The study demonstrated the effectiveness of nanosilver (linear particle size 10–20 nm) in the form of a patented composition. This form showed high bactericidal and fungicidal activity against gram-positive, gram-negative bacteria and candida in minimal concentrations.

Keywords: silver nanoparticles, bacteria, fungi

В исследовании продемонстрирована эффективность наносеребра (линейный размер частиц 10–20 нм) в виде запатентованной композиции, которое показало высокую бактерицидную и фунгицидную активность против грам-положительных, грам-отрицательных бактерий и кандид в минимальных концентрациях.

Ключевые слова: наночастицы серебра, бактерии, грибы


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**ATCC** – American Type Culture Collection
**ISO** – International Organization for Standardization

**MIC** – minimum inhibitory concentration
tential of undesirable reactions when they are used [2, 3].

The study aimed to determine the minimum bactericidal concentration of the nanosilver preparation for gram-positive, gram-negative bacteria and fungi.

**Material and Methods.** The activity of a 0.1 % solution of silver nanoparticles with a linear size of 10–20 nm in a matrix of 0.6 % sodium alginate in an aqueous medium (99.3 %) (patent UA N10539) against international test strains of bacteria with a known level of antibiotic resistance was studied: Staphylococcus aureus ATCC 25923; Escherichia coli ATCC 25922; Candida albicans CCM885.

The antibacterial and fungicidal activity was assessed by determining the minimum inhibitory concentrations (MIC) for each microorganism by diluting it in a liquid nutrient medium following ISO 20776-1:2006 and the National Standard GOST R ISO 20776-1-2010.

Monitoring of the experiment results was carried out after 24 hours by two methods: taking into account the formation of biofilms in the studied solution and the method of sowing the studied contents on the peptone agar. The positive result of biofilms was determined as the absence of the formation of a biofilm in a liquid nutrient medium with a bactericidal concentration of the preparation.

The second control of the experiment is the sowing of agar to detect the lack of growth of micro-organisms in a liquid medium containing nanosilverbiral, which confirms the bactericidal effect of the drug. The result was taken into account after 24 hours for the presence or absence of growth of colonies on the agar by sectors corresponding to the holes of the tablet with a particular concentration of the drug under study.

The mathematical processing on a personal computer using the statistical program Statistica 6.0 (StatSoft Inc., USA) was applied. The nature of the distribution was determined using the Shapiro – Wilk test, and, with a normal distribution, Student’s t-test was used.

**Results and Discussion.** In the course of the study, the ability to form a biofilm on the surface of a liquid nutrient medium without a studied composition containing silver nanoparticles is shown for all test strains. After 24 hours of exposure to microorganisms in a linear size of 10–20 nm, the drug content remaining in the nutrient medium with respect to staphylococcus strains, the presence of colonies was not observed in the control samples in each of the 10-fold dilutions, which may be due to the larger specific surface of nanoparticles in this composition and the increased area of contact of nanosilver with microorganisms [4]. Hence the possibility of reducing the toxic effect of silver as a metal a hundred times while maintaining its bactericidal properties, including for the remaining viable but un cultivable micro-organisms [2, 5]. Nanosilver offers a wide opportunity to create highly effective drugs and their wide use in medicine and other areas of human activity.

**Conclusions.** The results show a high bactericidal and fungicidal activity of the composition containing a 0.1 % silver nanoparticle solution with a linear size of 10–20 nm in a 0.6 % sodium alginate matrix in an aquatic medium with respect to staphylococcus strains, Escherichia coli and Candida with a known level of antibiotic resistance.

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DEVELOPMENT OF THE ADHESIVE PROCESS IN THE ABDOMINAL CAVITY USING PLASTIC DEVICES IN LAPAROSCOPIC SURGERY

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The study examined the risk of developing adhesions in the abdominal cavity using modern plastic devices used in endoscopic interventions. Two equivalent groups were formed out of 80 rats. In the first group, 40 rats were injected with a sterile fragment of classical endoscopic bag through a puncture of the anterior abdominal wall, while in the second one (40 rats) – sterile plastic was used for 3D printing in medicine. The animals were removed from the experiment on the 30th and 90th days. After the macroscopic determination of the development degree of the adhesive process, the parietal and visceral peritoneum was taken out, followed by IHC examination. As a result of the study, it was found that the plastic, which is a part of endo bags and 3D printing plastic, does not lead to the formation of viscero-parietal adhesions associated with the development of the adhesive process. Thus, using various plastic devices for 3D printing in the abdominal cavity is safe. However, additional research is needed.

Keywords: adhesions, abdominal cavity, experiment, endoscopic device, 3D printing, laparoscopy