**STRUCTURAL AND THERMODYNAMIC ASPECTS IN THE DESIGN OF THE COMPOSITE INGREDIENTS BASED ON FOOD BIOPOLYMERS AND BIOACTIVE LIPIDS**

DV Zelikina, AS Antipova, TA Misharina, NP Palmina, NG Bogdanova, VI Binyukov, VV Kasparov, EI Martirosova, MG Semenova

*N. M. Emanuel Institute of Biochemical Physics of Russian Academy of Sciences, Kosygin str. 4, 119334 Moscow, Russian Federation*

Composite ingredients based on food-grade biopolymers (covalent conjugates of sodium caseinate with potato maltodextrins (DE = 2 and 10)) and bioactive lipids in different combinations (soy phosphatidylcholine or lysophosphatidylcholine with triglycerides of flaxseed oil, alfa-linolenic and linoleic fatty acids) were developed in the absence and presence of plant antioxidants for the enrichment of the low-fat food by the adequate amount of omega-3 and omega-6 polyunsaturated fatty acids (PUFAs). The high levels (> 95%) of the encapsulation of the lipids by the covalent conjugates were found in their complexes at the specific biopolymer : bioactive lipid weight ratio (10 : 1). These supramolecular particles were studied by the combination of such physico-chemical methods like: (i) a static and dynamic laser light scattering for the determination of the structural (weight-averaged molar mass, *Mw*, the radius of gyration, *RG*, the hydrodynamic radius, *Rh*, the density, *d*, the architecture, *ρ*) and the thermodynamic parameters (that are the second virial coefficient, *A2*, and the chemical potentials of the complex particles) in an aqueous medium (at pH=7.0, I = 0.001M); (ii) an atomic force microscopy for the visual determination of the structural parameters (cross-section area, volume, height) both the pure and loaded by PUFAs phospholipid liposomes as well as the complex particles; (iii) the electrophoretic mobility of the studied particles for the zeta potential measurements; (iv) an electron spin-resonance spectroscopy (ESRS) for the estimation of the microviscosity of the bilayers of the pure and loaded by PUFAs phospholipid liposomes both pure and encapsulated by the biopolymers; (iv) a gas-liquid chromatography for the estimation of the antioxidant activity of the plant antioxidants relative to the PUFAs; (v) and spectrophotometry for the estimation of the extent of the PUFAs oxidation. According to the data obtained the molecular mechanisms underlying the formation and functionality (such as the high level of the solubility in an aqueous medium and the prolonged stability of the PUFAs against oxidation) of the formed composite ingredients were suggested and discussed.

This work was financially supported by the Russian Scientific Foundation (Grant 14-16-00102) and VI Binyukov and VV Kasparov were supported financially by the Federal Agency of the Scientific organizations in their kind assistance in conducting measurements using AFM, and ESRS in the IBPC Centers of the collective use of scientific equipment, respectively.