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Development of Sensitive Immunochemical Biosensors for Rapid Detection of Fluoroquinolones in Food Products

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ABSTRACT

Food contamination by antibacterial preparations is a relevant food safety problem. Consumption of antibiotic-containing foodstuffs can cause serious harm to human health and provoke severe antibiotic resistance. Therefore, it is extremely important to develop sensitive methods for monitoring antibiotic content in raw materials and finished food products. Traditional chromatographic methods are not applicable for rapid control in out-of-laboratory conditions. Therefore, immunochemical biosensors seem a promising alternative due to their high sensitivity, simplicity, low cost, and possible point-of-care application. Among different immunobiosensing platforms, immunochromatographic analysis can be noted. The immunochromatographic strip is a ready-to-use test system that does not require additional reagents or costly detectors. The analytical procedure is usually initiated by dipping the test strip into the sample followed by visual evaluation of the assay results. In this study, several immunochromatographic biosensors have been developed for the detection of antibiotics gatifloxacin (GAT) and ofloxacin (OFL), which belong to fluoroquinolone group demanded in medicine and agriculture. Their covalent conjugates with proteins were synthesized and used as immunogens. Monoclonal and polyclonal antibodies specific for GAT or OFL were produced and characterized. Different nano-dispersed labels were obtained including traditionally used gold nanoparticles and mono-, bi-, and trimetallic nanozymes, which allowed for catalytic enhancement of colorimetric signal on test strips due to their enzyme-mimic properties. Ultrasensitive test systems have been created, which enabled rapid (15–20 min) GAT and OFL detection in picogram range of concentrations. Moreover, the specificity of the developed test systems enabled revealing S- and R-stereoisomers of antibiotics and hence, distinguishing their biologically active forms used in pharmaceuticals and veterinary medicines. The developed biosensors were applied for antibiotic determination in milk and meat. They can be recommended as an effective tool for rapid, sensitive, and reliable control of food contaminants.

Keywords: antibiotics, fluoroquinolones, sensitive immunoassay, rapid test systems, nanoparticles, food safety

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References:

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