riedel, K.; Schmid, R.D. Microbial and Enzyme Sensors for Environmental Monitoring. In Handbook of Biosensors and Electronic Noses. Medicine, Food and the Environment; Kress-Rogers, E., Ed.; CRC Press: New York, 1997; 305-306.
17. Zhang W, Li X, Zou R, Wu H, Shi H, Yu S, et al. Multifunctional glucose biosensors from Fe?O? nanoparticles modified chitosan/graphene nanocomposites. Sci Rep. 2015;5(1):11129.