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## Piezoelectric immunosensors for the detection of individual antibiotics and the total content of penicillin antibiotics in foodstuffs

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### Abstract

Piezoelectric immunosensors on the basis of homologous and group-specific antibodies have been developed for detecting penicillin G, ampicillin, and the total content of penicillin antibiotics. The receptor coating of the sensor was obtained by the immobilization of penicillin G or ampicillin hapten-protein conjugates on the polypyrrole film obtained by electropolymerization and activated by glutaraldehyde. The affinity constants and the cross reactivity coefficients have been calculated. This made it possible to estimate the affinity and specificity of polyclonal and monoclonal antibodies used. The calibration curves are linear in the range of concentrations 2.5-250.0 ng·ml<sup>-1</sup> (penicillin G), 2.5-500.0 ng·ml<sup>-1</sup> (ampicillin), 1-500 ng·ml<sup>-1</sup> (group of penicillin). The limits of detection are 0.8 ng·ml<sup>-1</sup>, 3.9 ng·ml<sup>-1</sup>, which is lower than MRL, established for penicillin antibiotics. The sensors were tested in detecting penicillins in milk, pork, beef, liver.

**Keywords.** Piezoelectric immunosensor, penicillin, antibodies, foodstuffs.

### 1. Introduction

Penicillin antibiotics have been widely used for treating and preventing infectious diseases in veterinary. Penicillins are the least toxic of all antibiotics; nevertheless, owing to their fast removal from an organism, the doses for the treatment of animals manifold exceed the levels of other antibiotics, which can cause high residual concentrations in livestock products. As a result, they may cause allergic reactions, resistance to microorganisms and general lowering of immunity with consumers of meat and dairy products [1].

The risk of polluting food raw materials by antibiotics can be reduced only through effective monitoring system at all stages – from production to sales. Thus, severe requirements are established for the techniques of mass control of detrimental compounds in raw materials and animal products: these techniques must provide high sensitivity, selectivity of detection,

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