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Euro Bioparma 2018: Nanotechnology in the creation of new antibacterial drugs- Andrey Belousov- Laboratory of Applied Nanotechnology of Belousov

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The influence of basic physical factors caused by magnetite nanoparticles (constant magnetic field and sorption) on microorganisms by examining the reactions of the intensity of atom macromolecule peroxidation (FRLP) and bacteriostatic action was studied. It absolutely was well established that the magnetite nanoparticles caused unequal reaction in intensity of FRLP on completely different teams of microorganisms. it absolutely was determined that the foremost vital issue that influenced on the final word indicator of the intensity of luminescence on candida, Escherichia coli and Pseudomonas aeruginosa was constant magnetic field that induced by nanoparticles. On the contrary, activity was the foremost vital issue on cocci aureus. it absolutely was found that the speed of consumption of free radicals macromolecule reduced dependably on all microorganisms once their process by iron ore nanoparticles. The results of microbiological studies of Escherichia coli, enterobacteria pneumoniae and cocci aureus showed that organic process result was detected once exposure by iron ore nanoparticles. Visually, it absolutely was detected by decreasing the amount of colonies on the alimental medium as compared with the management. it absolutely was disclosed a motivating proven fact that physiological salt resolution (saline NaCl), that had antecedently been processed by iron ore nanoparticles additionally considerably had a marked organic process result on the studied microorganisms. This result might be explained by mechanism of amendment the polarization structure water of microorganisms by iron ore nanoparticles. it absolutely was discovered that degree of expression of organic process action that induced by iron ore nanoparticles had correlation with marks of reactions intensity of FRLP. most organic process result on cocci aureus was expressed in second variant application of iron ore nanoparticles wherever mechanism of activity was a lot of vital than action of the field of force. On the contrary, most organic process result on Escherichia coli and enterobacteria pneumoniae was disclosed in third variant, wherever time exposition of contact with microorganism's nanoparticles and, consequently, action of a continuing field of force was determinative.

Introductions

Today the world's attention is secured on the matter of microorganism proof against antibiotics – one in all the foremost serious threats to humanity. Chief medic, Dame Sally Davies, warned that if this drawback didn't resolved than in twenty years' time even surgery may cause death through untreatable infection. In Britain, in spite of greatly reducing hospital infections from bugs like MRSA (methicillin resistant cocci aureus) and microorganism} difficile to the amount of ten years agone – falling by eighty per cent – they were being replaced by time-serving bacteria like Escherichia coli and enterobacteria pneumoniae, that became one in all the foremost frequent agents of healthcare facility infections. About 5.000 patients a year within the UK died from blood infections, 1/2 them caused by drug-resistant organisms. Antimicrobial resistance may be a ticking time-bomb not just for the united kingdom however additionally for the complete world. several consultants believe that within the future all antibiotics would become useless and humanity had to refuse of taking them [1]. Even now, the numbers of recent antibiotics are reduced dramatically. Antibiotic resistance results in cases once folks get sick for an extended time, and will increase important infections. Resistant microorganisms additionally cause increasing spends of medical care as a result of as a result of keep within the clinics and this case needs treatment that's a lot of intensive. the event of recent antibacterial drug medicines supported nanoparticles is one in all the important ways in which to resolve this drawback. the primary scientific publications on the investigation influence of iron ore nanoparticles on microorganisms appeared in 1998. Reliable info regarding the organic process result of iron ore nanoparticles to bound pathogens was painted. Also, it absolutely was discovered that iron ore nanoparticles considerably increase the sensitivity of pathogens to antibacterial drug medications [2]. Action of nanoparticles and nanocapsules on microorganisms was tested before. The organic process and disinfectant effects of nanoparticles were confirmed [3-5]. moreover, AN example of finding out human erythrocytes showed that the iron ore nanoparticles altered dependably the polarizable structure of the water sector of cell microenvironment and as a result their porosity [6].

Materials and methods

Materials

Colloidal solution of magnet-controlled sorbent (MCS-B). The basis of MCS-B is magnetite nanoparticles (Fe3 O4). The size of nanoparticles is from 6 to 12 nm; the total sorption surface of NPs is from 800 to 1200 m2 /g; magnetization of saturation Is =2.15 kA/m; volume concentration q=0.00448; viscosity η=1.0112 cSt; ζ - potential=-19 mV; saline NaCl that had previously been processed by magnetite nanoparticles. Magnetite nanoparticles have been produced in Laboratory of Applied Nanotechnology of Belousova.

Research methods

The intensity of free radical peroxidation lipids (FRPL) was measured by means method of hemiluminescence for installing quantmetric equipment National Science Center "Kharkov Institute of Physics and Technology" with multi-channel photomultiplier PMT140 [7]. The studied object was placed in ther-

mostatic cuvette at 37°C, which was located at the time measurement of the photomultiplier (PMT) cathode end. The intrinsic noises of the PMT were in the range of 30-70 pulses/sec. The various kinds of hemiluminescencent reaction were used, which allowed to discover the nature of the various content oxygen products of FRPL. Chemiluminescent determination of superoxide anion radical was carried out in the luminol + bacterial medium. In a thermostatic cuvette chemiluminometer placed 1.5 ml 0.075% luminol + 0.25 ml of bacterial medium + 0.25 ml of a 0.1% solution of magnetite nanoparticles. Induction was carried out by means 0.05 ml 3% H2 O2 . Intensity of FRPL was determined at three stages: I stage - I max determined, II stage – I final, III stage – the sum of light ∑.

Conclusions

1. It was expanded the range of studying the mechanisms of the influence of physical factors of magnetite nanoparticles on microorganisms by examining the reactions intensity FRPL and bacteriostatic action.
2. It was established reliably that magnetite nanoparticles on different groups of microorganisms caused unequal intensity FRPL reaction.

It was determined that more significant factor that influenced on the ultimate indicator of the intensity of luminescence on Candida albicans, Escherichia coli and Pseudomonas aeruginosa was constant magnetic field which induced by nanoparticles. On the contrary, sorption was the most significant factor on staphylococcus aureus.