Study on influence of alternative carbon sources on lipids biosynthesis in yeast *Yarrowia lipolytica*

The increasing number of people in the world has resulted in growing demand for food and energy. These conditions put an obligation on modern society to seek for new feedstocks to follow the sustainable development approach. One of the key elements to ensuring safe, healthy food or materials and energy necessary for our civilization is the creation of a knowledge-based and renewable sources economy. Some of the most important fuels can be produced by using biomass, reducing fossil energy consumption. According to the development of biotechnology, more and more chemicals, including biofuels, will be produced by microorganisms using renewable feedstocks.

The production of biodiesel requires lipids (fats), which, after chemical reactions with alcohols, form esters. Nowadays, biofuels are mainly produced from the vegetable oils. This causes use of farmland on non-food crops. However, in the natural environment there are microorganisms that have the ability to produce and accumulate lipids inside the cells. The usage of oleaginous microorganisms can be a milestone for development of the bio-economy.

Among oleaginous microorganisms, *Yarrowia lipolytica* is one of the most studied. This yeast has been used for many applications, such as the production of sweeteners, aroma compounds and organic acids. It is nonpathogenic, safe for human and animals, and it is the natural flora of our environment. Like every living organism, yeast needs a carbon source for growth and biosynthesis of various compounds. The usage of plant biomass as a renewable feedstock is a subject of many researches. An interesting extension of this idea is a usage of biomass of seaweeds. Seaweeds are ideal producers of renewable feedstocks: they do not require arable land, fresh water and agricultural fertilization. Seaweeds contain a large number of compounds that can be a source of carbon for yeast. Especially brown seaweeds contain easily assimilated glucose polymers, mannitol (polyol) or alginate. The previously mentioned yeast *Y. lipolytica* can use mannitol for growth but the molecular mechanism of its assimilation is unknown. One of the aims of this proposal is to understand and describe the most important stages in transport and incorporation of mannitol into the metabolism of *Y. lipolytica*. It will extend the knowledge in yeast metabolisms and allows for efficient lipid synthesis from seaweed biomass.

The alginate from seaweed cannot be utilized by yeast. However, the genetic modifications such as introduction of the heterologous metabolic pathways, will allow for assimilation by yeast the previously unavailable carbon source. This is a perfect field for basic research to get answers for the influence of the alternative substrates on yeast’s metabolism.

Due to the possibilities of the synthetic biology combined with the development of basic metabolic research, it will be possible to create “a biological factory” based on yeast cells. This will enable for the utilization of difficult-to-decompose organic compounds with the synthesis of value-added products. In the future, an introduction into an every-day life, bioproducts based on microbial cell factories will be a response for growing demand of the sustainable development of our civilization.