

ABSTRACT
of the dissertation by Turabekov Manas Ramazonovich on the topic:
“Development of Disinfectants Based on Safe Compounds for Preventive
Disinfection of Livestock Facilities”, recommended for the degree of Doctor of
Philosophy (PhD) in the educational program 8D09102 – “Veterinary
Sanitation”

1. Relevance of the research topic.

Disinfection holds a significant place in the system of veterinary-sanitary measures that ensure the well-being of animals against infectious diseases, increase their productivity, and maintain the sanitary quality of resulting products, raw materials, and feed. The main objective of disinfection is to interrupt the transmission chain of the epizootic process, i.e., to prevent the transmission of the pathogen from the infection source to a susceptible organism.

According to many researchers, when developing new disinfectants, attention should be paid to multifunctional chemical compounds with a broad spectrum of bactericidal activity against microorganisms. It is emphasized that such compounds must be safe for humans, animals, and the environment.

In addition, one important area of research is the development of products that can be used in the presence of animals and birds without exerting toxic effects on their organisms. This allows for timely (as needed) preventive disinfection and optimizes the application technology.

2. Objective of the dissertation research:

To develop and introduce into production domestic, multi-component, environmentally friendly disinfectants based on safe compounds for the effective implementation of preventive disinfection in veterinary control institutions, ensuring environmental cleanliness, and preventing and eliminating infectious diseases.

3. Research objectives:

1. To study the active ingredients of disinfectants and to develop new composite formulations with low toxicity and high bactericidal activity.
2. To investigate the bactericidal, physicochemical, and corrosive properties of the developed disinfectant formulations.
3. To assess the toxicological properties of the developed disinfectant compositions.
4. To determine the technological application regimes of the developed disinfectants under laboratory and industrial conditions.
5. To evaluate the effects of the developed disinfectants on the organisms of animals and birds.

4. Research Methods.

The dissertation research was conducted at the Department of Veterinary Sanitation of the Kazakh National Agrarian Research University and the production facilities of the dairy farm “Amiran Agro” LLP in the Talgar district of the Almaty region, as well as the poultry production site of “Alatau Kus” JSC in the Ili district.

To carry out industrial experimental research work within the dissertation, the level of microbial contamination of the air in livestock buildings was assessed based on the methodology proposed by I.I. Guslavsky, Zh.B. Myrzabekov, P.Sh. Ibragimov, O.O. Tagayev, and others. To capture microorganisms, a UM-1 flask (microorganism holder) made of chemically pure glass with a volume of 50 ml was used.

The bactericidal activity of the tested compositions at various concentrations was determined using several methods (agar diffusion method, serial dilution method according to Kulikov, phenol coefficient, and protein index).

To implement preventive measures under production conditions, a “Cyclone-4” aerosol generator (Russia) with a high-pressure sprayer powered by a Honda fuel engine (China) was used for wet disinfection, and a small foam generator PG-24 (Italy) was used for foam disinfection.

The quantification of microorganisms was performed using a modern binocular microscope BM50W. The BM50W binocular microscope features a robust body, specialized software, and is equipped with a camera and a color LCD monitor.

5. Results submitted for defense.

- the results of monitoring various disinfectant products and determining ingredient compatibility in the new composite formulations (iodine, potassium iodide, acetic acid, hydrogen peroxide, dodecyldimethylbenzylammonium chloride, sodium hydroxide);
- data obtained from studies of the biocidal, physicochemical, and toxicological properties of the developed disinfectant formulations;
- technological application protocols for the prepared disinfectant compositions in laboratory and production settings;
- results of the biological effects of the developed disinfectant compositions on the organisms of animals and birds.

6. Characteristics of the Main Research Results:

As a result of the experiments conducted, a domestically produced disinfectant formulation based on hydrogen peroxide and iodine was developed, and its application modes in both laboratory and production conditions were determined.

It was established that the pH of the prepared composite formulations ranged from 5.95 to 7.76, indicating a neutral reaction. This ensures that the solution does not irritate workers' skin and does not cause metal corrosion.

To optimize the technological regimen for preventive disinfection, studies were conducted to determine the application methods of hydrogen peroxide and iodine-based disinfectants using different approaches (aerosol and foam). Considering that broiler chickens at “Alatau Kus” JSC are housed for up to 40 days, preventive disinfection should be conducted within 20 days, with disinfection cycles on days 20 and 40. At “Amiran Agro” LLP, microbial accumulation after 30 days of disinfection using aerosol and foam methods amounted to 78.3 ± 8.4 and 71.6 ± 8.2 thousand

CFU/m³, respectively. It is therefore proposed that preventive disinfection should occur every 30 days, every month throughout the year.

A 3-hour exposure to a 0.5% iodine-based disinfectant concentration in the presence of dairy cows eliminated microorganisms in the barn, while other scientific studies achieved this result after 6 hours of exposure. Additionally, in poultry houses, the concentration of airborne microorganisms was reduced by 2.71 times, compared to only 1.73 times in previous studies, resulting in a 0.98 times greater reduction.

7. Relevance, Novelty, and Significance of the Results Obtained:

The scientific novelty of this work lies in the development of multi-component disinfectant formulations based on iodine and hydrogen peroxide. Patents for utility models were obtained from the Intellectual Property Institute.

The developed application technology for the composite formulations enabled the creation of an optimized technological procedure for preventive disinfection, which is harmless to animals and birds and ensures a high sanitary level for veterinary-controlled facilities.

8. Alignment with Scientific Development Priorities or Government Programs:

Grant funding for young scientists was provided by the Committee of Science of the Ministry of Science and Higher Education of the Republic of Kazakhstan for 2021–2023 under the scientific project within the budget program AR09058530: “Development of modern disinfectants based on safe compounds for the prevention and elimination of infectious diseases.”

9. Description of the Doctoral Student’s Contribution to Each Publication:

A total of 10 scientific publications were produced based on the dissertation research, including:

2 articles in high-impact journals:

- Enhancing Animal Welfare and Immune Health: A Study on Hydrogen Peroxide and Iodine-based Disinfectants in Farms // Engineered Science, 2024, Volume 29, Article 1095, pp. 1–11. DOI: 10.30919/es1095

- Development of a Disinfectant Composition Based on Hydrogen Peroxide // Engineered Science, 2024, Volume 28, Article 1080, pp. 1–12. DOI: 10.30919/es1080

3 articles in journals recommended by the Committee for Quality Assurance in the Field of Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan:

- Development of Application Modes for a Hydrogen Peroxide-Based Disinfectant // Science and Education, Scientific and Practical Journal of Zhangir Khan West Kazakhstan Agrarian-Technical University, Uralsk, No. 4-1 (69), 2022, pp. 86–95. <https://ojs.wkau.kz/index.php/gbj/issue/view/55/191>

- Bactericidal Activity of a Disinfectant Composition Based on Hydrogen Peroxide // Science and Education, No. 3-1 (68), 2022, pp. 71–80. <https://ojs.wkau.kz/index.php/gbj/issue/view/52/189>

- Optimization of the Technological Regimen for Preventive Disinfection in Livestock and Poultry Facilities // Science and Education, No. 2-1 (75), 2024, pp. 219–230. <https://ojs.wkau.kz/index.php/gbj/issue/view/88/227>

2 articles in international conference proceedings:

- Study of the Toxicological Properties of Disinfectants to Ensure Animal Safety
// Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology, International Scientific-Practical Conference, Samarkand-2024, pp. 107–109. <http://vetmed.uz/maxsus-son-1-2024/>

- Determining the Method for Effective Application of Disinfectant Compositions Based on Hydrogen Peroxide in Production // Samarkand-2024, pp. 195–197. <http://vetmed.uz/maxsus-son-1-2024/>

2 utility model patents granted:

- Disinfectant / Utility Model Patent No. 8944 dated 20.03.2024

- Disinfectant / Utility Model Patent No. 8959 dated 29.03.2024

10. Structure and Length of the Dissertation:

The dissertation was typed using Microsoft Word (font: Times New Roman, size 14, single spacing) and comprises 101 pages. It includes the following sections: Introduction, Research Direction Definition, Independent Research, Research Results, Conclusion, List of References, and Appendices. The work is illustrated with 39 tables and 13 figures. The reference list includes works by 101 domestic and foreign scholars.