



## Complex hormonal-vitamin nanosomal preparations of argentum, zinc and copper nanoparticles for effective treatment of cows' endometritis

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Metal nanoparticles use in biology as antibacterial and tissue regeneration agents. They are components of dressings and are used as an effective factor in burns treatment. Silver nanoparticles have a toxic effect on more than 650 species of microorganisms and fungi. Thus, their use in reproductive biotechnology and veterinary practice has considerable interest in the treatment of pathologies of the reproductive system. Silver nanoparticles have low cytotoxicity and general toxicity to mammals compare to the microorganisms, which indicates their safe use in reproductive biotechnology.

Our work aimed to establish the effect of nanoparticles on biological processes for their effective use in reproductive biotechnology. We established the optimal doses of zinc and copper nanoparticles on reproductive cells. The effect of silver, zinc, and copper nanoparticles on the healing of burn wounds in rats was established. The data of the influence of intraperitoneal injections of zinc and copper nanoparticles on metabolic processes and reproductive capacity of rabbits and the toxicological effect of intravaginal administration of silver nanoparticles in rabbits were obtained. The main result of our study is the creation of effective complex hormonal-vitamin nano-preparations for the treatment of cows' purulent endometritis.

We obtained argentum, zinc, and copper nanoparticles with chitosan that have strong bactericidal properties by an improved method. No growth of any bacterial colony on Petri dishes was detected under influence of 10-fold diluted of their stock solutions. Argentum, zinc and copper nanoparticles at a concentration of 0.1 µg/ml showed bactericidal properties to the strains: *Bacillus subtilis* ATCC 31324, *Pseudomonas aeruginosa* ATCC 9027, *Candida albicans* ATCC 885-653, *Escherichia coli* ATCC 25923, *Staphylococcus aureus* ATCC 25922 and *Klebsiella pneumoniae* ATCC 2579. Argentum nanoparticles with chitosan had better antibacterial properties than nanoparticles with polyvinylpyrrolidone and copper nanoparticles were better than zinc nanoparticles. Nanosomal emulsions of nanoparticles have slightly reduced bactericidal properties compared to native nanoparticles due to the smaller contact area of particles with microorganisms. However, the concentration of nanoparticles in nanosomal preparations can successfully inactivate most pathogenic microorganisms in the uterus of cows.

The created complex hormonal-vitamin nano-preparations were tested on cows with endometritis in private farm *Barkom LLC* in Pustomyty district of Lviv region. We used current standard antibiotic shames of treatment as the control. Biochemical and hematological parameters in the dynamics of endometritis treatment were used as indicators of nanomaterials' toxic effects on the cows' bodies. We obtained great efficacy of nano-preparations in the treatment of cows' endometritis. Furthermore, complex hormonal-vitamin nano-preparations lead to effective correction of the reproductive function of animals at the pathology and have a positive effect on reproductive processes repair in comparison with the control (antibiotic treatment).

Therefore, complex hormonal-vitamin nanosomal preparations of argentum, zinc and copper nanoparticles have high efficacy in the treatment of purulent-catarrhal cows' endometritis. The high efficiency and lack of toxic effects make nanosomal preparations promising alternatives agents to antibiotics for the treatment of animal infectious diseases.