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**INTERNATIONAL MEETING**

# CLUSTERS AND NANOSTRUCTURED MATERIALS (CNM-6)

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The materials represent the contents of meeting's reports based on the results of fundamental and applied works on topical questions in the field of nanostructured systems, nanomaterials and nanotechnologies. Main attention is given to the consideration of problems of nanophysics and nanoelectronics, to atomic and electronic structure of cluster and nanostructured materials, amorphous alloys, nanostructured films and coatings, colloidal and biofunctioal materials, to study of their properties. The results of investigations in the field of supramolecular chemistry, synthesis of nanoparticles, nanostructores and multifunctional nanomaterials, physico-chemistry of superficial phenomena and diagnostics of nanosystems are presented.

The edition is designed for scientists, engineers, higher school lecturers, post-graduates and students of corresponding specialities.

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# PROBIOTIC LACTOBACTERIA FOR CREATION OF SELENIUM CONTAINING DIETARY SUPPLEMENT

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In recent years, it has been found that 100 million people worldwide suffer from selenium deficiency [1]. Lactic acid bacteria had proven to bind metal ions and metalloids like other microorganisms to their cells or transport and store them inside the cell [2,3].

Bacterial strains of Lactobacillus are capable of biotransformation of inorganic Se into organic forms [4,5].

According to Xia et al. [6,7] and Diowksz et al. [8] *Lactobacillus plantarum* and *L. bulgaricus* deposit elemental selenium via cell detoxification Se 4+. The creation of selenium-containing probiotic supplements is due to the trace element Se is involved in the biosynthesis of twenty-five selenoproteins, which regulate the optimal immune response of the body.

Selenium is associated with the metabolic processes of vitamins (E, C, A) and carotenoids, it plays an important role in iodine metabolism, affects the body's immune responses. Selenium is a component of glutathione peroxidase [9], thyroid reductase [10] and selenocysteine of the 21st amino acid, which is involved in the biosynthesis of cysteine (Cys) and redox reactions: humans, animals, birds and bacteria.

The aim of the study was to select probiotic strains of *Lactobacillus* are capable of biotransformation of sodium selenite into nanoselen formation to create probiotic selenium containing dietary supplement for birds.

Two strains of *Lactobacillus casei* IMB B-7280 and *L.plantarum* IMB B-7679, which are capable of transforming sodium selenite, were selected from the collection of probiotic cultures of the Department of Interferon and Immunomodulators. The selection of these strains of lactobacilli as producers of biogenic Nano-Se is due to their ability to transform sodium selenite and their ability to inhibit the reproduction of pathogenic and opportunistic microorganisms, increase the immune responses of the organism and their belonging to the category of Generally Recognized As Safe microorganisms.

Bacteria were cultured in liquid pH medium Broth (Conda) low pH, at a temperature of 30 $^0$C for 48 h aerobically in the absence and presence of different doses of sodium selenite.

Cultivation of cultures in the presence of Na2SeO3 was accompanied by a change in the color of the medium to a reddish-brown color, which according to [11] was a characteristic feature of the formation of biogenic nanoselen (Nano-Se). Growth in the presence of Na2SeO3 at low concentrations did not affect the change in morphology and culture properties of *L. plantarum* IMB B-7679. At the same time, enrichment of the culture medium of *L. casei* IIB B-7280 with sodium selenite was accompanied by a decrease in the viability of the culture.

According to the obtained data, the optimal conditions for the enrichment culture media with Na2SeO3 in order to determine ability of *L. plantarum* IMB B-7679 and *L. casei* IMB B-7280 to produce Nano-Se were obtained.

The formation of biogenic Nano-Se was confirmed by Transmission electron microscopy (TEM) using an electron microscope JEM-1400 (Japan). Both experimental strains showed the ability to reduce Se 4+ with the formation of different sized biogenic Nano-Se. High tolerance of *L.plantarum* IMB B-7679 to significant concentrations of Na2SeO3 and synthesis of more homogeneous Nano-Se in size were established. Synthesized Nano-Se is known to be one of less toxic form of selenium than toxicity of sodium selenite with high bioavailability.

However, the size of the spherical selenium nanoparticles formed by lactobacilli was more than 100 nm. Such Nano-Se particles are called Lactomicroselenium Particles or lactomicroSel.

Culture media of *L. plantarum* IMB B-7679 were enriched with Na2SeO3 in order to determine capacity rapid formation of nanospheres with a percentage deviation from the average size of 5-20%.

The high tolerance of *L.plantarum* IMB B-7679 to Na2SeO3 and the formation of Nano-Se advised us to use the abbreviation (parts per million), ie the concentration of Se in ppm to unify the results and compare them with the literature data. It is advisable to enrich the culture medium for Bacterial strains of Lactobacillus with sodium selenite in the range of concentrations based on Se concentrations, according to the norms of the European Food Safety Authority [12].

The ability of *L.casei* IIB B-7280 and *L.plantarum* IMB B-7679 to transform sodium selenite for synthesizing Nano-Se and other organic Se compounds which are suitable for making food additives makes it possible to consider Bacterial strains of Lactobacillus as a cheap source of organic Se and Nano-Se.


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Наукове видання

**МАТЕРІАЛИ 6-ї МІЖНАРОДНОЇ КОНФЕРЕНЦІЇ**
**«КЛАСТЕРНІ ТА НАНОСТРУКТУРНІ МАТЕРІАЛИ »**

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Наведено основний зміст доповідей за результатами фундаментальних та прикладних науково-дослідних робот з актуальних питань в області наноструктурних систем, наноматеріалів та нанотехнологій. Головну увагу приділено розгляду проблем нанофізики та наноелектроніки, електронній і атомній будові кластерних та наноструктурних матеріалів, аморфних сплавів, апатитоподібних біосистем, колоїдних нанорозмірних систем, наноструктурних плівок та покриттів, дослідженню їх фізико-хімічних властивостей. Представлено результати досліджень в області фізико-хімії поверхневих явищ, супрамолекулярної хімії, синтезу наночастинок, наноструктур і багатофункціональних наноструктурних матеріалів. Відображено особливості діагностики наносистем.

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