The project aims to develop **emulsions stabilised by biosurfactants dissolved only in the oil phase**. These surfactants won't pollute water. The project's second goal is **to introduce no-surface active drugs into the adsorption layer of emulsion by combining bioactive compounds using hydrogen bonds or electrostatic interactions with biosurfactants**. It will create a new compound or complex with medicinal (biologically active) and surface-active properties. Thanks to the acquired surface properties, they will reach the surface layer in higher concentrations than the concentration inside the layer. We studied similar interactions with saponin, which we used to introduce biologically active chitosan into the water surface layer. **As an oil phase, I will use only natural oils suitable for topical applications and have appropriate medicinal properties**. **Functionalised nanoparticles of natural origin will stabilise the emulsion**.

Human skin is a complex organ composed of the epidermis, dermis and subcutaneous layer. Due to its structure, it is a difficult barrier for active substances (drugs), which must diffuse through subsequent hydrophilic and lipophilic layers, passing through four phase boundaries. Unfavourable partition coefficients and diffusion coefficients slow down drug penetration. In my opinion, both factors can be positively influenced by modifying the physicochemical properties of the drug by combining it with a compound with surface properties. It will facilitate the drug's adsorption in the interfacial layer, penetration through subsequent phase boundaries and absorption into the bloodstream or lymphatic vessels. The drug's lipophilic (or hydrophilic) nature can also be similarly modified, positively affecting its adsorption in the skin and final absorption in the body.

Recently, several studies have been carried out on the physicochemical mechanisms involved in the ageing process of emulsions. Researchers wanted to describe the impact of the different additives. However, most formulations still rely on semi-empirical approaches. Moreover, the main research focused on emulsions stabilised by surfactants dissolved in the aqueous phase. The problem of stabilising emulsions using compounds dissolved in the oil phase exists only partially in the literature on the subject. Combining the stabilisation of emulsions with surfactants in the oil phase with the possible complexation of a medicinal substance, both physicochemical and medical, is practically absent from the literature on the subject.

The proposed project should give many results. I will study the adsorption and emulsion generation properties on all levels, from molecular interactions via interfacial rheology to emulsion structure and rheology analysis**. I want to solve the fundamental research problem regarding the impact of adsorption processes on dispersion system phase parameters and develop new and safe emulsion substitutes with excellent biocompatibility and biodegradability alongside their manufacturing technologies to reduce the harmful effects of traditional chemical surfactants.**

The detailed characteristics of the selected components of emulsion systems will show precisely the mutual interactions between biosurfactants and drugs in the adsorption layer. The physicochemical and rheological analysis fully describes the system's decomposition and describes the coalescence rate. **Tests of the kinetics of adsorption/desorption of surfactant/drugs sets on water/oil interfacial surfaces, kinetics of the release of the medicinal substance from the emulsion and cytotoxicity and antimicrobial activities examinations describe the possible applications of the developed emulsions.**

The proposed approach should allow reductions in the biosurfactants' concentrations and therapeutic doses of biologically active compounds dissolved in the oil phase.

Hypoallergenic, non-toxic emulsions based on surfactants dissolved in the oil phase will be a modern, innovative product of green technology in the 21st century. The complexation of biosurfactants with drugs will bring many cosmetological, medical or industrial applications.