

Constantly increasing population is associated with the need to find new sources of food. Today, almost one billion people in the world are starving. There is a need to increase food production on a global scale. However, escalation of the food production based on conventionally known solutions is too serious burden on the ecosystem. Therefore, meeting the nutritional needs of the population requires the search for unconventional sources of nutrients including fats (lipids). Valuable unsaturated fatty acids, which play an important role in human physiology and have not only anti-inflammatory, but also immunomodulatory, anti-atherosclerotic or anticancer effects, are conventionally obtained from plant-based oils or marine fish.

A new sustainable alternative to known vegetable fats may be microbial oils stored in oleaginous yeast cells capable of accumulating fats in amounts greater than 20% of cell dry weight, the cultivation of which is associated neither with the use of large agricultural areas nor with the need for constant sunlight or irrigation.

The Department of Chemistry of the Institute of Food Sciences at the Warsaw University of Life Sciences has been working for several years on the application of green chemistry methods in the preparation of valuable compounds with functional properties, including microbial oils rich in unsaturated fatty acids, which have potential in the context of their use as vegan food additives. With consumers increasingly open to new products, functional foods, dietary supplements and more and more choices dictated by the well-being of the planet, microbial oils could prove to be a global innovation.

Microbial lipids production has many advantages. However, there is a need to clarify the phenomena and mechanisms accompanying the process of their accumulation in yeast biomass. In cells of oleaginous microorganisms, lipid synthesis may proceed in two ways: *de novo*, i.e., when sugars constitute the carbon source, or *ex novo* from hydrophobic substrates present in the environment. The aim of the project is to determine the conditions under which microbial oil biosynthesis is possible by both *de novo* and *ex novo* pathways in media containing only hydrophobic substrates. So far, the separation of the two mentioned microbial oil accumulation pathways has been postulated, depending on the type of carbon source used in culture. Nevertheless, the authors of the project were the first put forward a hypothesis on the coexistence of both pathways and the possible dominance of one over the other depending on the culture conditions. The process of microbial lipid accumulation in cultures with hydrophobic substrates is much less understood.. We consider this issue to be highly novel and of interest to other researchers. In cultures designed to produce microbial metabolites, such as microbial oils, sugars are the main source of energy for cells. Our research will provide insight into the properties of microbial oils derived from biomass cultured in complex media containing lipid carbon sources, including waste sources.

The project consists of five research steps starting with the selection of well digested hydrophobic carbon sources as well as strains for studies using genotypic analysis. In order to gain insight into the metabolic processes involved in microbial oil accumulation by yeast, it is necessary to select markers specific for both *de novo* and *ex novo* pathways, followed by pathway analysis in hydrophobic carbon source media under varying environmental conditions. Microbial oils are undoubtedly a product of great potential, but there is still a lack of basic knowledge about the process of their accumulation in microbial cells. In the research we will use a model species of oleaginous yeast *Yarrowia lipolytica* with specific abilities to adapt to diverse environmental conditions and fully sequenced genome.

The results of the project will expand the knowledge on basic research in the field of food science, especially the course of selected metabolic processes and the influence of selected parameters on the efficiency of microbial oil accumulation in the studied oleaginous yeast species. The knowledge gained will allow the author of this project to begin work on the development of the concept of effective stimulation of the process of microbial oil accumulation in order to use it in selected food products. The results may contribute to the design of subsequent cultures with the use of new, more diverse media, which will be the basis for further research and application for further funding from the National Science Center.