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## CHARACTERISTIC OF BACTERIOCINS PRODUCED BY LACTOBACILLI

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Antagonistic properties of lactobacilli are of great interest of the scientists all over the world and the specialists of different industries. These organisms exert antagonistic influence due to the metabolic products with antimicrobial effect among which are bacteriocins.

Bacteriocins are the antibiotic substances of protein nature with bactericidal activity against most phylogenetically related species of bacteria. They are allotted to four main classes according to their structural features, particularities and characteristics of the action. The first two groups are considered the most investigated [3].

Bacteriocins are sensitive to the action of proteolytic enzymes. They can be both primary and secondary metabolites. In accordance to it their synthesis occurs in an exponential stage or continues in the stationary growth phase. Moreover, atsydocin B is synthesized by the cells of *Lactobacillus acidophilus* M46 during the anabiosis stage. Bacteriocins are encoded by both plasmid and chromosome DNA. The biosynthesis on ribosomes in a form of prepeptide is their characteristic feature.

Very often the optimum conditions for bacterial growth (temperature, pH value) are unfavourable for maximum synthesis of antimicrobial peptides. And the other way round, stress effects (extreme temperature, pH, osmomolarity, high concentrations of sodium chloride, ethanol, oxygen) stimulate the bacteriocin production. First of all bacteriocin yield depends on a culture-producer density and it is determined by quorum sensing (QS) system.

The mechanism of QS consists, besides the autoinducer, of an ATP-binding cassette (ABC) transporter for secretion of the peptide and a two-component regulatory system (QG-TCS) for sensing of the autoinducer concentration (the histidine kinase (HPK) and the response regulator (RR)) [2].

The synthesis process of bacteriocins is regulated by own signal system of bacteria. The autoinducer is continuously produced at low level and secreted by the ABC-transporter. The latter protein is assisted by an accessory protein needed for the secretion, but of which the exact function is still unknown. When a threshold level of autoinducer concentration is reached, the histidine kinase (HK), the membrane-bound sensor part of the two-component regulatory system (QS-TCS), is auto-phosphorylated [1]. The phosphate is then transferred to the response regulator (RR), a cytoplasmic DNA-binding protein, which

subsequently activates transcription of the autoinducer structural gene, the regulatory genes and the transporter genes. During secretion, the autoinducing peptides become activated by cleavage of their leader sequences.

But at the same time producing cells exhibit specific immunity to the action of its own bacteriocins. The resistance is provided by dual mechanisms of expression of immunity proteins. The I system is determined by the genes Lan FEG, the II system is encrypted by the gene Lan I.

The I system contains specialized transport proteins. It is connected with the of bacteriocins. Thus, the gene lan F encodes the intracellular ATP; the genes lan G and lan E code the synthesis of subunits of membrane protein. In the experiments it was shown that the immunity molecular mechanism is the result of export of proteins to the membrane surface. The II system acts via specific immunity proteins that interact with the inner surface of the cell-producing membrane. This prevents adsorption of antimicrobial peptides on the surface of bacterial cells [4].

The action of bactericins on sensitive cells is determined by the formation of hydrophilic pores (channels) in the cytoplasmic membrane or embedding of positive charged screw-like formation of peptide in membrane disrupting the energy status of the cells. The inhibition of bacteria cell wall synthesis is observed more rarely.

Bacteriocins are applied as preservatives in the making of meat and dairy products, and also medical drugs to prevent bacterial infections. The wide prevalence of bacteriocin protein macromolecules in the bacteria of complex microbial communities, such as gastrointestinal tract, oral cavity and others demonstrates the regulatory role of these substances in populations of bacterial ecosystems. Bactericins influence on the formation of microbial communities. It proves the importance of selective advantage of bacteriocin-producing strains of *Lactobacillus* [1].

*1. Klaenhammer T.R*. Bacteriocin of lactic acid bacteria // Biochimie. – 1988. – Vol. 70, № 3. – P. 337–349.

*2. Klaenhammer T.R.* Genetics of bacteriocins produced by lactic acid bacteria // FEMS Microbiol. Rev. – 1993. – Vol. 12, № 1/3. – P. 39–86.

*3. Margaret A.R. et al.* Bacteriocin: Evolution, Ecology and Application // Annu. Rev. Microbiol – 2002. – Vol. 56. – P. 117–137.

*4. Nes I. F.* Biosynthesis *o*f bacteriocins in lactic acid bacteria // Antonie Van Leeuwenhoek Int. J. Gen. Mol. Microbiol. – 1996. – Vol. 70, № 2 – 4. – P. 113 – 128.