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Twisting Biosensor Studies Towards Farmers Need Base Demand

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Abstract

Any analytical device, utilized for the detection and analyses of a bimolecular substance from a mixture is usually called as biosensor. Such device is a combination between a biological component and a physicochemical detector. Any biological compound, for example, cell surface or cell free receptor(s), enzymes, hormones, antibodies, DNA or RNA etc. can be detected. So, a material of biological sources (analyte) when interact with bio-receptor in the sensor, it enables the sensor to detect the former one. Glucometer, being a bright example of such biosensor used to detect blood sugar level. However, such detectors are scantily used in agricultural sectors, to detect, predict or speculate farmers need based demand in cultivated fields in developing counties. Countries such as India, being hugely agriculture based sub-continent, need such studies in future.

Main Text

A biosensor is usually a handy device used to instantly detect biomolecules from a complex mixture derived from biological sources, for example, blood, body fluid, urine, plasma, synovial fluid etc. Usually it is employed for instant detection of biochemical in body or tissue fluids. It normally constitutes five basic components [1]. They are a bio-recognition site, biotransducer component, and electronic system that act as signal amplifier, processor, and display. Transducers and electronics can be combined together in a microsensor system. The recognition component that detects the biochemical is usually called as a bio-receptor. It includes a particular bio-receptor (present on the recognition site) interaction with the analytes to detect the later one [2]. The intensity of interaction usually corresponds to the concentration of the analytic and is measured by the bio-transducer [3]. The interaction is measured by the signals that are received due to the interaction of the target analyte in the sample with bio-receptor (Figure 1). If the signal is low then it is magnified by the amplifier and processed to be displayed in the display of the biosensor [3].

Owing to the importance of the biosensors, their use has been broadened from daily life to research field. Glucometer is a good example to cite in this context. It is used almost in every household in the developing nations where diabetic condition is more often prevalent. Similarly, total dissolved salt measuring meters are widely used in both field and research to quantify the total dissolved salt in water. It is used both for screening drinking water as well as water used for research. However, its use at firm level by uneducated or under educated farmers is still wanting. On the other hand, for agricultural/ veterinary testing, numbers of diagnostic tests are available which may not be a true biosensor but used for instant detection system. More often they are called as diagnostic kits. So, no true biosensor systems have made an impact in agricultural field [4].

India and other developing countries those majorly based on agriculture, need to improve their management of agricultural practices on multiple fronts including many societal issues. Improvements in agriculture performance have weak linkage in major social issues such as improving nutrition. It can be improved by supplying nutrition to poor family through multiple ways [5-7]. Some of the ways are increasing incomes of farming households, diversifying production of crops, empowering women, strengthening agricultural diversity and productivity, and designing careful price and subsidy policies that should encourage the production and consumption of nutrient rich crops [5]. For such improvement, use of technology is the foremost need. Diversification of agricultural livelihoods through agri-allied sectors such as animal husbandry, forestry and fisheries have although enhanced livelihood opportunities, strengthened resilience and led to considerable increase in labour force participation in the sector, the demand and supply ratio in relation to different agriculture products in developing counties is very high [5]. For example, India being the world's second most populous country with a population of 1.27 billion, having the seventh (rank) largest area across the globe, with 3.288 million sq kms and a long coastline of over 7,500 kms, needs to act as a global leader in huge agri-products such as fisheries and poultry. Agriculture, with its allied sectors, is the largest source of livelihoods in India. About 70 percent of its rural households still depend primarily on agriculture for their livelihood, with 82 percent of farmers being small and marginal. In 2017-18, total food grain production was estimated at 275 million tonnes [5]. However, use of modern technology including biosensors and kits by above 70% population is still a challenge.

In agricultural fields, the need is for instant, fast, on-line and accurate sensing to detect and measure the analytes. Therefore, it opens up opportunities for biosensors in many different agricultural areas. For example, *in situ* analysis of pollutants in crops and soils, detection and identification of infectious diseases in crops and livestock, on-line measurements of important food processing parameters, monitoring animal fertility, pollution detection and screening therapeutic drugs in veterinary testing [8]. Biosensors can be used in different sectors of agriculture such as in food/ fruit quality control, to analyses the

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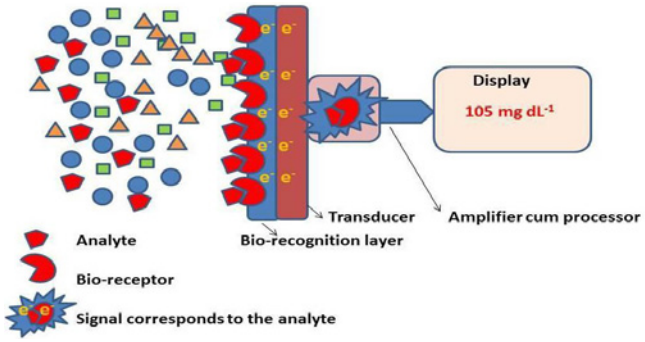

Figure 1: Schematic representation of a typical biosensor.

biochemical composition of fruits for example to determine fruit maturity, ripening and quality relationships, to measure mmajor organic acids (pyruvic acid and lactic acid, malic acid, benzoic acid) in fruits as an indicator of growth, maturity, ripening, onset of rotting, to detect pollutant biomagnification, to detect diseases, to detect mass metabolic disorders, to detect malnutrition in mega culture system, to detect right brood stocks, and to detect species [9,10]. However, the commercialization and use of biosensorin agriculture is still need to march a long distance in developing countries [11]. Some of the challenges that might restrict use of biosensors in agri-fields remains the competitive price of the device, availability of specific need based biosensors, training to farmers, correlation of the results by farmers, longevity of the device, availability of defect free device, availability of acombo device in which data can be auto-correlated to advice mode for under educated farmers.

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