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Commentary

Authentication of Biosensors for Food and Agricultural Safety

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DESCRIPTION

The foundation of contemporary civilization is the agricultural and food sectors, which require ongoing development to attain higher levels of production and quality. Since the turn of the twenty-first century, pesticides and fertilisers introduced by contemporary industrial development have greatly increased agricultural productivity, but it is impossible to ignore the negative effects of their residues in food and environmental damage. The inevitable loss and quality assurance of the entire process from farm to fork should also be given top priority at the same time. In the past, we have frequently relied too heavily on laboratory-based precise detection technologies like High-Performance Liquid Chromatography (HPLC), Gas Chromatography (GC), etc. however, these technologies are always constrained by their high cost, lengthy processing times, highly experienced technologist requirements, and specialised equipment. The biosensor is a type of integrated sensing device that combines a biological sensing element and a physicochemical transducer. It primarily entails the steps of sample pretreatment, analytes extraction, biological probe identification, detection signal conversion, signal analysis, and ultimately detecting the analyte by converting molecular interactions into a distinguishable signal. Commercial portable glucose metres are a notable example, and several biosensors for agricultural and food safety have appeared in the last ten years, with advantages mostly based on the quick test, portability, and practicality. Technologies like precision agriculture, assisted by a range of biosensors and electronics, have the potential to replace the restricted usage of conventional equipment.

Planting and poultry farming

Planting: With the development of intensive agriculture, these factors can be artificially improved to some extent, and a number of commercial sensors have been developed for monitoring a variety of factors such as soil moisture, water level, soil temperature, conductivity, salinity, pH, solar radiation, CO_2, and soon. Climate and environment are significant factors that affect crop yields, but these factors can be artificially improved to some extent. Biosensors therefore concentrate more on identifying pests, viruses, diseases, and environmental factors that are harmful to agricultural production.

Poultry farming: In this context of animal poultry farming, illness diagnosis, health monitoring, disease prevention, and management are crucial. In particular, infectious diseases of livestock and wildlife represent a severe danger to human health, and biosensors are crucial as a quick diagnostic tool. The well-known Foot and Mouth Diseases (FMD), mastitis illnesses in dairy animals, alcomprehensive analysis of biosensors in poultry and aquaculture used the clever technology of the vocalisation detection system in an intriguing specific situation to identify numerous infectious illnesses. With a diagnostic accuracy of 66.6% on day two and 100% on day eight, clostridium perfringens type a infection-related necrotizing enteritis can be identified and diagnosed using sound signals gathered by microphones and data collection cards and examined by a neural network pattern recognition system. The development of corresponding biosensors for prevalent animal diseases is encouraged, with a focus on the detection of radiation in imported aquatic products due to the contamination of nuclear wastes. Additional applications of electrochemical biosensors and optical biosensors in the detection of bacterial infections, pathogens, and antibiotic residues can be found.

Production and packaging

According to reports, around 30% of the food produced annually throughout the world is wasted, in part as a consequence of poor production and packing. Controlling the manufacturing environment and creating intelligent food packaging might both benefit from the use of biosensors. The nutritional value, Total Soluble Solids (TSS), Titratable Acidity (TA), and quality sensory characteristics of naturally ripened fruit differ from those of artificially ripened fruit. Glucose biosensors can be used to measure the glucose content in fruits and can thus be used to correlate this information with the ripening state of the fruit as well as to determine the shelf life. The developed packaging surface is specific, stable for at least 14

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days under a variety of pH conditions (pH 3-9), and can detect E. coli in meat and apple juice. Biosensors that ensure food safety can also be designed on food packaging by using an *E.coli* specific RNA-cleaving fluorogenic DNAzyme probe to covalently attach to the transparent cyclo-olefin polymer packaging film. Furthermore, because the chemical recognition probe is capturing a change in the gas environment (CO_2), biosensor-based intelligent tags may potentially represent a change in a vital role in the food package.