The presence of emerging contaminants, including pharmaceuticals, is a potential factor contributing to the deterioration of freshwater, marine, and coastal ecosystems. The increasing rate of pharmaceutical consumption linked to population growth and aging, and relatively low removal efficiency of conventional wastewater treatment plants are some reasons for the widespread presence of these compounds in the aquatic environment. Coastal marine ecosystems are considered the final sink of most of the pharmaceutical residues. Ionic liquids are substances that have gained lots of attention over recent years because of the potential applications in various industries, including modern chemical technology as “environment-friendly” alternatives replacing traditional solvents. However, thanks to their unique physicochemical properties and resistance to biodegradation, they are possible water micropollutants.

Presently, regulatory risk and hazard assessments are mainly based on the evaluation of the effects of individual chemicals. Yet, ecosystems are exposed to multi-component pollutant mixtures. The interactions between those pollutants and their continuous presence in the aquatic environment can cause an increase in the overall threat to living organisms and result in unforeseen negative effects. So far, the primary focus has been directed towards understanding the ecotoxicological impact of these compounds on freshwater ecosystems, with less attention being paid to coastal and marine environments. Moreover, fewer data are available regarding the chronic effects of pharmaceuticals and ionic liquids exposure on marine phytoplankton organisms as most of the ecotoxicological studies focus on acute effects and freshwater microorganisms. As phytoplankton species exhibit varying sensitivity to pollution, changes in the biota composition and species succession are likely. Overall, the information on the ecotoxicity of both ionic liquids and pharmaceuticals present individually or in the mixtures in the marine environment is insufficient.

The project aims to fill knowledge gaps in the evaluation of environmental risk resulting from the presence of mixtures of emerging micropollutants. Ionic liquids- potential water micropollutants and pharmaceuticals already found on the wide-scale in the Baltic Sea have been selected. The investigation of the overall long-term exposition of representative Baltic species of microalgae and cyanobacteria to the mixtures of the chosen compounds present at low, environmentally relevant levels will be performed. The specific objective is to evaluate the sensitivity of marine photosynthetic microorganisms and get information about the potential, underlying modes of action of selected compounds through a series of laboratory experiments. The assessment of the negative effects of micropollutant mixtures on the growth and functioning of microorganisms, including different physiological endpoints ex. processes involved in photosynthesis and photoprotective, antioxidant mechanisms can reflect the environmental impact on the primary producers. The Baltic Sea - a shallow inland sea with an extensive catchment area is especially sensitive to pollution. It is under multiple anthropogenic stressors related to intensive agriculture and industry of the region, and dense coastal area population. The scope of the project is important to model phytoplankton community structure and function under the adverse influence of micropollutants. The report on the effects of ionic liquids and other organic micropollutants will for the first time provide information on the ecotoxicology and physiological modes of action of the mixtures of these compounds.

Shifts in algal populations can affect the balance of the entire ecosystem because of the disruption of their important functions like biogeochemical cycling and oxygen production. Since the marine and estuarial environments and especially the Baltic Sea area are under intense anthropogenic pressure, the studies concerning the impact of emerging micropollutants on marine communities and bottom-up effects, ecosystem degradation, and dynamics are of high importance.