Thus, the microecological approach to assessing the state of the microbiota provides the necessary information on the relationship between individual microorganisms in its composition and can be a valuable tool in deciphering the mechanisms for reducing fertility associated with nonspecific infections.

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IMPROVEMENT OF BACTERIAL BIOFILM'S INVESTIGATION

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Existing approaches to the investigation of biofilms haven't a unified methodology. Researchers use different solvents, allow deviations from the original technique. Each of them distorts the results and doesn't allow them to be compared.

The aim of investigation was to evaluate the possibility of using alcohol and acetic acid for dissolution of crystal violet, as well as additional dye Lugol's solution for the coloring biofilms.

The studies were carried out on *S. aureus*, *S. epidermidis*, *E. coli*. To form biofilms, the strains were cultured in flat-bottomed plates for 48 h. Biofilms were stained with a 0.1% solution of crystal violet (CV). In part of the studies after the coloration of biofilm with CV, Lugol's solution (LS) was used for 2 min. Extraction of dyes was performed with 70 and 95% alcohol and 33% acetic acid. Results were taken into account by measuring the optical density of solutions at a wavelength of 590 nm. Statistical analysis of the data was carried out using the paired version of the Student t-test. The threshold value was taken as $p < 0.05$. The data are given as the arithmetic mean (M) and its error (m).

It was shown that the use of 70% alcohol qualitatively elutes CV from biofilms than 95% one. This may be due to the fact that 95% alcohol narrows the pores of the cell wall and the dye is less efficiently released into the solution. The acetic acid more efficiently elutes the CV from biofilms formed by grampositive microorganisms. The use of LS after staining by CV showed the best results, but only if the extraction was carried out with a solution of acetic acid prepared with alcohol. This approach seems most optimal. LS fixes the dye in the cell and dissolution with a mixture of alcohol and acetic acid makes it more possible.

It was shown that extraction of CV is best performed with 70% alcohol. When fixing CV by LS, it is more appropriate to use a solution of acetic acid in alcohol.

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EFFECT OF METAL OXIDE NANOPARTICLES ON THE EXCHANGE OF GENETIC MATERIAL BETWEEN BACTERIA

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The development of resistance to antibiotics in bacteria is one of the most serious threats to global public health. The spread of resistance genes to antibiotics is caused by the increase and misuse of antibiotics in medicine and in animal feed. Nanomaterialscan increase the efficiency of horizontal transmission of multiresistance genes localized in plasmids between bacteria. Some studies have indicated that nanomaterials can cause damage to bacterial membranes, possibly by forming reactive oxygen species and can deliver DNA or RNA molecules to animal or plant cells. It was shown earlier the increase in efficiency of horizontal transmission of multidrug-resistant genes localized in plasmids by alumina nanoparticles (NPs) [1]. In this study, we observed the effect of different metal oxide NPs on the horizontal transfer of antibiotic-resistance genes between different *Escherichia coli* strains.

For the analysis of plasmid horizontal junctions, NPs of metal oxides Ta_2O_5, HfO_2, Fe_3O_4, ZrO_2, TiO_2, Al_2O_3 were used at a concentration of 5 mmol/L. The studies were conducted between *E. coli* strains containing different plasmids with different resistant cassettes. The transconjugants growth after incubation with metal oxides NPs was fixed on medium with appropriate antibiotics. The effect of metal oxide NPs was compared with control samples without addition of NPs.

In this study, we showed that the addition of NPs metal oxides can enhance the efficiency of horizontal gene transfer between different bacteria.

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SONOCHEMICAL NANOSTRUCTURING OF ANTIBIOTICS IS A NEW APPROACH TO INCREASING THEIR EFFECTIVENESS AGAINST RESISTANT STRAINS

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One of the most urgent problems of modern medicine is bacterial resistance to antibiotics. Development of new treatment approaches is a laborious and expensive process. One of the strategies for developing new antimicrobial agents is a modification of existing antibiotics. Sonochemical nanostructuring of antibiotics can become a cheap alternative to modern complex methods. In this regard, the aim of this research was to analyse the antimicrobial activity of sonochemically-modified tetracycline against sensitive and resistant strains.

Escherichia coli Nova Blue TcR (with antibiotic resistance) and *E. coli* 292–116 (without drug resistance) were used in this study. Tetracycline, a broad-spectrum antibiotic, was modified using industrial sonicator UIP1000hdT (Hielscher, Germany). The effectiveness of antibacterial properties was estimated using the disc-diffusion method and spectrophotometry analysis of liquid cultures. The results were confirmed by flow cytometry after staining with propidium iodide and Syto-9 dyes. The antimicrobial action of the modified antibiotic solution during long-term storage has also been studied.

The ultrasound processing time determines the change in antimicrobial properties against both sensitive and resistant cells. As a result of sonochemical treatment, the effectiveness of antibacterial properties increases up to 25% against the resistant strain and up to 100% against the sensitive strain. The long-term storage at +4°C does not reduce the antimicrobial properties.

The obtained data shows that sonochemical modification of antibiotics can be a new promising and cheap approach to the development of new drugs effective for antibiotic therapy against drug resistance strains.