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ELECTROCHEMICAL SENSING OF PESTICIDES IN FOOD

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Pesticides are chemical compounds widely used in agricultural activities to prevent, control, regulate, and eliminate various pests (fungi, insects, mites, rodents, weeds) on agricultural crops. Plant crop yields increased significantly after the introduction of pesticides in agricultural cultivation. On the contrary, numerous pesticides have toxic properties. The uncontrolled use of these chemical compounds affected their significant environmental accumulation. As a result, plant crops (vegetables, fruits), water, groundwater, air, and agricultural soil are contaminated, simultaneously representing the pathways of pesticide residue entry into the food chain. The human organism is frequently exposed to pesticide residues through contaminated food, which may lead to acute or chronic effects on consumers' health. Accordingly, control of pesticide residue levels in food (generally in the environment) is of great importance. Electrochemical methods offer a promising avenue for pesticide residue determination. They outshine other analytical methods (gas chromatography, liquid chromatography, fluorescence spectroscopy, colorimetry) due to their distinct advantages, such as simplicity, low-cost equipment, fast analysis, simple sample preparation, and high sensitivity and selectivity during target analyte determination. The development of nanotechnology and the use of nanomaterials/nanocomposites in constructing various electrochemical sensors have significantly improved sensing performances (low limit of detection, high selectivity). In addition, nanomaterials have proven to be suitable matrices for immobilizing biological species (enzymes, antibodies, nucleic acids) during the development of electrochemical biosensors and immunosensors for pesticide residue detection in food samples. The miniaturization and commercialization of these sensors are among industrial production's main challenges and interests. Today, portable miniature devices (touch- or paper-based sensors) connected to smartphones can be found on the market, especially in food quality assessment. Therefore, there is a constant need for the development of electroanalytical platforms that include innovative approaches in preparing electrochemical sensors for food contaminants detection.

Keywords: electrochemical sensors, food safety, food contaminants, nanomaterials, pesticides.

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