VETERINARY AND SANITARY ASPECTS OF MONITORING SYNTHETIC PYRETHROID RESIDUES IN BEEF AND ENSURING FOOD SAFETY

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Abstract

This thesis analyzes the monitoring of synthetic pyrethroid residues in beef, their significance for food safety, and modern laboratory methods used in veterinary and sanitary examination, based on a review of the literature. It examines the possibility of residual insecticides used against ectoparasites in livestock remaining in products of animal origin, the criteria for assessing product safety, and approaches to improving laboratory monitoring. Based on local veterinary research and international regulatory sources, scientific and practical recommendations for ensuring the safety of meat products are summarized.

Keywords: beef, synthetic pyrethroids, pesticide residues, veterinary and sanitary examination, food safety, laboratory monitoring, chromatography, toxicological assessment.

Introduction

Ensuring the population's access to high-quality and safe products of animal origin is one of the priority areas of modern veterinary medicine and food safety systems. Contamination of meat products with chemical contaminants is an important consideration when assessing their safety for human consumption. In this regard, monitoring pesticide residues, including synthetic pyrethroids used in livestock farming, represents a relevant scientific and practical issue.

Synthetic pyrethroids are a group of chemical compounds used to control insects and certain external parasites. Permethrin, cypermethrin, and deltamethrin

are well-known representatives of this group. Although these compounds play an important role in protecting animals against ectoparasites, failure to follow the prescribed conditions of application and violations of food safety requirements may create risks associated with residues in products of animal origin.

The safety of pesticide residues is assessed by considering the type of substance, its concentration, toxicological properties, and applicable regulatory requirements. The FAO/WHO Codex Alimentarius system establishes maximum residue limits for pesticides in food products. These limits are important for assessing product safety and promoting a consistent approach to international trade [1].

Aim of the Study

The aim of this study is to examine the scientific foundations of monitoring synthetic pyrethroid residues in beef through a literature review, analyze the capabilities of modern laboratory methods, and identify key approaches to ensuring food safety in veterinary and sanitary examination.

Materials and Methods

This thesis is based on a literature review involving a comparative analysis of local veterinary research articles, international scientific publications, and regulatory materials related to food safety. The analysis focuses on methods for detecting pesticide residues, assessing their concentrations, and comparing laboratory results with applicable regulatory requirements.

Gas chromatography–mass spectrometry (GC-MS), as well as liquid chromatography–tandem mass spectrometry (LC-MS/MS), may be used to detect pyrethroid residues in beef, provided that the analytical conditions are appropriate for the substances under investigation. The choice of method depends on the target compound, sample composition, method validation, and the laboratory's technical capabilities.

Results and Discussion

The literature review indicates that monitoring pesticide residues in beef requires consideration of several interrelated factors. These include the active ingredient of the pesticide, the method of application, the animal's level of exposure, and the distribution and elimination of the substance within the animal's body. These factors may influence the presence of residues in meat. Therefore, drawing identical conclusions for different compounds and products of animal origin would not be scientifically justified.

Research conducted by Uzbek scientists in the field of veterinary and sanitary examination highlights the importance of organoleptic and laboratory assessments in evaluating meat safety. In particular, Rasulov U.I. and co-authors investigated the veterinary and sanitary assessment of meat obtained from animals subjected to compulsory slaughter [2]. Furthermore, research by Rasulov O‘.I. and co-authors on the efficacy of preparations used against ectoparasites in cattle [3] provides relevant local scientific context for the use of chemical agents in livestock parasite control.

However, these local studies should not be interpreted as direct evidence confirming the concentrations of synthetic pyrethroid residues in beef. Reliable conclusions in this area require specific laboratory studies designed to detect the relevant active substances directly in meat samples.

Modern instrumental analytical methods make it possible to identify pesticide residues qualitatively and quantify their concentrations. In this process, sample collection and preparation, method selectivity, detection and quantification limits, calibration, and reproducibility of results are important considerations. Laboratory findings should be compared with the applicable maximum residue limit established for the specific substance and food product [1].

Examining the external appearance, color, odor, and consistency of meat is an essential component of veterinary and sanitary examination. However, these characteristics cannot reliably confirm or rule out the presence of pesticide residues. Consequently, appropriate laboratory testing plays a crucial role in assessing chemical safety.

When evaluating the potential risks of pyrethroid residues to human health, it is necessary to consider the toxicological properties of the substance, the concentration detected, and the amount that may enter the human body through food consumption. International regulatory sources and pesticide residue assessment reports prepared by the FAO/WHO provide an important scientific basis for evaluating these risks [1, 4].

From this perspective, investigating pesticide use practices in livestock farms in Uzbekistan, detecting relevant residues in beef samples under laboratory conditions, and comparing the findings with international standards represent important directions for future research.

Conclusion

Monitoring synthetic pyrethroid residues in beef is an important component of veterinary and sanitary examination and food safety assurance. The literature review highlights the need to use chemical agents in accordance with established requirements, improve laboratory monitoring, and assess product safety against applicable regulatory standards.

Modern instrumental methods, such as GC-MS and LC-MS/MS, can be used to detect and quantify pyrethroid residues under appropriate analytical conditions. Nevertheless, specific laboratory investigations are required to determine the occurrence and concentrations of pyrethroid residues in beef under local conditions. Such research may strengthen the scientific foundations of veterinary and sanitary control and contribute to ensuring the availability of safe meat products for consumers.

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