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Biosensor Technologies for Quantification and Initial Discernment of Plant Pathogens

Kaveri Bisht*

Department of Life Sciences, Graphic Era University, India

***Corresponding author**: Kaveri Bisht, Department of Life Sciences, Graphic Era University, India, E-Mail: kaveribisht88@gmail.com

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Abstract

Plant microorganisms are a significant explanation of diminished yield efficiency and may prompt a deficiency of nourishment for both human and creature utilization. Albeit synthetic control stays the primary technique to decrease foliar contagious illness rate, successive use can prompt loss of powerlessness in the parasitic populace. Moreover, over-showering can cause natural defilement and represents a hefty monetary weight on cultivators. To forestall or control illness scourges, growers must have the option to recognize causal microorganism precisely, delicately, and quickly, so the best practice sickness the board methodologies can be picked and ordered. To arrive at this objective, many culture-reliant, biochemical, and atomic strategies have been produced for plant microorganism location. Nonetheless, these strategies need exactness, explicitness, dependability, and quickness, and they are for the most part not reasonable for in-situ investigation. In like manner, there is solid premium in creating biosensing frameworks for ahead of schedule and exact microbe identification. There is likewise incredible breadth to interpret imaginative nanoparticle-based biosensor approaches grew at first for human infection diagnostics for early location of plant illness causing microbes.

Keywords: Biosensor; Nanotechnology; Plant disease

Introduction

A myriad of plant pathogens directly affects crop quality and decreases food supply, with the greatest impact occurring when the affected crop is a staple food of a large population, in a poorly resourced developing region. As evidenced throughout history, a single staple crop pathogen can cause mass starvation and/or migration. More recently, the Ug99 strain of Puccinia graminis tritici has posed a significant risk to global wheat production for the last three decades, most immediately in South Asia. This was of a particular concern since 90% of the analyzed wheat varieties that were initially tested were highly susceptible. Despite a massive effort to breed for resistance and to develop disease management strategies, an estimated 10%-16% global annual productivity loss remains due to plant pathogens.

Plant diseases are managed by following specific cultivation and chemical application practices including crop rotation, clean seed, resistant variety use, and seed and foliar fungicidal treatment. Fungicides in particular are used to achieve an acceptable level of disease control. However, the long term or over use of fungicides has led to a selective rise in insensitivity within the fungal

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populations to certain modes of action. It is therefore, very important to devise tools to aid in the accurate, sensitive, and the speedy detection of causal pathogens for more effective pre-emptive application of optimal chemistries. This in turn will reduce unnecessary numbers and quantities of chemical applications in the cropping system, and thereby reduce the selective pressure on the pathogen populations and the potential secondary environmental impacts.

Biosensors have appeared as advanced detection tools used in many research fields including environmental monitoring, detection of airborne pathogens, real-time detection of human blood components and pathogens and pesticide residues in foods and beverages. In this review, we refer to a biosensor as a diagnostics device, which typically integrates a biological sensing element and physicochemical transducer to generate an electronic signal when it contacts with a specific analyte of interest or pathogen in solution. Subsequently, a transducer converts a biomolecular interaction into a digital output. The biological element that plays the role of a bioreceptor can be antibody, DNA, enzyme, tissue type, whole cell etc. These bioreceptors are responsible to provide recognition specificity to the biosensor through the selective nature of the biochemical interaction. Based on the transducer type, a biosensor may be classified as an electrochemical, optical, thermal, or piezoelectric biosensor.