Nanoscience and Nanotechnology With reference to Nanosensors as Biosensors

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1. Introduction:

Nanoscience refers to the study of visualization of matters at the scale of one Billionth of a metre i.e. per one hundred crore of a metre. This specific visualization draws anyone's interest in research activities with Nonoscience. The growing impact of Nanoscience in our lives develops interest to know Nanoscience in details through specific research. It has come to know that scientist from several discipline are applying Nanoscience principles for advanced application in energy, medicine, information storage, computation for better livelihood. Nanosensors are Nanoscale devices that measure physical quantities and convert those to signals that can be detected and anyalised.

There are several reported technique to fabricate electrodes to develop highly sensitive, selective and rapid Nanosensors for Biosensing application acting as Biosensors.

A historical background reveals the fact that the concept Nanoscience came into existence by a talk given by renowned physicist Richard Feynman "there is plenty of rooms at the bottom" where he gave an idea of synthesis of matters via direct manipapulation of atoms i.e. bifurcating matter at the atomic or molecular level. But in order to carry out the study about Nanostructure, specialized study was needed and in this regard some inventions in later 80's like Scanning Electrom Microsope (SEM), Atomic force Microscope (AFM), TEM etc. ease the way of researcheres. A Nanosensors is comprised of Bio-Sensitive layer that is attached covalently to aonther element called a transducer. Nanometerials can be used for immobilization of Bio-molecules for application of signal as mediators, electroective species etc. Depending on the transducer machanism such as electrochemical, optical, thermoelectric etc. in Bio-Sensors Nanoparticles are utilized.

2. Literature review:

Biosensors are analytical devices that combine Bio-chemical and Biological components with physical transducers for identification and detection of various analytes.

Nanomaterials can enable Bio-Sensors development as sensing material or signal amplifier. Nanosensors are portable, robust, high performence analytical devices.

Biosensors enforced by Nanosensors are applicable fro analytical study in the following fields.

(i) Medical diagnosis (Cancer, Infectious disease and wound)

(ii) Environmental monitoring (Water, air quality check, surface contamination check)

(iii) Aquacultrue & agricultrue (Fish farm water monitoring, detection of fish disease, pesticide content)

(iv) Food safety (chemical and biological contamination) (v) Drugs screening and pharmaceutical process monitoring)

In recent years their has been significant interest in advanced Nano-biosensors technologies with their exceptional properties for real time monitoring, ultra-sensing and rapid detection. With relevant experimental data highly selective and hypersensitive detection of various analytes is possible using Biosensors based on Nanosensors. In particular, biosensors focus on vital issues such as disease for early diagnosis and treatment, risk assesment of quality, food water control, food safety measurment and many more in the row.

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3. Mathodology:

Amongst the above mentioned Nanofields, the mostly studied applied field is Nanosensors. Nanosensors are Nanoscale devices that measure physical quantities and convert those quantities to signals which can be detected and analyzed. Our modern lives rely on sensors to allow society run hassle-free. Sensors in the road detect cars at traffic light and adjust the flow through intersection accordingly. Sensosrs at shopping malls detect your presence and open doors allowing you to enter. Sensor measures the water level in our washing machines and alerts about overflow.

To carry out conjucation of Nanoparticles with Biomolecules an interaction between them is essentially required for sucsessful applications of Biosensors.

The Nanoparticle-biomolecule interactions under controlled system have successfully turned toward a number of biological applications viz. biosensing, imaging and hyperthemia treatments. The process of conjugate formation crafts an interface which is compatible with enviornments of real biological systems. Many approaches are available which enables the formation, modification and organization of metal nanoparticles. The most frequently utilized method includes incorporation of nanoparticles on glassy surface, the use of biomolecules as linker, incorporating bivalent linker compounds, and deposition of the particles on structured surface. The formation of nanoparticle-biomolecules conjugate can be classified as follows.

(i) Binding of the biomolecule to the surface of the inorganic particle core through ligand mediated binding, usually by chemisorption.

(ii) Covalent binding by conjugation chemistry, exploiting functional groups on both particle and biomolecules.

(iii) Electrostatic interactions between positively charged biomolecules to negatively charged nanoparticles or vice versa.

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4. Concision & Discusstion :

Today, as a result of rapid industrilization global problems bring about pollution, disease and many other complications. Early detection, prevention and elemination of these problems have become very important for the contunity of the ecological system. Due to increasing technological developments, the rapid high sensitivity and reusable detection of these situations have made possible with Biosensors.

To state historical review it is belived that, in 1962 the first electrochemical enzymatic Biosensors was invented by clark et al. to detect glocose in Biological samples due to oxygenetion of blood samples by reducing oxygen on the surface of platinum electrode. With this discovery Clark has been regarded as father of Biosensors.

5. References:

(i) Nanomaterials in Biosensors

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(ii) Dr. Debabrat Baishya - Nanotechnology Review, A glimpse in to the Nano World

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