

APPLICATION OF NANOTECHNOLOGY IN THE TREATMENT AND PREVENTION OF MASTITIS IN DAIRY COWS*

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Mastitis is one of the most common and most expensive diseases of dairy cows. It can be caused by a broad spectrum of bacteria, both Gram- positive and Gram- negative, as well as pathogenic, fungi and algae. The effect of the mastitis in cow herds is the increase in the number of somatic cells, which cause losses for both producers and milk processors. Microorganisms involved in inflammation process in cows udder are often resistant for antibiotics, which are available with the most commonly used drug. These issues forced scientists to looking for new solutions in udder inflammations treatment.

Nanotechnology is currently one of the fastest growing fields of science, and the properties of nanoparticles are increasingly used in medicine, veterinary and pharmaceutical industries. Unique chemical and physical properties, as well as large surface area in relation to its volume, make nanomaterials an alternative in combating pathogens, including those causing mastitis in dairy cows. Literature data indicate more than 20 different nanoparticles of elements, whose properties allow their use in medicine and veterinary medicine, however, silver, gold and copper nanoparticles are most often used to fight pathogenic microorganisms. Moreover, nanoparticles do not effect on bacteria resistance which is currently the most crucial problem in mastitis treatment.

Nanoparticles also have toxic effect on bacteria because of formation reactive oxygen species, DNA degradation and lipids and proteins peroxidation. Gram-positive bacteria have thick peptidoglycan layer that makes them less susceptible on toxicity of silver nanoparticles comparing to Gram-negative bacteria. Gold nanoparticles change the membrane potential and activity of adenosine triphosphate synthesis (ATP) in the pathogen cell, which leads to inhibition of metabolism in pathogenic bacterial strains. Copper nanoparticles are more toxic for Gram-positive bacteria what results in damaging their cells membranes. It is connected with high amount of amine and carboxyl groups that are part of cell membranes in Gram-positive bacteria.

Currently, studies are being conducted to develop synergistic combinations of nanoparticles in mixtures that will be most effective in the treatment of various pathogens.

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