Biomaterials science has developed greatly in the last couple of decades. Among biomaterials especially significant are hydrogel materials, which are characterized by great biocompatibility and physical properties similar to natural biological tissue. Broad spectrum of usage of hydrogel materials in the fields related to human health and life makes these materials, despite many years of research, are still in the centre of attention of scientists working on the development of biomaterials. Achievements of science in the field of hydrogels have found wide range of application in ophthalmology, which uses this type of material in the production of contact and intraocular lenses. Possibility of correction or restoring somebody's' sight constitutes an important aspect of caring for the comfort and health of people suffering from sight defects.

Producing intraocular implants involves carrying out numerous tests in order to check chemical stability and toxicity, and to determine optical properties of the material. Parameters obtained in this way allow only to characterize functional features of implants. Using intraocular lenses is also related to the influence of chemically aggressive biological environment, where the material able to absorb fluids is subject to constant contact with aqueous humour. This type of biological fluid contains many organic and inorganic ingredients which may influence hydrogel material and change its functional properties. An example is calcification of hydrogel structure which leads to reduction of transparency of the material. This results in deterioration in seeing of the person using such an implant and it is advisable to perform another surgery in order to replace the lens. In order to decrease the risk of further surgeries, it is essential to produce material with such properties that will not favour occurrence of the aforementioned effect. However, in order to achieve this goal, the effect needs to be included in the materials currently used and then mechanisms that accompany to its creation need to be understood. In the in vitro research that will be conducted, intraocular lenses based on hydrogel will be incubated in solutions of different concentrations of tricalcium phosphate and glucose in order to check their influence on the changes of the internal structure of the implants that lead to disturbances of matter transport processes. Verification of the solutions impact at different concentrations of chemical substances mentioned above on matter transport properties through hydrogel structure will be performed by examination of changes and distribution of free volumes in a material. Free volumes that constitute empty spaces not filled with any matter seem to be suitable places enabling fluid flow and location of accumulation of solutions components in a hydrogel. Determining parameters of the flow rate of the solutions of different concentration through the structure of the material will provide information about the possibilities of disturbances of transport processes in hydrogels, which will allow to relate kinetics of flow parameters to the changes of free volumes sizes. Linking aforementioned research with the research on evolution of water structure in a hydrogel in the process of its dehydration will allow to presume probable morphology of resultant deposits of substances diffusing into the hydrogel. To summarize, the research will enable understanding the way the internal structure of a material is changed as a result of incubation in solutions of different concentrations of selected chemical substances, and how structural changes disturb normal transport of fluids in a material. The results obtained will allow to ensure if chemical factors applied are accumulated in the internal structure of a material and if their influence on the structure of polymer chains is permanent.