Abstract

Preparations containing probiotic strains of bacteria have a beneficial effect on human health. The results of clinical trials show the positive effects of taking probiotics on diseases of the gastrointestinal tract, including irritable bowel syndrome, diarrhea, enteritis, and allergic conditions, such as atopic dermatitis. Probiotics have also been shown to increase the body's immune resistance through immunomodulation. This translates into an increased interest in methods for both preservation and assessment of microorganisms.

The aim of this research was to analyze the physiological and morphological analysis of probiotic microorganisms after fluid bed drying using imaging flow cytometry, cell sorting, and machine learning. These methods allow to take into account also the subpopulations of cells with intermediate metabolic activity and cellular membrane damage in addition to subpopulations of living and dead cells. Additionally, the study also assessed the impact of exposure to sublethal stresses during culturing of probiotic bacteria on their viability during drying, long-term storage and *in vitro* simulated digestion, as well as their adhesion to the intestinal epithelium. It was proven that the degree of cell membrane damage significantly affects the adhesion ability of probiotic bacteria. It was also found that the use of stress conditions during bacterial cultivation allows for increased cell survival in the probiotic preparation during its drying and storage. The durability of the preparation during long-term storage was also influenced by factors such as the use of a protective substance during coating and storage conditions (temperature, presence of oxygen). A simulation of the production process of probiotic preparations using fluid bed drying was also prepared, along with an economic analysis and risk assessment of the project on an industrial scale.

Keywords: lactic acid bacteria, viability, adhesion, digestion, technological process

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