MULTIDISCIPLINARY RESEARCH

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Optical Fiber Biosensors and Food Safety

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Abstract:

Packaged food is a need of world. So food safety is additionally a vital part of food industry. Many sorts of safety measurements are being taken for that. This paper dealswiththe utilization of Optical Fiber Biosensorsin food industry. Optical fibers biosensors are no time and sensitive way of pathogens detection in food.Here we discuss the number of ways by which optical fibers biosensors are utilizedin food industry.

Keywords: Optical Fiber, Biosensors, Food Safety, Pathogens.

Introduction:

This is often an era of top quality and high speed. Optical fibers biosensors plays a significant role during this. Optical fibers don't seem to be only used for fast communication but also utilizedin food industry. This is often one in all the fastest and sensitive way of pathogens or microbes detection in food. An optical fiber is a cylindrical dielectric wave guide. Transmission of light along its axis based on the principal of total internal reflection. The fiber consists of core surrounded by a cladding layer manufactured of dielectric materials. The ratioof refractive index of the core islarger than that of the cladding[1]. Fiber-optic Biosensors use a combination of biological receptors and physical transducers, which represent a new and unique technology with great potential to fulfill the need for the rapid detection of low levels of biomolecules[2,3]. Fiber-optic biosensors exploit the measurement of fluorescent light excited by an evanescent wave generated by a laser to quantitatively detect biomolecules immobilized on the ûber surface [4, 5, 6]. A report showed that E.coli O157: H7 can be detected at levels as low as 30 CFU/ml with a fiber-optic sensor[7]. Liu et al.[8] has developed a chemiluminescent fiber-optic biosensor. This type of biosensor could detect about 100 CFU of E. coli O157: H7/ml from hamburger, chicken carcass, and lettuce samples within 1.5 hour.

The application of different types of Optical Fiber Biosensors for detection and monitoring of threats to food safety are discussed below.

A study shows that sprout seeds as the source of the contamination [9]. It was observed thatthe spent irrigation water used to irrigate sprouts can act as a carrier of many microorganisms, including pathogenic strains of E.coli and Salmonella enterica. Pathogens are most likely to be present at detectable levels at or after 48 hours from the start of the sprouting process therefore the Sprout producers aresuggested by the FDA to incorporate microbiological testing of spent irrigation water minimum of 48h after seeds have germinated as part of an overall strategy to boost the safety of sprouts[10]. A rapid (20-min) automated fiber optic–based biosensor assay could directly detect a minimum of 5×10^5 CFU of Salmonella Typhimurium per ml in spent alfalfa sprout irrigation water. The study shows that spent irrigation water collected from sprouts grown from alfalfa seeds is more positive detection when the concentration of Salmonella Typhimuriumin the seeds had to be high i.e. 10^4 and 10^3 CFU/g of seed for 19h and 43h post germination spent irrigation water, respectively [11].

Miguel A.et. al. has developed a low-cost optoelectronic sensor for working within the NIR region of light spectrum. The developed sensor consists of a chrome steel tube, optical fibers for light conduction from a light emitter to the milk to a light receiver, and circuits for the signal treatment and control unit. Light proceeding from an infrared LED comes into contact with the milk, where part of the light is reflected and so, detected by a photodiode. The reflected light depends on milk fat, Lactose and protein content of milk [12].

A colorimetric optical fiber probe has encompasses a lot of applications in food industry. It usedfor the analysis of color of grape juices and wines in wine industries. Another interesting application is for the color determination of consumption oil, because it can be used to identify the sort of oil, even the olive type and also the acidity level [12].

A study indicates that the ûber-optic sensor can detect L. monocytogenes from enriched ready to eat meat samples with initial low levels of inoculation in under 24 hour. In this studya fiber-optic immunosensoris developedto detect feasible L. monocytogenes cells from ready-to-eat meat samples in less than 24 hours from the point of food sampling. To generate strong signals in the fiber-optic sensor, a suitable enrichment broth was used that support sufûcient antigen expression for capture and detection antibodies[13]. In thefurther research of the team, a sensitive flow-through immobilization method was used to test food samples, which could detect 5×10^5 cfu/ml of L. monocytogenes in frankfurter sample (a seasoned smoked sausage made of beef and pork). An automated fiber-optic- based immunosensor, RAPTOR™ technique was developed and used for detecting L. monocytogenes in food samples. Detection of L. monocytogenes in phosphate buffered saline (PBS) was performed to gauge both static and flow through antibody immobilization methods for capture antibodies in a sandwich assay and thus a sensitive detection may be achieved using the RAPTOR™ biosensor even within the presence of other bacterial species within the matrix [14].

YaHsin Chang et.al has developed a rapid, sensitive, and easy-to-use fiber-optic biosensor for the detection of protein A, which is an indicator of the presence of S.aureus. For the study sandwich assay of protein A,anti-(protein A) antibodies are immobilized on optical fibers to capture the antigen, and FITC-Labeled anti-(protein A) IgG is employed for signal generation. The evanescent wave was allowed the sensor to watch the antigen-antibody reactions in real time. The detection limit of the immunosensor was 1ng/ml protein A [15].

Conclusion:

This paper is a summary of optical fiber biosensor technology in the field of food industry. Some examples of real applications have been described in the paper. The optical fiber biosensors could be a promising technology that allows to keep up an outsized number of facilities in food industry. Though optical fiber biosensors show enormous potential for the detection of pathogens there is further research and development of optical fiber monitoring technologies are expected in highly reliable optical services.

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