STRESZCZENIE

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„Antibacterial effect of metal nanoparticles against selected bacteria constituting the typical microflora of the upper respiratory tract”

English version

The theoretical part of the paper contains basic information related to the development of inflammatory conditions of the nasopharynx, including the strains most commonly found in these diseases. Problems in the control of nasopharyngeal infections, such as the poor availability of bactericidal substances in the case of the formation of bacterial colonies in the formed biofilm, are also presented. Due to the difficulties associated with increasing drug resistance, the search for new ways of using effective therapies is one of the most important elements in ensuring the safe treatment of patients.

Literature data confirm the high bactericidal efficacy of silver and nanosilver, which offers an opportunity not only in the treatment of nasopharyngeal infections, but also in the treatment of difficult infections. Nanosilver, or colloidal silver in the form of nanoparticles, is used as a natural antibiotic and antiseptic. It is effective against many pathogens, including bacteria, viruses and fungi, and can help fight nasopharyngeal infections. Nanosilver, or colloidal silver in nanoparticle form, is used as a natural antibiotic and antiseptic. It acts against many pathogens, including bacteria, viruses and fungi, and can help fight infections of the nose and throat, among other things. Metal nanoparticles have a significant impact on the development of new antibacterial therapies, as pathogens do not develop resistance to this type of substance, unlike traditional antibiotics. However, it should be noted that the efficacy of nanosilver may depend on a number of factors, such as particle size, concentration, exposure time, and the way the nanosilver product is prepared and applied. In addition, some bacterial strains may have different sensitivities to nanosilver, meaning that not all bacteria will be equally susceptible to its effects.

Nanosilver has shown efficacy against various strains of gram-positive and gram-negative bacteria, but efficacy may vary depending on the specific bacterial strain and test conditions. Nanometals inhibit bacterial growth by damaging the cell membrane, inhibiting metabolism

including disruption of respiratory chain processes, or interfering with DNA replication processes.

In the following part of the paper, the proposed silver (section 2.1.1) and gold (section 2.1.2) nanomaterials are characterized and their mechanism of action, medical use, and safety of use are described. As raw materials and plant preparations have long been used in the treatment of nasopharyngeal inflammation, the properties and use of such raw materials as lanceolate plantain, papillary birch, tea tree oil, imbir rhizome, thyme, Iceland lichen, eucalyptus oil, sage oil, and oregano are described.

Nanometallic and herbal preparations for nasopharyngeal infections may contain a combination of active ingredients that help fight bacterial infections and relieve inflammatory symptoms of the throat and nose. Such preparations, used in the form of water-soluble nasal drops or throat rinses, are beneficial in reducing inflammation. Herbs such as eucalyptus, ginger, and green tea have the strongest anti-inflammatory and antibacterial effects, which can help relieve symptoms of infection.

Next, we have characterized the promoters used for permeation through biological membranes, such as dimethyl isosorbide ether (Section 3.1), 4-hydroxyacetone (Section 3.2), dimethyl sulfoxide (Section 3.3), caprylyl glycol (Section 3.4), ethylhexyl glycerin (Section 3.5), glycerin (Section 3.6), hexylene glycol (Section 3.7). For these substances, their properties, toxicological information, use and effect are given. This paper focuses on the study of the effect of these substances on increasing the antimicrobial activity of silver compared to formulations without these substances.

The use of transepidermal transport promoters, such as DMSO and hexylene glycol, helps deliver active ingredients to the site of infection and increases efficacy. Studies have shown the best efficacy of silver in combination with dimethyl sulfoxide (DMSO), but satisfactory results have also been obtained with hydroxyacetophenone and dimethyl isosorbate.

The next section of the paper describes two substances that have protective and soothing effects on the nasal mucosa: lactoferrin (section 2.3.1) and dexpanthenol (section 2.3.2). For these substances, their properties, toxicological information and uses, as well as their effects. The study evaluated the effect of adding these substances to formulations on the antimicrobial activity of silver compared to formulations without these substances. The study showed that the addition of these substances did not reduce the antimicrobial activity, but the addition of

substances that affect the consistency of formulations, such as carbomer, silicone or polyethylene glycol, reduced the antimicrobial activity of the formulations (Section 1.5.2).

The following sections of the paper describe the results of microbiological tests with the determination of MIC values, MBIC and the diffusion-circulation method test, where it was confirmed that silver nanoparticles have strong antibacterial properties, making them an effective tool against infections caused by bacterial pathogens.

Studies have shown that silver nanoparticles can inhibit the growth of Gram-positive (+) and Gram-negative (-) bacteria and reduce inflammation caused by bacterial infections of the throat and nose (Chapter III).

Silver aXonnite® (AgNPs) have antimicrobial activity that can help fight or inhibit bacterial growth in the nasopharynx. They can be particularly effective against bacteria that have become resistant to traditional antibiotics. In the final part of the research, the antibacterial efficacy (MBIC) of nanosilver and nanogold was determined against 48 selected model bacterial strains present in the biofilm (Section 4.1.2). The results indicate that Xonnite® nanosilver and Xonnite® nanogold are highly effective against selected typical bacterial and fungal strains present in the biofilm, although by far the stronger antimicrobial activity was shown by silver AgNPs, no significant differences in activity were observed for Gram-negative or Gram-positive bacteria.

Preparations based on nanosilver support the relief of inflammation of the nasal mucosa, such as sinusitis and chronic rhinosinusitis.