Brief information about the project

Title	AP22685516 «Obtaining pigments of phototrophic microorganisms and studying their immunomodulatory properties and antibacterial activity».
Relevance	Ensuring an increase in food production in a situation where it is impossible to expand cultivated areas due to both climatic constraints and the need to maintain a balance with areas of natural ecosystems is a task that goes beyond the capabilities of traditional plant and animal resources. Considering the environmental problems associated with expanding food production on agricultural land, the potential of photosynthetic microorganisms - microalgae and cyanobacteria - capable of synthesizing highly valuable bioproducts in a short time, can be used to solve them. The cultivation of microalgae and photosynthetic cyanobacteria provides valuable biomass that is an attractive source for a wide range of innovative products, including proteins, polyunsaturated fatty acids (PUFAs), carotenoids, phycobiliproteins, polysaccharides and phycotoxins. These intriguing properties of phototrophic microorganisms are due to their ability to efficiently utilize solar energy, atmospheric CO_2, and available nutrients, and the diversity of species available allows the production of a wide range of valuable products on an industrial scale. Among these derivatives, pigments are biosynthesized, which have health-promoting properties and are now widely used to enhance the attractiveness of industrial products. Pigments from microalgae and cyanobacteria have high commercial value as natural colorants in the nutraceutical, cosmetic and pharmaceutical industries, as well as in clinical research and molecular biology, and as natural dyes in the textile industry.
Goal	The aim of the project is to extract pigments from the biomass of phototrophic microorganisms and study their potential immunomodulatory properties and antibacterial activity for application in the food industry.
Tasks	1. Search and isolation of novel cultures of microalgae and cyanobacteria from diverse extreme ecosystems based on their biomass productivity. 2. Study of morphological-cultural and physiological properties of accumulative and axenic cultures of microalgae and cyanobacteria, which possess potential as producers of valuable pigments within biotechnology. 3. Screening of isolated axenic cultures of microalgae and cyanobacteria to produce active pigments, including secondary carotenoids and phycocyanin. 4. Identification of highly productive strains of phototrophic microorganisms with high potential for pigments accumulation in cells. 5. Optimizing cultivation conditions of phototrophic microorganisms' strains to enhance biomass productivity and pigment yield. 6. Extraction and purification of pigments from the cells of selected strains of phototrophic microorganisms, and the quantitative analysis through chromatographic and electrophoretic methods. 7. Study of the effect of pigment extracts of selected strains of phototrophic microorganisms on immunocompetent cells of experimental animals in laboratory conditions.

Expected and Achieved Results	- New cultures of phototrophic microorganisms were isolated from water and soil samples obtained from various extreme ecosystems, including the Chundzha thermal springs (Almaty region) and the Alakol salt lake (Zhetysu region). - The morphological properties of the isolated axenic cultures of microalgae and cyanobacteria were studied, their cultural and physiological properties were characterized. - Screening of the isolated axenic cultures of microalgae and cyanobacteria was carried out to determine active pigments, including secondary carotenoids and phycocyanin.
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Publications list with links to them	1. Ismailova Sh., Kali A., Sandybayeva S. Comparative purification techniques for cyanobacteria and microalgae from varied aquatic habitats in Kazakhstan. Materials of International Scientific Conference of Students and Young Scientists “Farabi alemi”, Almaty, Kazakhstan, 2025. 2. G. Muratkhan, N. Aizharykova, B. Ondabayeva, S.Sandybayeva. AI-driven in silico optimization of algal cultivation for enhanced pigment biosynthesis. Proceedings of the Satbayev International Conference (2025), 25 (1), Almaty, Kazakhstan. – p. 755-770. https://doi.org/10.51301/SIC.2025.i1.105
Patent information	-