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PROSPECTS FOR USING ELECTROCHEMICAL ANALYSIS TO DETERMINE RESIDUAL ANTIBIOTIC CONCENTRATIONS IN MILK USING MACHINE LEARNING

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In the field of the food industry, both for producers and for consumers, the guarantee of the production of safe and high-quality products is relevant today. Products can become contaminated with drugs, which in turn has a detrimental effect on both production processes and public health. In our work, we propose a new methodology to detect residual concentrations of antibiotics in dairies.

Antimicrobials are widely used to treat cattle on farms, and are added to feed as an additive to speed up animal growth and prolong the shelf life of the produce. Residual amounts of antimicrobial agents end up in milk and then in the hands of the end user, with a number of negative consequences.

There are currently many methods available for the detection of antibiotics in raw milk, but they have a number of drawbacks. Microbiological methods are labour intensive and require complex instrumentation. Laboratory tests using rapid tests are not economically viable on a continuous basis.

In this work, we propose a simple and sensitive method based on electrochemical oxidation of drugs. As the electrode system we choose carbon electrodes and a silver chloride (Ag/AgCl) as a reference electrode. For samples analysis we prepare solutions of cephalosporin class with a range of concentration from 0.01 to 100 mg/kg. We performed all set of experiments at least three times for reproducibility. We applied different voltage from 0.02 to 2.00 V. Cyclic voltammograms give us the data set which we processed in «OriginPro» software. Next, we created databases for machine learning with application of «Weka» software. After training, we select the best fit model. In our machine learning approach we use two algorithms: «Multylayer Perceptron» and «Random Forest». Our findings show that accuracy of «Random Forest» algorithm is 82.5%.

Thus, the proposed method is a modern alternative to the existing techniques. The creation and implementation of the electrochemical sensor platform will allow a large range of drugs to be tested, reducing analysis time, manual labour and the cost of expensive equipment.