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## A STUDY OF THE POTENTIAL OF SPIDER SILK USE FOR THE DEVELOPMENT OF ANTIBACTERIAL DRUGS

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Spidroin is the natural material possessed unique properties such as biocompatibility, noninflammatory property, controllable biodegradation, hydrophobicity. It can be used as functional biomaterial after processing and post-processing. In recent years the functional hybrid materials based on spidroin have been developed for the various biomedical and nanotechnological applications including drug delivery, tissue engineering, nanostructured optics, nanoelectronics, sensors, filtration, surface modification. In this study a hybrid consisting of spider silk and metal oxides that can generate active molecular forms as a result of interaction with peptides was investigated. Their biological properties were studied.

Hybrid materials were obtained by precipitation of nanoparticles of tungsten and molybdenum oxides from hydrosol. The natural silk was obtained in insectarium where the spiders *Linothele fallax* are grown. A preliminary study was conducted on the activation of the web hybrids in a contact with two types of the test-microorganisms: gram-positive *Staphylococcus aureus* 209 R and gram-negative *Escherichia coli* XL-1. The study of antibacterial properties of hybrid silk-based material was carried out by agar diffusion method.

The spider silk and their composites had a greater impact on the gram-positive type of bacteria itself. The results obtained for the hybrid material are comparable to the concentration dependence of the effect of nanoparticle solutions on bacterial cells. Moreover, a tendency for the synergistic effect of spider silk with deposited composite metal oxides on it was observed. In addition, there was a color change zone the dense medium. The colored area is considered as the result of interaction of a silk-based composite with the peptides of the medium and the exogenous proteins secreted by bacteria.

The results show a positive trend that requires further study to verify the possibility of creating a new biomaterial as effective antibacterial complex.

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## CAPSULE SPECIFIC POLYSACCHARIDE DEPOLYMERASES OF *KLEBSIELLA PNEUMONIAE* BACTERIOPHAGES: IMPLICATION IN TYPING AND TREATMENT

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To overcome the carbohydrate barrier of bacteria, many bacteriophages use specific enzymes, polysaccharide-depolymerases (PS-dep), which destroy bacterial polysaccharide capsules, thereby ensuring the adsorption of the phage at the outer membrane receptors, the penetration of phage DNA, and the lysis of the bacterial cell. Phage depolymerases are an attractive and promising means for controlling pathogenic bacteria, such as *K. pneumoniae*, whose main virulence factor is a pronounced polysaccharide capsule.

The aim of the work is to characterize the specificity and anti-bacterial (anti-virulence) potential of polysaccharide depolymerases encoded by capsule specific *K. pneumoniae* bacteriophages.

We cloned and expressed genes PS-dep of the phages KpV71, KpV74 and KpV79, lytic for *K. pneumoniae* of capsule types K1, K2 and K57, respectively, into the *E. coli* cells. The recombinant proteins Dep_kpv71, Dep_kpv74, and Dep_kpv79 were isolated and purified and the PS-degrading activity of the recombinant proteins was demonstrated. The spectrum of activity of PS depolymerases against to *K. pneumoniae* strains of different phenotypes and genotypes was determined. It was shown that recombinant proteins are more specific to polysaccharides of the corresponding types than "parent" phages.

It was found that the depolymerases Dep_kpv74 and Dep_kpv79 are specific glycosidases that cleave the *K. pneumoniae* polysaccharides of capsular types K2 and K57 by β-glucoside and β-galactoside bonds, respectively, to form monomers and dimers of the tetrasaccharide repeating unit of the polysaccharide. Protein Dep_kpv74 is a bifunctional protein and, in addition to β-glucosidase activity, determines, as assumed, the phage binding with the primary bacterial receptors, the capsular polysaccharides.

*In vitro* and *in vivo* experiments showed that treatment of virulent hypermucoid strains of K2- or K57-type *K. pneumoniae* with Dep_kpv74 or Dep_kpv79, respectively, leads to a significant decrease in *K. pneumoniae* strain virulence in mice and ensures the survival of animals in the development of *K. pneumoniae*-sepsis.

In conclusion, the obtained data testify to the perspectives of using of phage PS depolymerases for *K. pneumoniae* capsular typing, as well as for treatment of *K. pneumoniae*-infections.

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## DEVELOPMENT OF A NEW ANTI-INFLUENZA COMPOUND BASED ON CAMPHOR SCAFFOLD

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Despite success in chemotherapy and vaccine development, influenza remains a hard-to-control infection due to high genetic variability and long-term complications after the acute stage leading to a "hidden" or secondary mortality caused not by the influenza virus itself but by virus-induced secondary processes. The use of antiviral compounds leads to the rapid emergence of resistant strains. Therefore, the development of new anti-influenza drugs with new targets and other mechanisms of action is an important task of medical science and practical public health worldwide.

We identified a group of derivatives of natural terpenoids that exhibit a high level and a wide spectrum of activity against influenza viruses. Among them, camphecene (1.7,7-trimethylbicyclo [2.2.1] heptane-2-ylidene-aminoethanol) is one of the most active, possessing virus-inhibiting properties against influenza viruses A and B, both *in vitro* and in experiments on laboratory animals. The selectivity index (chemotherapeutic index) for influenza virus was 74–661, depending on the type and subtype of the virus, the protection index in animal experiments was 67% for influenza A and 89% for influenza B. The mechanism of camphecene activity was the suppression of fusogenic activity of the viral hemagglutinin,