БИОЛОГИЧЕСКИЕ НАУКИ

УДК 619:576:314: 577.1: 57.08

THE STUDY OF THE BACTERICIDAL ACTION OF A COMPLEX COMPOUND BASED ON SILVER AND IODINE

Krasochko Pyotr Albinovich
Doctor of Veterinary Sciences, Doctor of Biological Sciences, Professor
Shienok Marina Alexandrovna
Senior Lecturer
Ponaskov Mikhail Alexandrovich
Graduate student
Pritychenko Alesya Viktorovna
Candidate of veterinary sciences, associate professor
Kalesnikovich Kseniya Vyacheslavovna
Student
Vitebsk State Academy of Veterinary Medicine, Republic of Belarus, Vitebsk

Аннотация: *Использование антибиотиков продуктивным животным не всегда оказывает положительный терапевтический эффект. Так, антибиотики и сульфаниламидные средства могут накапливаться в конечной продукции, вызывая желудочно-кишечные расстройства и пищевые аллергии у человека. Поэтому разработка и внедрение в производство новых эффективных экологически безопасных препаратов, оказывающих антибактериальное и противовирусное действие для лечения животных, является одной из актуальных проблем ветеринарной медицины. Большой интерес из-за своей антибактериальной активности вызывает комплексный препарат на основе серебра и йода, что явилось предметом изучения авторов данной статьи.*

The use of antibiotics for productive animals does not always have a positive therapeutic effect. So, antibiotics and sulfa drugs can accumulate in the final product, causing gastrointestinal upsets and food allergies in humans. Therefore, the development and introduction into production of new effective environmentally friendly drugs that have antibacterial and antiviral effects for the treatment of animals is one of the urgent problems of veterinary medicine. The subject of this article based on the great interest in antibacterial activity of a complex drug based on silver and iodine.

Ключевые слова: *антибиотикорезистентный штаммы микроорганизмов, антибактериальная активность, антагонистическая активность, комплексное соединение, серебро, йод.*

Key words: *antibiotic-resistant strains of microorganisms, antibacterial activity, antagonistic activity, complex compound, silver, iodine.*

Since 1940s, antimicrobials began to be used actively in veterinary medicine.

The widespread use of antibiotics in agriculture is to prevent and treat infectious diseases in animals, however, unjustified and irrational application of antibacterial drugs (not observing the multiplicity, course and dosage of the drug) leads to the long-term maintenance in animals with low concentrations, which contributes to the development of antibiotic-resistant (resistant) forms microorganisms [6, P.289.].

The Summary Report EFSA & ECDC (2013) established the relationship between the amount of antibacterial drug used and the number of microorganism resistant strains isolated from productive animals [3, P.30.].

The problem of antibiotic resistance is becoming increasingly relevant throughout the world. As antibacterial drugs lose their effectiveness, it becomes more difficult (and sometimes impossible) to treat infections that affect both people and animals.

Therefore, WHO pays great attention to curbing the spread of antibiotic-resistant strains of microorganisms from a position of food safety for the population [2, P.53.] and defines the rational use of antibacterial drugs as "the economically feasible use of antimicrobial agents, which provides maximum therapeutic activity and at the same time minimizes the toxicity of drugs and the possibility of formation of resistance"[5].

Therefore, in the modern world there is a tendency to replace the use of antibiotics and other synthetic antimicrobial agents with complex compounds based on salts, nanoparticles, organic acids, herbal remedies, etc.

There is a great interest to the complex compounds based on silver and iodine, which have highly pronounced antibacterial, antiviral and antifungal properties.

Silver is a metal with a pronounced bactericidal, antiseptic, anti-inflammatory effect, which is effective against 650 types of bacteria that do not acquire resistance to it, unlike almost all antibiotics. Silver acts as antibiotic against many protozoa and even viruses [6, P.885.].

Iodine preparations have a wide antimicrobial spectrum of action - they act both on gram-positive and gram-negative bacteria, fungal microflora; do not cause the development of resistance of strains of microorganisms [1, P.63.].

The aim of this work is to study the antibacterial effect of the complex compound of silver and iodine in terms of the minimum inhibitory concentration with subsequent evaluation of the reaction results by spectrophotometry.

Materials and research methods. A complex compound based on silver and iodine was prepared at the Department of Chemistry, EI VSAVM.

Antibacterial activity of the test compound in different dilutions was carried out according to the minimum inhibitory concentration (MIC) evaluation, according to the Guidelines for testing antibacterial sensitivity followed by evaluation of the reaction results by spectrophotometry [7, P.58].

This method of assessing antibacterial activity, thanks to the automation of the process, allows you to objectively keep track of the reaction produced by the optical density index using a spectrophotometer. In addition, in contrast to the traditionally used diffusion method, which is a semi-quantitative analysis of the antibacterial activity of substances and preparations, this technique is quantitative, allowing statistically significant determination of the minimum inhibitory concentration. Antibacterial activity was studied against *Escherichia coli, Salmonella enterica, Streptococcus pneumoniae, Staphylococcus aureus*.

The principle of the method is to suppress the growth of bacteria in a liquid nutrient medium under the influence of the studied compounds. In this case, the optical density of the bacterial suspension was taken into account before and after the introduction of the complex compound in comparison with the control. In the wells of the plate where the compound was added, microorganisms are subjected to bactericidal and bacteriostatic effects, and the optical density increased the less the more pronounced this effect.

Research results. As a result of the studies, the antibacterial effect of the complex compound against *Escherichia coli, Salmonella enterica, Streptococcus pneumoniae, Staphylococcus aureus* was established. At the same time, the complex compound diluted to 50% has a high activity - its activity was 119-142% in relation to the studied bacteria. When diluted to 25%, the activity ranged from 90 to 141%, when diluted to 12,5%, it ranged from 67 to 136%.

Conclusions. Studies of the antibacterial activity of various concentrations of the complex compounds allow us to draw the following conclusions:

1. The complex compound has higher antibacterial activity against *Escherichia coli, Salmonella enterica, Streptococcus pneumoniae, Staphylococcus aureus* at a dilution in 50% concentration;

2. The complex compound in each individual dilution demonstrates relatively the same activity against various test cultures (gram-positive and gram-negative microorganisms);

3. A complex compound based on silver and iodine, as an antibacterial environmentally friendly substance, can be recommended when designing veterinary drugs.

Список литературы

1. Соловьев, А. Альтернатива антибиотикам в ветеринарной медицине / А. Соловьев, А. Марцинкевич / Белорусское сельское хозяйство. – 2018. – № 9. – С. 62–63.

2. EFSA (Euripean Food Safety Authority) and ECDC (European Centre of Disease Prevention and Control) The European Union summary report on antimicrobial

resistance in zoonotic and indicator bacteria from humans, animals and food in 2015/EFSA Journal. – 2017. – Vol.15. - №2. – P.49–64.

3. EFSA (European Food Safety Authority) and ECDC (European Centre for Disease Prevention and Control), 2015. EU Summary Report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2013/EFSA Journal. - 2015. – Vol.3. - №2. – P.20–36.

4. Woodford, N. Carbapenemase-producing Enterobacteriaceae and nonEnterobacteriaceae from animals and the environment: an emerging public health rick of our own making?/ N.Woodford, D.W.Wareham, B. Guerra, C.Teale / Journal of Antimicrobial Chemotherapy. - 2014. – Vol.69. – P.287-291.

5. WHO. Global strategy for containment of antimicrobial resistance. Geneva, 2010.Режим доступа:http:/www.who.int /drugresistance/WHO_Global_Strategy_English. – Дата доступа : 15.11.2019.

6. Woodward R.L. Review of the Bactericidal Effectiveness of Silver /J. Amer. Water Works Assotiation. -2013. -55. N7. -P. 881-886.

7. Manual of antimicrobial susceptibility testing / Stephen J. Cavalieri [et al.] / II. American Society for Microbiology. – 2015. – № 3. – P.53–62.