Biofilms are structures composed of microorganisms such as bacteria or fungi and extracellular matrix synthesized by them. The matrix is built up of a polymer which in turn is composed of sugar molecules. This structure is responsible for adhering microbes to each other and to a surface that, in the course of infectious diseases, can be the tissues of living organisms. The production of biofilm in the living body is associated with certain benefits for microbes, mainly protection against immune cells and weakening of the effects of antimicrobial substances such as antibiotics or disinfectants. This is due to the presence of the extracellular matrix, which forms a barrier impermeable to cells and many chemical compounds. Moreover, biofilms show certain characteristics of a multicellular organism since under the influence of external factors they are able to change their structure, species composition or divide into highly specialized units, each responsible for conducting other metabolic processes.

The oral cavity is populated by more than 700 species of microbes. Most of them are localized in plaque which is a special example of biofilm. When a person's diet is rich in simple sugars and sucrose, species composition of the plaque undergoes noticeable changes, with a significant increase in acid-forming microbes, including *Streptococcus mutans* - bacteria species that is playing a major role in the development of caries. This microorganism feeds on sugars in the diet, subsequently producing organic acids, which in turn dissolve the tooth's hard tissues leading to the formation of carious cavities. In addition, this bacterium, using sucrose, present in large quantities in sugary drinks and sweets, synthesizes large amounts of biofilm matrix, providing itself with an excellent barrier to protect against the effects of saliva components with antimicrobial properties.

One of these components is lactoperoxidase — an enzyme secreted into saliva which has the ability to oxidize thiocyanate (SCN^-) ions (also present in saliva) to hypothiocyanate ($OSCN^-$) ions, which possess the ability to damage microbial proteins involved in the metabolism of sugars, ultimately leading to the death of the microbes. Unfortunately, the products of the described physiological lactoperoxidase system have proven to be of little effect in combating bacterial and fungal biofilms. Nevertheless, there are a number of non-physiological substrates, that can be oxidized by this enzyme, whose oxidation products are characterized by stronger oxidative properties than physiological ones. However, their effect on biofilm has not yet been studied.

The aim of this project is to study the effects of the lactoperoxidase system, modified by applying a number of non-physiological substrates, on bacterial and bacterial-fungal biofilms responsible for the development of tooth decay.

Advanced microbiological, genetic and chemical techniques will be used in the course of the research. The parameters describing the reactions of lactoperoxidase with each analyzed substrate will be characterized. Studying the effect of individual systems will consist of investigating the change in biofilm formation, its mass, the three-dimensional structure, the amount of matrix produced and viability of microbes. In addition, the effect of modified lactoperoxidase system on *Streptococcus mutans* sucrose dependent pathogenicity, gene expression and its metabolic profile will be assessed. The final stage of the study will involve examining the toxicity of the systems to human gum cells. As a result of the studies, the mechanism of action of tested modifications of the lactoperoxidase system will be determined together with their antibiofilm potential against the biofilms associated with the development of tooth decay.

These results will expand the knowledge in the field of pharmacotherapy and prevention of infectious diseases, pharmaceutical microbiology, and in the future may provide the basis for further research on the use of a modified lactoperoxidase system in the treatment and prevention of biofilm-related disease development.