The biomass of unicellular algae is a sustainable bio-based source of biologically active compounds, such as fatty acids, proteins, carbohydrates and a potential feedstock for the production of biofuels. A combination of microalgal cultivation and wastewater treatment has been recognized as a viable way to reduce the costs of freshwater input and nutrients in microalgal biomass production. However, a major bottleneck in these processes is the presence of other microorganisms, e.g. bacteria, and the presence of pollutants and their toxicity, which may be a source of environmental stress for algae. Emerging contaminants (ECs) are trace compounds or materials commonly found in the environment that threaten organisms and the environment. These include e.g. compounds released into the environment as a result of the decomposition of microplastics, such as bisphenol A, cadmium, lead and nanoplastics.

Interactions between microalgae and bacteria stimulate the secretion of extracellular polymeric substances (EPS). Literature reports that EPS play an important role in microalgal-bacterial co-cultures and in the biosorption and the biodegradation of environmental contaminants.

The main goal of the project is to explore and analyze the impact of single-species and multiple-species bacterial EPS on growth processes, photosynthetic activity, EPS synthesis and metabolic profile of unicellular algae. We also intend to elucidate the mechanisms of the impact of bacterial EPS on the metabolic processes and in unicellular algae under stress, i.e. in the presence of emerging contaminants and on the removal of ECs by unicellular algae.

The novelty of the research proposed in the project results from the fact that:

- the role of single-species and multiple-species bacterial EPS on growth and metabolic processes of unicellular algae is scarcely investigated
- there are no data on the influence of bacterial EPS on microalgal cells in the conditions of environmental stress caused by the presence of emerging contaminants
- there are no data on the interaction of ECs with algal cells concerning the characteristics of EPS released by microalgal cells in response to biotic stress and their impact on the biodegradation/bioaccumulation of these contaminants by algal cells
- there are no studies that would take into account the impact of bacterial extracellular polymeric substances and the impact of a combination of pollutants and nanoplastics on the metabolism of unicellular algae, which indicates insufficient knowledge in this area.

The research planned in the project based on metabolomic, biochemical, and biological analyses will help to determine whether EPS, thanks to its properties, has an impact on biosorption processes and bioaccumulation of contaminants by unicellular algae. The prospective results will broaden the knowledge in physiology and biochemistry of unicellular algae.