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Electrochemical sensors; Types and applications in the food industry

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ABSTRACT

Today, the use of new technologies in the food industry has become very important and widely used. Identifying these technologies and expanding them is very important for industrial societies. One of the new methods for analyzing and measuring materials in trace levels is elecptrochemical sensors. In the electrochemical sensors the reaction between food analytes and sensors are happen. These sensors have the ability to generate electrical signals appropriate to the concentration of the analytes. These sensors have been very effective in measuring and determining compounds and are being developed using new techniques. These sensors have many advantages over older and more expensive methods, while also being highly accurate. These sensors have a lot of potential and benefits, so in this study, it has been tried to define these new methods by using practical examples and described the use of these new methods in various industries, especially in the food industry.

1. Introduction

In general, a sensor is a device that responds to a physical or chemical stimulus (such as chemical gas, heat, light, sound, pressure, magnetic field, or motion). A chemical sensor is a device that changes its physical properties (such as electrical conductivity, capacity, or mass) when exposed to a compound or mixture of several compounds. The change in these physical properties is used as a physical signal to sense analyte. Electrochemical sensors act through the redox reaction of the species on the electrode surface and generate an electrical signal commensurate with the concentration of the analyte species. Electrochemical biosensors are an important subset of chemical sensors in which electrodes are used as converters that convert biological information into electronic signals. To date, extensive studies have been conducted on electrochemical sensors, and in some cases the sensors obtained from these studies have been commercialized and widely used in various clinical, industrial, environmental, and agricultural fields [1-4]. Electrochemical biosensors are a class of electrochemical sensors whose component detector (receptor) is the biological element. The electrochemical biosensor is able to combine the analytical capability of electrochemical techniques with the specific function of the biological element. The biological receptor is stabilized on the appropriate electrode and the interaction of the analyte (the measured substance) with the biological receptor leads to the production of an electrical signal (Amperometric response, potentiometric response, etc.) which the signal amount depends on the analyte concentration [5].

2. Classification of electrochemical biosensors

According to the structure of biomaterial and detection process, electrochemical biosensors are divided into two categories: 1. Catalytic (enzymatic) biochemical biosensors, whose biological component is an enzyme, cell, or tissue. 2. Optional biosensors, in which antibodies, membrane receptors, or nucleic acids are stabilized on the electrode.

Enzymes are an important class of proteins that catalyze chemical reactions in biological systems. These catalysts are highly efficient and selectable. To make enzymatic sensors, a layer of an enzyme is fixed on a suitable electrode by various methods such as surface adsorption, covalent bonding, electrostatic adsorption, polymer trapping, etc. Such a sensor is able to measure the specific substrate inhibitor or substrate with high specificity and efficiency. Oxidoreductase enzymes are

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