

**MECHANICAL AND CHEMICAL PROCESSES DURING  
THE DEVELOPMENT OF CRYOGENIC TECHNOLOGY  
OF NANOPOWDERS FROM TOPINAMBUR WITH PREBIOTIC PROPERTIES**

One of the promising areas of deep processing of raw materials, which is developing in various industries to day (chemical, metallurgical, technology, textile, etc.) is the direction, based on a study of mechanical and chemical processes — chemical transformations of materials (ingredients) that are influenced by fine-dispersed mechanical grinding, and give the opportunity to obtain nanopowders and complete products of new quality. In the Food Industry mechanical and chemical processes during the processing of herbal raw materials and obtaining of fine-dispersed powders were not practically studied and mechanisms of impact of mechanical chemistry to preservation and transformation of biologically active substances (BAS), biopolymers during their reception were not discovered.

This scientific work is devoted to studying of mechanical chemistry during the development of cryogenic technology of fine-dispersed prebiotic additives in the nanopowders form from topinambur, 80% of carbohydrates of which are presented by prebiotic inulin. The cryogenic treatment of raw materials with the use of liquid and gaseous nitrogen, which includes cryogenic «shock» freezing, freeze-drying, low-temperature fine-dispersed grinding were used as an innovation. Complex using of these processes leads to more complete (1,8...2,3 times) extraction of BAS from raw materials and obtaining of additives from topinambur with a record containing of water-soluble forms of biopolymers (45...55%), particularly, polysaccharide inulin, which is transformed into fructose and fructooligosaccharides and soluble forms of protein—free  $\alpha$ -aminoacids and simple peptides. The main goal during the development of cryogenic technology of nanopowders with the use of deep processing of raw materials, including cryogenic «shock» freezing and fine-dispersed grinding, was to increase the degree of extraction from raw materials of hidden (connected with the biopolymers) forms of low-molecular BAS into the free state, transform polysaccharides, oligosaccharides and proteins into the soluble form due to mechanical chemistry, mechanical destruction and cryolysis. It is established that fine-dispersed powders from topinambur have prebiotic properties due to chemical composition, content of BAS, dispersed composition and exceeded the known world analogues. In addition, most of the substances of powders are in the nanoscale form. Thus, in soluble biopolymers (proteins, inulin, cellulose, etc.) are transformed half into a soluble form till separate monomers (fructose, free  $\alpha$ -amino-acids, glucose) molecules size of which is 0,8...1 nm. In addition, the size of low BAS such as L-ascorbic acid, phenolic compounds is 1,1...1,2 nm.

**KEY WORDS:** *cryogenic technology, mechanical and chemical processes, nanopowders from topinambur, prebiotics*