Modern biotechnological processes also require innovative solutions. The economic and environmental aspects of these processes are playing an increasingly important role. Similarly important is the social aspect of conducted research connected with the pursuit of modern science to solve environmental problems generated by anthropological human activity.

The key stage in the processes associated with the use of microorganisms for the production of valuable metabolites is the selection of the substrate. The focus is on the use of cheap and renewable substrates, which are often waste from other industries. In addition, raw materials used for the cultivation of microorganisms must not compete with food production. A promising carbon source for biotechnological processes are therefore volatile fatty acids (VFA) - acetic, propionic and butyric. These acids are formed as a result of fermentation of waste from the wood industry, sewage treatment plants and various biodegradable organic waste, generated also during the fermentation of municipal waste. The constantly growing standard of living, mainly related to the global development of industry and trade, contributes to a faster increase in the amount of municipal and industrial waste. Only at the beginning of the 21st century more than 95% of generated solid waste was stored in landfills and was not segregated and reused. Landfilled municipal waste causes a deterioration in the quality of surface and groundwater and contributes to the formation of unpleasant odors from fermentation processes. Although VFA has already been used for lipid biosynthesis by *Yarrowia lipolytica*, their metabolism has not yet been fully characterized. The acid mainly used in these processes was acetic acid, in turn, little information can be found in the literature on propionate and butyrate and their use in the production of valuable metabolites by *Y. lipolytica*.

Therefore, one of the key assumptions of the presented project is to characterize the metabolism of acetate, propionate and butyrate in the yeast *Y. lipolytica* and to develop a method for their effective use in the production of metabolites with high added value.

The production of cell metabolites is associated with the second main goal of this project, which is wax production. Waxes include a very diverse class of hydrophobic compounds in which esters of long chain fatty acids and long chain fatty alcohols play a major role. Natural sources of wax are: mineral oils, microorganisms, plants and animals. Currently, most wax esters are purified from mineral oils, but their renewable sources, particularly environmentally friendly, are highly desirable. Earlier, the most widely available natural source of wax was oil was obtained from a sperm whale. At the end of the 18th and early 19th century, sperm whale oil was used as an excellent lubricant due to its low viscosity and stability, and did not freeze to -30°C. Catches of sperm whales were so huge that these animals were finally strictly protected as an endangered species. The substitute for sperm whale oil became the oil from the jojoba seeds (Simmondsia chinensis), commonly known as jojoba oil. More than half of this oil is in the form of waxes, which composition resembles esters of a sperm whale wax as well as those found in human skin. However, the use of jojoba oil is still limited due to its low supply and high prices. Waxes are widely used in many personal care products, lubricants or coatings. In the automotive industry, it is estimated that the global car wax market will be valued at USD 743.5 million by the end of 2018. This market is expected to reach USD 1,126.4 million by the end of 2028.

In order to meet market expectations, the goal of this project will be wax biosynthesis by oil-producing yeast *Y. lipolytica*. Preliminary studies indicate the high potential of these microorganisms for wax biosynthesis, however, these compounds are toxic to cells. Therefore, great emphasis will be put on developing a method that allows effective wax biosynthesis without harming yeast cells. The development of a system that allows the separation of individual wax components biosynthesis in time and space and/or a system that allows their secretion into the culture medium will undoubtedly be a significant achievement. In addition, the combination of wax biosynthesis using volatile fatty acids will make an extremely valuable contribution to environmental protection and improve the quality of life.