ВПЛИВ НОВИХ СТАБІЛІЗОВАНИХ НАНОЧАСТИНОК МАГНЕТИТУ НА РОЗВИТОК СТАНДАРТНИХ ШТАМІВ МІКРООРГАНІЗМІВ

THE INFLUENCE OF NEW STABILIZED MAGNETITE NANOPARTICLES ON THE DEVELOPMENT OF STANDARD MICROBIAL STRAINS

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Magnetite nanoparticles (MNPs) use opens up new prospects in the fight against infectious diseases. In this respect, the most important are two areas: improving of antimicrobial's delivery with significant reduction in the minimal inhibitory concentration (MIC) of the drug and a control of microbial attachment and biofilm on medical coated surfaces. These areas are regarded as alternative strategies to eradicate infections caused by resistant bacteria and film-forming microbes. The above mentioned became a background for the investigation of antimicrobial properties of MNPs stabilized by polyvinyl pyrrolidone (PVP) and mexidol (2-ethyl-6-methyl-3-hydroxypirydine succinate).

Research aim is to study the effect of MNPs stabilized by PVP and mexidol on the development of standard strains of microorganisms in the liquid medium.

To prepare composite NPs we used powdered magnetite condensate with a particle size of 5-8 nm obtained by electron-beam technology. Condensate was dissolved in distilled water to the concentration 269 μg iron (Fe)/ml in the presence of stabilizing agents: mexidol (20000 μg/ml) and PVP (30000 μg/ml). Physical parameters of this colloidal solution were controlled by means of laser correlation spectroscopy, magnetometry and atomic optical emission spectrometry with inductively coupled plasma. Susceptibility of *S. aureus* and *E. coli* strains to MNPs was studied by the standard method of serial dilutions. The results were registered according to the visual signs of microbial growth in the liquid medium after the incubation at +37°C for 24 hours.

It is shown that fluid with stabilized MNPs exerted bacteriostatic effect on *E .coli* strain. Its MIC was 134.5 μg/ml of Fe, 10000 μg/ml of mexidol and 15000 μg/ml of PVP. At the same time solution of MNPs without stabilizing agents had not action on the *E. coli* growth. In the culture of *S. aureus*, MIC of the fluid with stabilized MNPs was lower than in the previous case: 33.6 μg/ml of Fe together with 2500 μg/ml of mexidol and 3250 μg/ml of PVP. Non-stabilized MNPs also had weak antimicrobial activity against *S. aureus* under the MIC 134.5 μg/ml of Fe.

So, MNPs stabilized by mexidol and PVP have antimicrobial activity against the standard strains of gram-positive and gram-negative microorganisms, which is more than the same of non-stabilized NPs. This can be the basis for further study the effects of given NPs on the microorganisms in order to explain their mechanism of action.

МОЖЛИВЕ ВИКОРИСТАННЯ МЕКСИДОЛУ ДЛЯ ЛІКУВАННЯ ПЕРЕВАНТАЖЕННЯ ОРГАНІЗМУ ЗАЛІЗОМ

POSSIBLE USE OF MEXIDOL FOR THE TREATMENT OF IRON OVERLOAD OF THE BODY

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It is known that iron (Fe) overload in hemochromatosis, beta-thalassemia, and frequent transfusions of erythrocytes mass requires the treatment with Fe chelating agents, which include desferal, deferiprone and deferasirox. Choice of Fe chelators is limited and their toxicity is large, making further relevant search of similar preparations. One of them may be mexidol (2-ethyl-6-methyl-3-hydroxypyrydine succinate) that interacts with Fe *in vitro*.

Research purpose is to study the effect of mexidol on Fe concentration in the blood serum and target organs of laboratory animals in the acute Fe overload of the organism.

During the experiment, albino rats were divided into 4 groups: intact animals, acute Fe overload without treatment (control pathology), acute Fe overload with mexidol (experimental group) or desferal (referent group). All animals, except intact rats, were administered orally by solution of Fe chloride (III) at the toxic dose of 2000 mg/kg of body weight. 10 minutes after that, mexidol was administered to the animals of experimental group both orally (1250 mg/kg) and intraperitoneally (100 mg/kg). Desferal as a reference preparation was used in the same manner (250 mg/kg and 80 mg/kg). 5 days after, the animals were sacrificed and Fe concentration was determined in the blood serum, liver and spleen by the method of atomic emission spectrometry with inductively coupled plasma.

Fe overload in the control pathology group was characterized by an increase of this element content 3.4 times in the blood serum, 1.4 times in the liver, and 1.5 times in the spleen as compared to the intact animals. Application of mexidol caused 3-fold decrease of the concentration of serum Fe as compared to control pathology. In the spleen, a decrease in the Fe content was 1.5 times. In the liver, there was a tendency to reduce of this element concentration. When desferal has been used, Fe content in the blood serum was decreased 2.9 times in a comparison with the pathological background. Also, referent preparation caused 1.7-fold decrease of this parameter in the liver of the animals with Fe overload. In the spleen, Fe concentration stayed unchanged after the treatment with desferal.

Thus, in the acute overload of the body by Fe, mexidol reduces the content of this element in the blood serum and target organs that is similar to the effect of desferal, the standard Fe chelator.