

Project entitled "Modeling the structure of glycerol polyesters depending on the process parameters" consists of creating mathematical models which could propose the conditions for obtaining polyesters with a specific structure and thus with specific properties. In the project, polyester resin from glycerol and dicarboxylic acids will be synthesized. Then the resins will be thermoset to solid films without defects, which will allow for reliable testing of their properties. Glycerine is a triol, which has three reactive hydroxyl groups. There are two primary groups with higher reactivity and one secondary group with lower reactivity. Due to the trifunctional nature of glycerine, the formation of branched structures is possible. However, the different reactivity of the hydroxyl groups can be used to control branch formation. Branching significantly affects the properties of resins and films. It is now known that by changing the parameters of the production process of glycerol polyesters, their properties, such as glass transition temperature, elastic modulus, tensile strength, or even viscosity, change significantly. Unfortunately, so far, no one has investigated how the preparation methods affect the structure of polyesters of glycerol, from which their properties are directly derived.

The project was divided into three tasks. The first one consists in identifying the best methods of synthesizing resins with a structure close to a linear, a highly branched structure and an intermediate structure. The next task is to find the best method of producing defect-free films. The last task is crucial for this project. Based on the first and second task results, models will be developed, which will be linking the parameters of the manufacturing process with the structure and properties of the products. Models will be assigned to resins and films, respectively. To implement this project, mathematical methods of Design of Experiment will be used, which will allow to achieve the goal while minimizing the number of performed experiments. The models will allow to study not only the general rules determining the dependencies between the structure and properties of glycerol polyesters, but also to design the production process of a polymer with the desired properties.

This project will provide a better understanding of the formation of polyesters of glycerine and dicarboxylic acids. Moreover, these polymers are currently being tested for applications in tissue engineering. The dependencies described in this research will allow for further sustainable development towards specific applications of these materials. The results should show the direction of further investigation, which is extremely important. All this means that the project should be of interest to both scientists and industry.