



## **Fund “Nauka” Project № 21001 Resume – Competition-Based Session 2021:**

**“Development of a green phycocyanin manufacturing process from *Spirulina* with potential applications in pharmacy and food technology”**

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The increased content of biologically active substances, the high productivity in cultivation and assimilation in the human body define the freshwater micro algae as the food of the future. Of great importance for the pharmacology and the nutrition are their high antioxidant activity, determining antidiabetic, antiacetylcholinesterase, antimicrobial, anticancer, antitumor, anti-inflammatory, photoprotective, antiviral properties.

The current project is focused on the development of a green method for the extraction of phycocyanin from *Spirulina platensis* grown in a bioreactor. The compound has immunostimulatory, immunomodulatory and anti-inflammatory action.

**The aim** of the proposed project is to study the possibilities of green methods for the production of phycocyanin from *Spirulina platensis* grown in a bioreactor and to develop:

1. Phycocyanin therapeutic systems with immuno-stimulating and antibacterial action,
2. Food product (healthy cupcakes) with high phenolic content, biologically active substances and high antioxidant activity.

**The object** of study of the developed pharmaceutical and food systems are physico-chemical and rheological properties, sensory quality indicators, their visco-elastic behavior, textural and porous properties, and microbiological stability. The change in the antioxidant activity of the developed innovative foods with the addition of phycocyanin will be monitored. The aim is to enrich the products with biologically active substances and to develop a therapeutic system with immunostimulating action.

**Methods** such as liquid chromatography, visible, infrared, flame and fluorescence spectroscopy, as well as determination of rheological and texturometric parameters, electron microscopy and measurement of hydrodynamic particle diameter by dynamic and static light scattering (DLS) will be used for the research.

The project is aimed at and corresponds to the objectives of the National Research Strategy and the regional, national and European priority areas for the development of science and innovation, and can be referred to priority area 2. “Health and quality of life, biotechnology and ecologically clean foods” from the strategy for development of science in Bulgaria until 2020.

The project “Development of a green method for obtaining phycocyanin from *Spirulina* with potential application in pharmacy and food technologies” focused on the comprehensive investigation of *Spirulina platensis* as a natural source of biologically active

compounds. The implemented activities included cultivation and characterization of biomass obtained from a bioreactor in Bulgaria, comparative analysis of *Spirulina* samples from different origins, and optimization of extraction methods for the recovery of phycocyanin and chlorophyll. Green extraction approaches were developed and evaluated, with particular emphasis on ultrasound-assisted extraction. The results showed that water is a suitable solvent for C-phycocyanin extraction, while ethanol is not effective for this purpose. Optimized extraction conditions enabled the production of phycocyanin with yield and purity suitable for use in food, cosmetic and potentially biomedical applications. The obtained extracts were subjected to physicochemical, spectroscopic and biological characterization. The stability of phycocyanin was investigated under different pH and temperature conditions, providing important data on its thermal and chemical stability. *In silico*, *in vitro*, *ex vivo* and *in vivo* studies were also performed to evaluate the bioavailability, safety profile and anti-inflammatory potential of phycocyanin. The applied part of the project included the development of functional food products enriched with *Spirulina platensis*, *Chlorella vulgaris* and phycocyanin, such as yogurt, muffins, fruit bars and chocolate products. In addition, silver nanoparticles synthesized using *Spirulina platensis* extracts were obtained and characterized, demonstrating antimicrobial and anti-inflammatory activity. The results confirm the significant potential of *Spirulina platensis* and phycocyanin as natural functional ingredients for food technologies, pharmacy, nutraceuticals, cosmetics and biomedical research. The project contributes to the development of environmentally friendly technologies for obtaining bioactive compounds and provides a solid basis for future interdisciplinary studies and practical applications.