



Fund “Nauka” Project № 15005 Resume

“Creation of infrastructure for controlled concentration of biologically active substances from natural products”

Project leader: Prof. Bistra Galunska, PhD

Researchers from MU-Varna have extensive experimental experience regarding the role of medicinal plants extracts and fruit juices in various diseases. Their effects were monitored both in experimental models on cell cultures and experimental animals, and in a clinical settings in patients with hypertension and metabolic diseases.

The problem with the use of medicinal plants teas, infusions or juices as an adjunct to the main therapy is the deviation in the concentration of individual biologically active substances (BAS) in different batches, which cannot be controlled.

The project is dedicated to the purchase of a high-tech system for concentration of samples on water and non-water basis, allowing work with different relatively small volumes of plant extracts or juices in order to achieve optimal ratio of BAS, good taste and the necessary composition and concentration of BAS. Concentrates have higher penetration, faster effect, they can be more precisely dosed, and are easier to store and intake. On the other hand, they have a higher efficiency than lyophilized products, as they retain the useful ratios of BAS and their biological activity.

The current development is a priority for MU-Varna and reflects a new direction in the key priority – „Food and Nutrition“. It represents a new step in the development activity, joining the efforts of teachers and students from all faculties in order to implement the scientific achievements in practice. It is a joint development of the Department of Pharmaceutical Technology, the Department of Biochemistry, Molecular Medicine and Nutrigenomics, the Department of Ophthalmology and Visual Sciences. A member of the research team of the project is also the Vice Rector for Innovation and Translational Medicine, Prof. Christina Grupcheva, MD, PhD, DSc.

Objective: Development of a methodology for obtaining concentrates from natural products of plant origin and their application as food additives in human medicine.

The **methodology** is innovative and is based on sample concentration technology, ensuring rapid evaporation of the solution at low temperature under vacuum and ensuring the preservation of all BAS in the sample. Technically, it combines vacuum centrifugation and precisely controlled heating of the sample in a stream of moist air at low temperature, which makes the device extremely convenient for working with biological samples, extracts from natural products containing biologically active substances sensitive to high temperatures.

Specialized software controls the two main factors for solvent evaporation - temperature and pressure, which achieves a constant concentration of BAS in the sample with minimal loss and contamination.

The vacuum concentrator is fully automated, allows monitoring of the process during operation, has excellent reproducibility of the results and ensures safe operation with volatile organic solvents. It has the capacity to simultaneously concentrate or obtain a dry residue both from a large sample volume (2700 ml, 6 containers of 450 ml) and for working with small volumes (1 ml, 2 ml, 15 ml). The apparatus is also very convenient for sample preparation for chromatographic analysis, as it allows the sample to be concentrated or evaporated directly in the container of the sample injection module.

The **implementation** of the project includes conducting a series of experiments for obtaining concentrates of chokeberry fruit juice from different producers in Bulgaria and of elderberries with constant qualitative and quantitative composition, which contain optimal BAS in terms of concentration and ratio. Such a concentrate could be packed in ampoules and applied easily and conveniently as adjunctive therapy in many fields of medicine.

Perspectives: The purchase of the concentration apparatus is the first important step in the construction of a high-tech structure for complete analysis of biologically active substances in extracts and juices from natural products. This allows expanding the research work of young scientists from MU-Varna, concerning the biological effects of infusions and extracts of medicinal plants such as smoke tree (*Cotinus coggygria*) leaves, Agrimonia eupatoria, as well as fruit juices of elderberry, chokeberry and others. The availability of such infrastructure makes possible to study the effects of concentrates of natural products rich in polyphenols and anthocyanins at organism level, in patients with diabetic retinopathy, macular edema and others as well as for making decisions for inclusion such concentrated natural products extracts as supplements to the basic therapy.

Areas of application of the concentrating system:

- research of natural products (fractionation, purification, concentration, extraction of functional molecules from natural products)
- extraction and purification of DNA or proteins for the purposes of genomic and proteomic analysis
- storage of biological and non-biological samples in concentrated form without loss of activity
- sample preparation for different types of chromatographic analyzes (HPLC, UPLC, SFC, flash chromatography, etc.)
- research on the composition and safety of food, functional foods, alcoholic and soft drinks.