



Bionanoferm Ltd.

Bionanoferm Research and Development Ltd. • 4032 Debrecen, Egyetem tér 1. • Tax. reg. No.: 14401497-2-09; HU14401497
Trade register No.: 09-09-015339 • Account No.: 60600163-11044901-00000000

Nanotechnology in practice

Bionanoferm Ltd. is a spin-off enterprise established for the purpose of utilizing a new technology developed as a co-operation project by the University of Debrecen and Dr. Aliment Ltd. The invention is a fermentation procedure that makes it possible to produce high-purity red and grey elementary selenium nanospheres with the help of microorganisms used in the food industry. The size and crystal form of the nano sized (50-500 nm) and spherical granules is characteristic of and determined by the organism selected. This genetic determination results in an easily reproducible production procedure and a material of a special character that can be utilized in several fields of industry and research.

Selenium is an essential microelement with an antioxidant effect, and is a constituent of numerous enzymes. In Hungary it would be especially important to increase the selenium content of food and feed, since the soil in most parts of the country has a deficient level of selenium. A diet rich in selenium decreases the occurrence of oncological diseases by 30-50%.

Selenium forms different chemical compounds, each of which has a different degree of effect, or can even be toxic in bigger quantities. Therefore, it is relevant which compound of selenium will be put into food, and which compound is produced in the course of the production process. According to general knowledge the greatest risk lies in overdosing water-soluble inorganic selenium salts, and previously we used to assume that it is organic selenium, seleno-methionine and seleno-cysteine that are the most suitable

compounds for increasing the selenium content of food and feed. It is also known that from among the numerous forms of selenium it is elementary selenium has the lowest toxicity.

In the course of our experiments we examined how probiotic yoghurt bacteria transform inorganic selenium compounds to organic compounds. At the same time researchers' curiosity lead us to investigate what kind of an effect overdosing inorganic selenium compounds has on bacteria. We experienced it with the delight of discovery that certain bacteria protect themselves against the effects of a quantity of selenium salts that would be toxic for them in a way, that they produce elementary selenium within the cell at the end of a reaction process mostly unknown until then. The elementary selenium is stored in the form of small, nano sized globules.

The nano particles produced by the bacteria can be retrieved and used as a basic component of comestibles, fodder and medicine.

The size of globules produced was between 100 and 500 nanometres, depending on the breed of bacteria; as regards the shape and size of the globules, a homogenous grain-size distribution is characteristic of the given breed of bacteria. The procedure formulated is a fundamental innovation and is a solution for producing nano particles at an industrial scale.

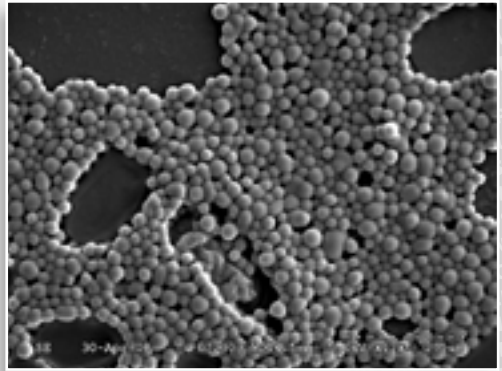


In the course of the fermentation process the clear nutrient solution becomes red from the nano selenium produced by the proliferating bacteria

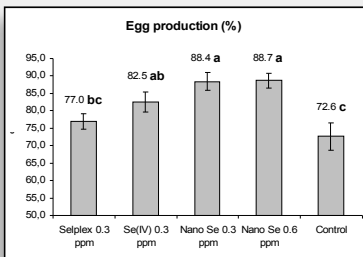
A uniform size and shape and the spherical form are advantageous for microelectronic and pharmaceutical technologies, and promise a unique behaviour as a constituent of comestibles and fodder as well. Fermentation procedure, the technology developed with the help of probiotic bacteria, that are used in the food industry for producing yoghurt among other things, opens the way to an industrial production of nano particles, owing to its low cost and simplicity.

Encouraged by the success at the project competition of ValDeal PLC, the University of Debrecen and Dr. Alimont Ltd. together with the inventors have established Bionanoferm Ltd., a spin-off enterprise for the purpose of producing nano selenium and researching the utilization possibilities of nano selenium. Bionanoferm Ltd. has already started producing nano particles and researching their utilization possibilities.

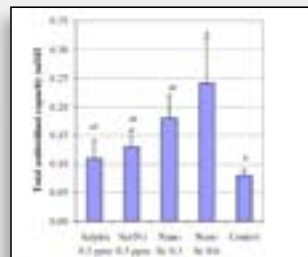
We have verified it with animal tests carried out on quails, chickens and fish that nano selenium has a significantly greater antioxidant effect than other forms of selenium used before, and it is the product with the most spectacular effect on the health of the animals. We carried out experiments for examining the presumed cancerocidal effect of selenium nano globules on cell cultures, and started the development and inspection of comestibles containing nano selenium as well.



Electron micrograph of selenium nano globules with a diameter of 250 nm



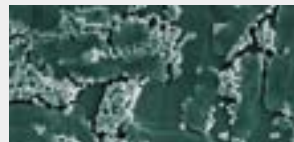
Egg production of quails
(number of eggs / 100 quails / day)



Antioxidant intensity in the blood
of chickens

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A projekt a Nemzeti Kutatási és Technológiai Hivatal támogatásával valósult meg.