DETERMINING THE INFLUENCE OF THE NANOPARTICLES ON THE GROWTH AND GENERATION OF LACTIC ACID BACTERIA

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Abstract

Nanotechnology "nano" (from the Greek. Seq. "Dwarf") is used in the terminology to describe longitudinal units equal to one billionth of from 1m (1nm = 10^{-9}m).

Nanotechnology, nanoscience, the science and technology of colloidal systems, colloid chemistry, colloid physics, molecular biology, all microelectronics, the fundamental differences between colloidal systems, which include: clouds, human blood, DNA and proteins, transistors, which they are going to microprocessors, is that the surface of these particles or molecules in the vast millions of times greater than the volume of the particles, such particles occupy an intermediate position between the true homogeneous solutions, alloys, and ordinary objects macrocosm. The behavior of such systems is very different from the behavior of true solutions and melts and macrocosm of the objects through the high surface usually such effects begin to play a significant role when the particle size is in the range of 1-200 nanometers, hence it word substitution colloidal physics, chemistry, biology on nanoscience and nanotechnology, meaning the size of the objects in question.

Keywords: *nanotechnology, nanoparticles, lactic acid bacteria*

The current trend toward miniaturization has shown, if we take a very small part of the substance that the substance may have completely new properties. Particle with size of 1 to 100 nm are usually called "nanoparticles". For example, it was found that nanoparticles of some materials have very good catalytic and adsorption properties. Carefully purified nanoparticles can be built in very specific structure. This structure contains a strictly ordered nanoparticles and often exhibit unusual properties.

As is well known, the last few years have started studies of nanoparticles of some elements in the form of mineral salts in the composition of fertilizers for crop production. For example, nanoparticles of magnesium in plant plays an important role, i.e., cover a requirement to magnesium in plant growing period. Magnesium is an essential component of chlorophyll molecules. Magnesium deficiency in plants presented by chlorosis.

Nowadays there develop projects for the creation and improvement of nutritional supplements, getting oil from nanoadditives, which prevent entry of cholesterol to the blood of mammals.

Currently in animal breeding successfully used silver nanoparticles in filters and in other details of dairy processing equipment for the inhibition of fermentation processes and the souring of milk. Nanoparticles of iron and other micronutrients include the premix composition for increasing the viability and productivity of animals. Nanotechnology is used in packaging and storage of food. Overall molecular biology can be called nanotechnology.

In biotechnology nanoparticles used in the form of mineral salts to increase the number of cells of lactic acid bacteria in milk.

In this regard, we are confronted with the task looking in biotechnology to determine the effect of nanoparticles of magnesium, iron and zinc on the viability of lactic acid bacteria *Lactobacillus bulgaricus 018ch-1*.

Lb.bulgaricus 018k-3, isolated from the three-day kumys (Almaty region Kegen District, 2012), is a straight rods with rounded ends, are usually alone, sometimes forming short chains of size 4,0-4,6 x 0,9 m. Gram-positive, catalase-negative, fixed, asporogenic. Macro colonies on agar slightly raised with a rough edge, oily texture, surface of colonies smooth, shiny, white in color with a bluish tinge, nontransparent. Deep colonies are smooth, in the form of pieces of cotton wool, white. Grows well in the hydrolyzed milk, whey, MRS, wort medium and agar media. Microaerophile, facultative anaerobic. Minimal growth is in 20^0 C, the best - 39-41^0 C, maximum -53^0 C.

Gelatin is not diluted. Acidify the milk to form a clot with delectable flavor and smell. Coagulated skim milk for 15 hours. Active acidity is 142˚T. Limiting acidity 275˚T. Growth in meat-peptone broth at pH 8,3 is not observed. In hydrolyzed milk 2 and 4% content NaCl and 20, 40% content bile grows well. In skim milk containing up to 0.4% phenol growth is good.

Growth in the synthetic medium with mineral nitrogen is good. Does not grow on the potato medium. Acidifying the medium gas without glucose, lactose, galactose, fructose. Raffinose slightly fermented. Sucrose, arabinose, salicin, mannitol, sorbitol, xylose, starch, glycerol does not use. Regarding test bacteria (Sarcina, Bac.mycoides, St.aureus, E.coli, Proteus, Diplococcus, Salmonella) has antagonistic activity (suppression zone up to 14 mm). Highly adhesive. By the third generation antibiotics slightly sensitive. Phage-resistant (Figure 8).

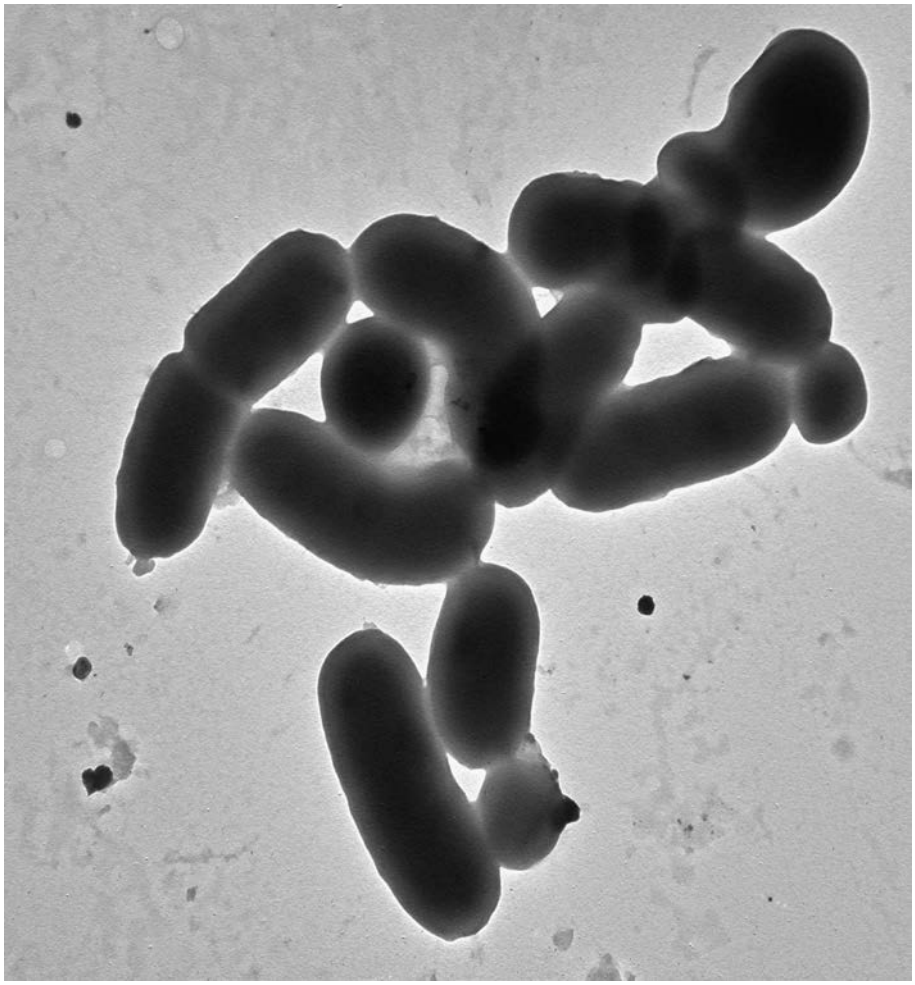


Figure 1. Strain *Lb.bulgaricus, 018k-3* (on electron microscope). Zooming 2000 times.

In order to study comparative effects of the nanoparticles strain Lb.bulgaricus, 018k-3 were cultured in a hydrolyzed milk agar medium with nanoparticles of magnesium, iron, zinc, in three different concentrations, 0.01%, 0.005%, 0.0025%, and as in the original environment control without nanoparticles with subsequent counting of the number of colonies (Table 1).

Table 1. Effect of culture medium with the addition of nanoparticles of magnesium, iron and zinc on the growth of cultures Lactobacillus bulgaricus 018ch-1

AHM with NP magnesium, %	The number of CFU cultures	AHM with NP iron, %	The number of CFU cultures	AHM with NP zinc, %	The number of CFU cultures	Control the number of CFU cultures on AHM without NP
0,01	$833x10^8$	0,01	$851x10^8$	0,01	$803x10^8$	$396x10^8$
0,005	$570x10^8$	0,005	$510x10^8$	0,005	$521x10^8$	
0,0025	$280x10^8$	0,0025	$280x10^8$	0,0025	$270x10^8$	
Note: AHM- agarized hydrolyzed milk; NP-nanoparticles.						

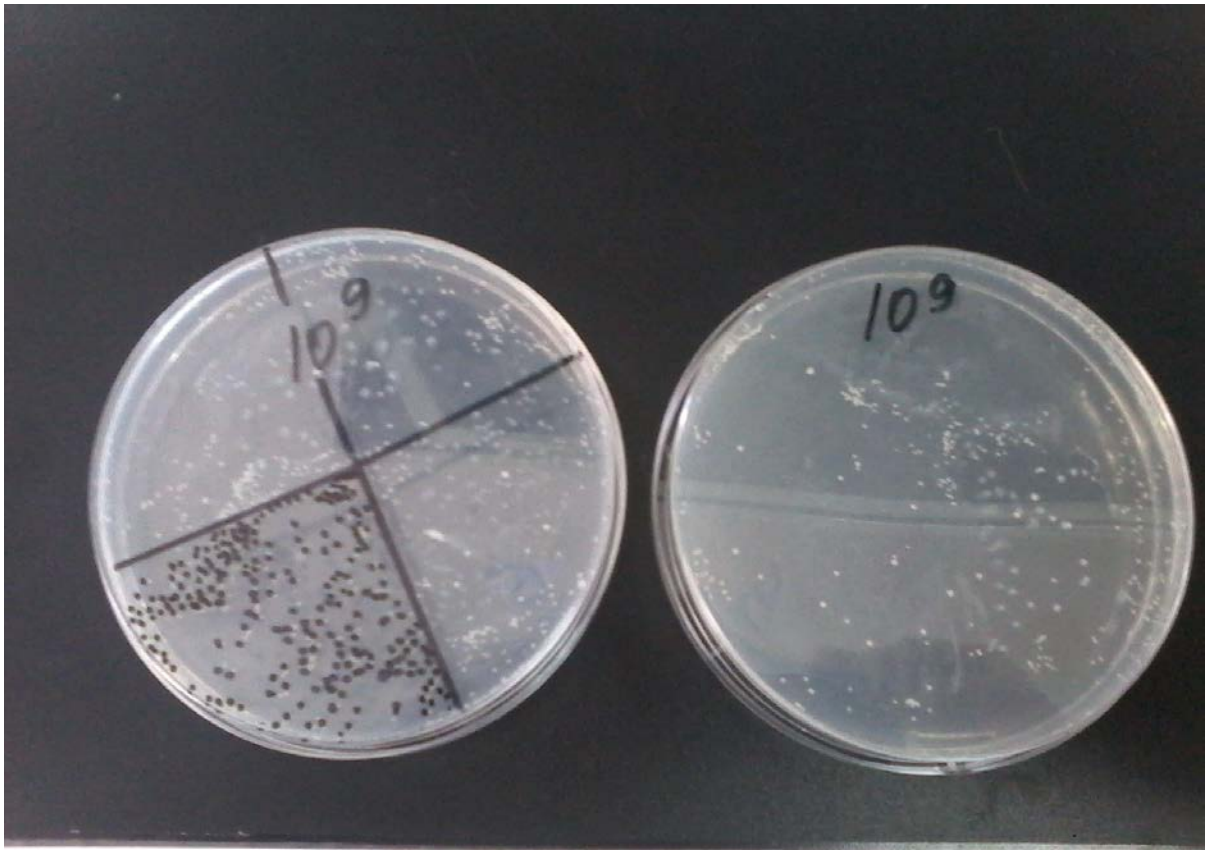


Figure 2. Colonies of strain *Lactobacillus bulgaricus 018ch-1* (in left on medium MHM with nanoparticles iron, on the right on the source medium MHM)

As a result of studies have shown that the tested nanoparticles have a positive effect on the growth of lactic acid bacteria cultures. The growth of lactic acid bacteria colonies on the agar medium hydrolyzed milk with all nanoparticles superior control almost 2 times. It should be noted maximal stimulatory effect of iron nanoparticles, as the number of CFU (colony forming units) in the medium of cultures with AHM nanoparticle iron concentration was 0.01% in average $851x10^8$ CFU versus CFU $396x10^8$ control, whereas the nanoparticles in media in concentrations 0 01% of magnesium and zinc the number of CFU was $833x10^8$ and $803x10^8$ respectively.

The results indicate that the nanoparticles of magnesium, iron and zinc in a concentration of 0.01% activated growth and development of the strain *Lactobacillus bulgaricus 018ch-1*.

One of the important properties of industrial - value strains is a their antagonistic activity against patogen.

Therefore, our work has been done to study the antagonistic properties of the strain *Lactobacillus bulgaricus 018ch-1* on the 12 test cultures. As a test cultures were used strains of *Sarcina flava, Bac. mycoides, St.aureus E. Coli Proteus vulgaris D. septicus S.choleraesuis, sht.177 S. abortus equi, sht.841 S.abortus ovis S. typhimurium S. dublin S. gallinarum.*

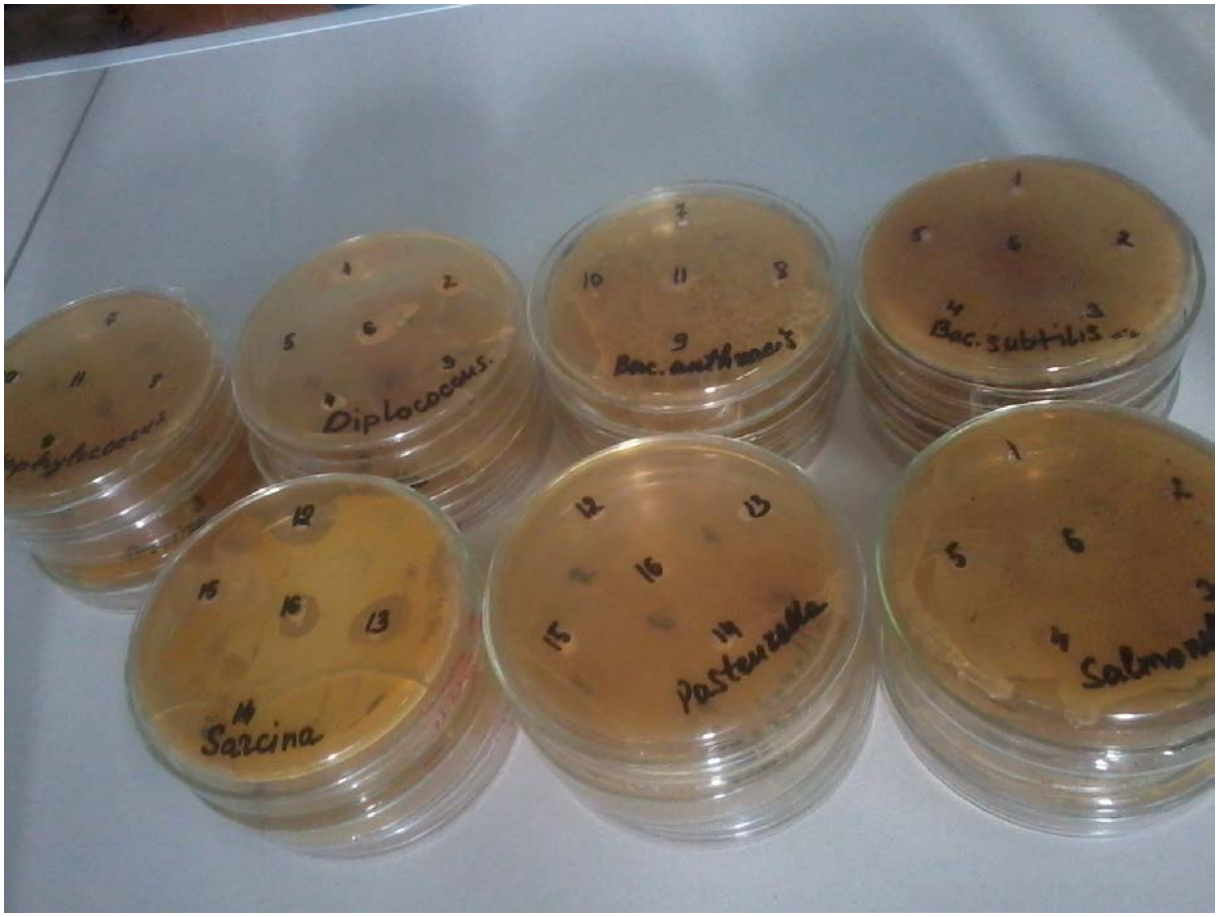


Figure 3. The antagonistic activity of the strain *Lactobacillus bulgaricus 018ch-1*

To determine the influence of the nanoparticles on the antagonistic activity of the strain *Lactobacillus bulgaricus 018ch-1* in culture medium were injected nanoparticles of magnesium, iron and zinc in a concentration of 0.01%.

The result revealed positive influence of the nanoparticles of magnesium, iron and zinc on the antagonistic activity of the test strain. The results are shown in Figures 4, 5, 6.

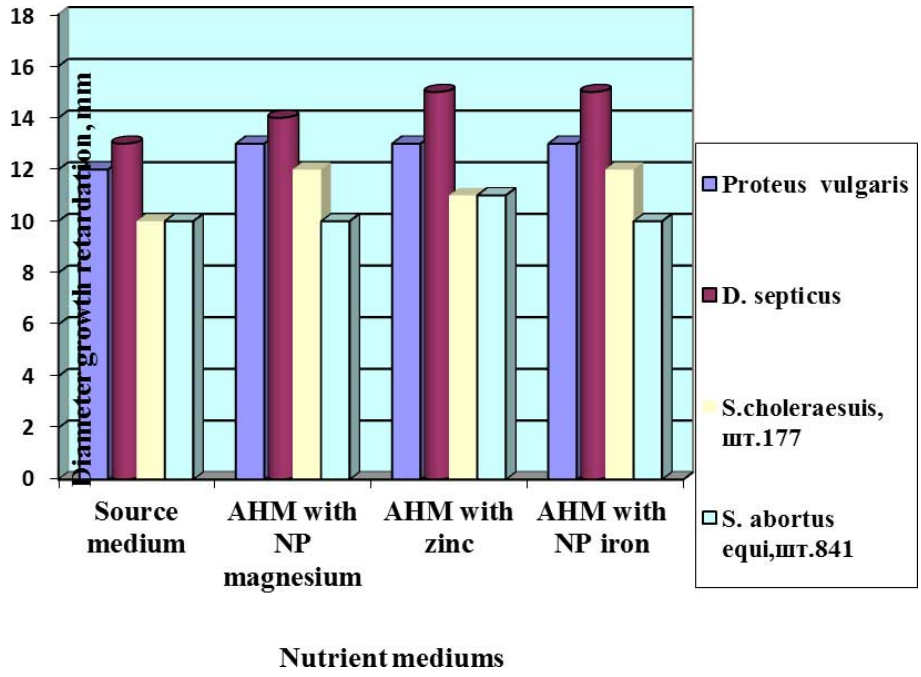


Figure 4

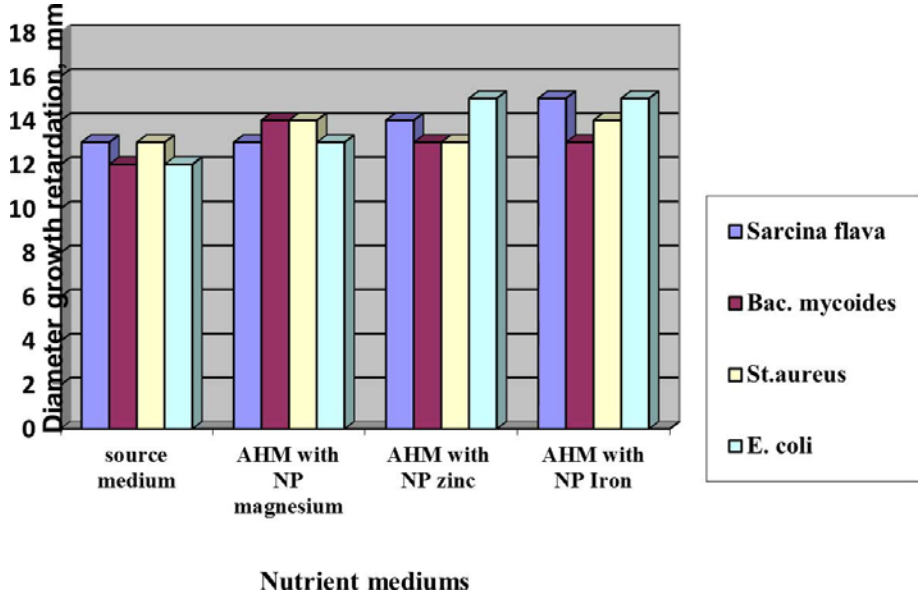


Figure 5

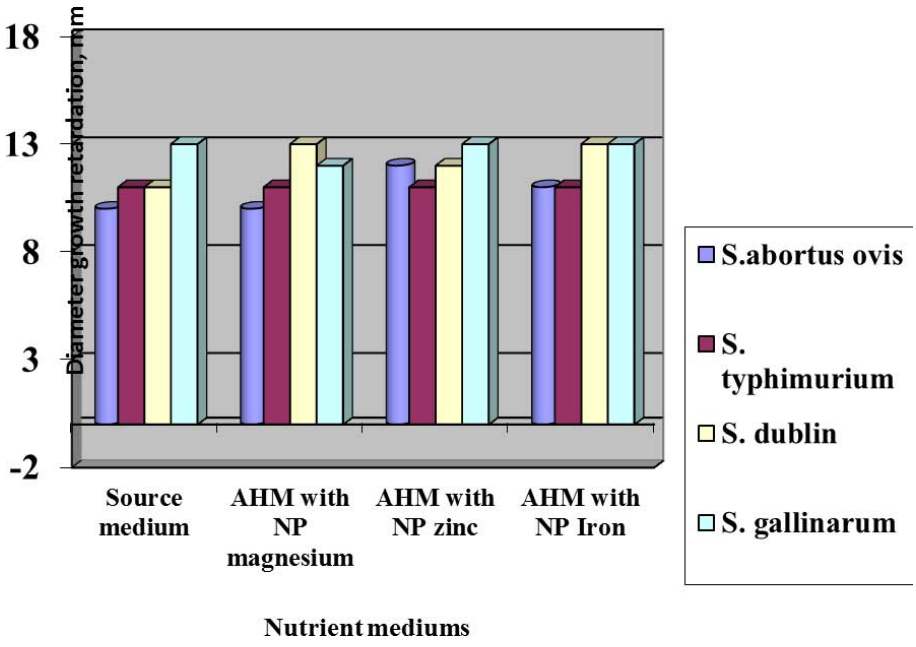


Figure 6

Figure 4, 5, 6 - The results of the comparative evaluation of antagonistic activity of a strain of *Lactobacillus bulgaricus 018ch-1*.

CONCLUSION

Area stunting studied opportunistic pathogens and cultures was 10-16 mm. The high antagonistic activity of *Lactobacillus bulgaricus 018ch-1* as the relative gram-negative and gram-positive bacteria, especially *Escherichia coli, Diplocococcus septicus, Sarcina flava.*

Addition to the culture medium of nanoparticles of magnesium, iron and zinc in a concentration of 0.01%, not only soohranyalo antagonistic activity against pathogenic and conditionally patogen microorganisms, but in some cases, increased it.

The most antagonistic activity of the strain *Lactobacillus bulgaricus 018ch-1.L*. used in relation to the test cultures observed when added to the medium size iron nanoparticles in a concentration of 0.01%, which is consistent with the data obtained in determining the effects of nanoparticles on the growth and propagation of the microorganism strain.

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