EFFECT OF CERIUM DIOXIDE NANOPARTICLES ON BIOFILM FORMATION AND AUTOAGGREGATION OF *BIFIDOBACTERIUM ANIMALIS* STRAINS

Vasyliuk O., Babenko L., Kharkhota M., Kharchuk M.
D.K. Zabolotny Institute of Microbiology and Virology of the NAS of Ukraine
e-mail: olyav345@gmail.com

Bacteria of the *Bifidobacterium* genus and their metabolites play an important role in the microbiome of macroorganism under normal conditions and during infectious and inflammatory pathologies.

Autoaggregation is a process by which bacterial cells can physically interact with each other. It plays an important role in biofilm formation. In most cases, the aggregation ability is related to the adhesive properties of the cells, which also includes their ability to survive and persist in the gastrointestinal tract. Moreover, aggregation can suppress the growth of pathogenic microorganisms.

The aim of the work was to investigate the influence of cerium dioxide nanoparticles on the process of autoaggregation and biofilm formation of *Bifidobacterium animalis* VKB and *B. animalis* VKL strains.

Materials and Methods. The subjects of the study were two probiotic strains *B. animalis* VKB and *B. animalis* VKL deposited in the Ukrainian Collection of Microorganisms (IMV of the NAS of Ukraine). Autoaggregation studies of test strains were performed according to the Balakrishna method [Balakrishna A., 2013]. The ability to form biofilms was studied by determining adhesion to polystyrene microplates according to the Rode method [Rode et. al. 2007.]. Cerium dioxide nanoparticle concentrations from 2.5 μL to 250 μL per liter of Bifidum medium (Merck, Germany) were used. Cultivation of bifidobacteria was carried out in an anaerostat using GasPack (bioMerieux, France) at a temperature of 37 ^{0}C for 24-48 hours.

Results. 27 % of autoaggregation by *Bifidobacterium* genus bacteria was detected after 1-hour of cultivation, it increased each hour and reached the highest value at the fifth hour of the study. *B. animalis* VKL strain had a higher degree of autoaggregation compared to *B. animalis* VKB strain (57.1 ± 1.13 % and 54.75 ± 1.21 %, respectively).

The relationship between the increase of CeO_2 concentration and the potential of biofilm formation by *B. animalis* VKB strain was established; with an increase in the concentration of nanoparticles, the ability to form a biofilm decreases. When studying the *B. animalis* VKL strain, the opposite effect was established. Cerium nanoparticles at a concentration of 250.0 μg/L have no significant difference in effect on biofilm formation potential, while the use of 2.5 μg/L has a strong inhibitory effect on biofilm formation by this strain. Cerium dioxide nanoparticles at a concentration of 250 μl/L of culture medium had the highest effect on the process of biofilm formation.

Conclusions. The high percentage of aggregation of *B. animalis* VKL (57.1 ± 1.13 %) and *B. animalis* VKB (54.75 ± 1.21 %) strains will increase their adhesive activity and contribute to their survival in the gastrointestinal tract. Cerium dioxide nanoparticles at a concentration of 250 μl/L of culture medium had the highest effect on the process of biofilm formation by *B. animalis* strains.