Nanocomposites and nanomaterials

Synthesis of silver nanoparticles using lactic acid bacteria

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Biological methods of nanoparticle synthesis using microorganisms have offered a reliable, eco-friendly alternative to chemical and physical methods [1].

A total of 22 of *Lactobacillus* strains, isolated from different ecological niches, were screened for their capability towards production of silver nanoparticles. Only ten strains had the potential to reduce the silver ions to silver nanoparticles. The colorless bacterial biomass changed to yellowish brown color after incubation with 1 mM aqueous $AgNO_3$ solution suggested the formation of silver nanoparticles. A typical silver nanoparticles absorption band in the visible region was obtained with plasmon peak at 420 nm.

In most cases Ag nanoparticles had a diameter between 10 and 40 nm (89.6%), whereas 0.7 % of Ag nanoparticles had a diameter smaller than 10 nm and 9.7% of nanoparticles were greater than 40 nm. The silver nanoparticles produced by strains *L. rhamnosus* CCM 1825^T and *L. plantarum* 92T had the smallest mean particle size, 19.21 and 19.92, respectively. The largest size nanoparticles were synthesized by strain *L. acidophilus* ncs (36.99 nm). The most narrow size distribution was in case of strains *L. plantarum* 92T and *L. fermentum* CCM 7192^T. At the same time, the mean particles size was species dependent.

Thereby, the components produced by these strains and causing the sorption and reduction of silver ions to silver nanoparticles are most likely associated with the cell surface of bacterial cells. About this may indicate the location of Ag nanoparticles on the surface of cells, preferably in the capsular layer.

The difference in the ability to reduce the silver ions and nanoparticles size may be due to differences in the cell wall and capsule composition of these *Lactobacillus* strains [2]. The results obtained are the basis for future research in order to understand how to controls shape and size of nanoparticles.

1. *Narayanan K. B., Sakthivel N.* Biological synthesis of metal nanoparticles by microbes // Adv Colloid Interface Sci.-2010.-**156.- P.** 1-13.
2. *Schär-Zammaretti P, Ubbink J.* The Cell Wall of Lactic Acid Bacteria: Surface Constituents and Macromolecular Conformations // Biophys J.-2003.-**85.-** P. 4076-4092.