

METABOLISM OF *LACTOBACILLUS*, *BIFIDOBACTERIUM* AND *BACILLUS* PROBIOTIC STRAINS IN THE PRESENCE OF CeO₂ NANOPARTICLES IN THE CULTIVATION MEDIUM

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The use of nanotechnology products, in particular nanocrystalline cerium dioxide, in the creation of probiotic preparations could increase their effectiveness by changing the metabolic activity of probiotic microorganisms. Understanding the mechanisms of the stimulating effect of nanoparticles (NP) on microorganisms is possible only by studying their metabolic profiles. Therefore, the purpose of our work was to study the metabolic profiles of probiotic strains of microorganisms in the presence of CeO₂ nanoparticles in the culture medium.

The objects of the study were 8 strains of probiotic bacteria of *Lactobacillus*, *Bifidobacterium*, and *Bacillus* genera. Cultivation of microorganisms was carried out with the addition of different concentrations (2.5 µg/L; 25 µg/L; 250 µg/L) of CeO₂ NP. Metabolites from cell biomass were extracted with a mixture of methanol/chloroform. The qualitative composition of trimethylsilyl derivative metabolites was studied by gas chromatography-mass spectrometry on an Agilent 6890N/5973inert device ("Agilent Technologies", USA) using an HP-5MS capillary column (30 m × 0.25 mm × 0.25 µm) ("J&W Scientific", USA).

It was shown that CeO₂ NPs significantly influenced the metabolic profiles of the studied probiotic strains, changing the quantitative content of 48-82 % of the total amount of all endometabolites of the strains. A significant effect of CeO₂ NP on the synthesis of organic acids, in particular lactic, and a negative effect on the synthesis of a number of amino acids – asparagine, alanine, phenylalanine, and tyrosine – was noted. It was established that the content of lactic acid is positively correlated with the content of isoleucine, citric, and phenyllactic acids, and negatively – with valine. According to the nature of the correlation patterns, the investigated strains were divided into two groups: the first group included *L. plantarum*, *L. acidophilus*; *L. rhamnosus*, *L. casei* strains, to the second – *L. delbrueckii*, *B. animalis* strains. A feature of the second group of strains is the predominance of positive dependencies in correlation patterns. This phenomenon is probably related to the features of the primary metabolism of strains of the second group.

So, we have shown that in the presence of CeO₂ nanoparticles, the studied strains have their original patterns of metabolites. Patterns of correlation of lactic acid content with other endometabolites of probiotic strains were revealed.