To deliver the drug substance to the specific site of the body in a controlled manner and at defined velocity, is a great challenge and also the main target for current pharmacy. Introducing novel additive components, as well as defining the influence of their production on the efficacy of the drug is a very actual and extremely important topic, mostly in the case of safe and efficient therapy. Undoubtedly, the intensive development of pharmacy would not be possible without application of naturally derived polymers. There are several important facts behind this, such as widespread availability, relatively low production costs and a lack or very low toxicity. Chitosan, sodium alginate, hyaluronic acid, cellulose derivatives, starch and polysaccharides of bacterial origin, such as xanthan gum or gellan gum, are the most frequently studied natural polymers. In the last case, there is currently a clear increase in interest in potential applications of gellan in pharmaceutical technology. Gellan is an anionic bacterial exopolysaccharide discovered in 1978, in USA. It is used in two forms, acetylated (HA), sometimes called native and deacetylated (LA). The solutions of LA gellan even in low concentrations (from 0.1%) reveal the tendency to form hydrogels during cooling and in the presence of cations. This phenomenon is known as ionotropic gelation and can be used to enclose active substances in polymer matrix capsules to modify their release in the gastrointestinal tract. The reasons for modifying drug release are several and they depend on the properties of the substance as well as on the type of disease. In turn, the modification of release can relate to both reaching a specific place in the digestive tract and the speed at which this process occurs. Gellan-based matrix capsules exhibit pH-sensitive properties. In this case, this means that they are stable in an acidic environment, but break down as the pH increases. Due to this behavior, they are studied as carriers for drugs that require release at the level of the small or large intestine. One such substance is mesalazine, which is an amine derivative of salicylic acid with anti-inflammatory properties. It is the active component of sulfasalazine, compared to which it has fewer side effects. Since 1984, mesalazine has been used in the oral therapy of ulcerative colitis, alleviating the symptoms of Crohn's disease and preventing the development of colorectal cancer. Mesalazine is poorly absorbed from the large intestine, showing mainly local effects. Therefore, it is fully justified to conduct research on the development of new carriers for this substance, which in the first stage will deliver it to the large intestine, and in the second release in a prolonged manner. It should also be noted that the release significantly depends on the composition of the capsules, including the type of additional polymers used, as well as the conditions under which they are produced. The main factor affecting stability is the way of cross-linking of gellan. Traditionally, one-, two- or trivalent cations are used for this purpose, then it is called physical cross-linking. In the literature you can also find chemical cross-linking of the polymer. It has been shown that it results in higher stability of the capsules in the gastrointestinal tract, which in fact slows the release process. One of the possible cross-linkers is glutaraldehyde.

According to the facts above, the aim of the project will primarily be to answer the question "*How does chemical cross-linking affect the properties of matrix capsules based on gellan gum containing mesalazine*?", with the main focus on assessing the possibility of obtaining the sustained release of the drug at the level of the large intestine.

Capsules will be analyzed, both immediately after receiving and after traditional drying or lyophilization. In the first case, shape and surface assessment using a stereoscopic microscope will be applied, as well as mechanical tests, using a texture analyzer. Capsules after dehydration will be characterized by the following techniques: Raman analysis, differential scanning calorimetry, nuclear magnetic resonance imaging, infrared spectroscopy, electron microscopy. The crosslinked gellan will be analyzed in terms of cell toxicity. In addition, parameters such as swelling at different pHs, drug content and degree of encapsulation and pharmaceutical availability in simulated gastrointestinal fluids will be assessed. The cross-linked polymer will also be evaluated for cellular toxicity. Planned studies also include assessing the behavior of the capsules in the gastrointestinal tract of rats.

The research to be carried out under the project is part of the current trend of searching for new carriers for known active substances in order to improve their effectiveness and increase the safety of therapy. The obtained results will provide very important information on how chemical cross-linked capsules will differ from the analogous ones obtained with the traditional method. In addition, the detailed characteristics of the resulting polymer, including both structure analysis and assessment of physico-chemical properties, as well as evaluation of cell culture safety and behavior in the gastrointestinal tract of rats will make a significant contribution to the development of the field of polymer chemistry with simultaneous consideration of pharmaceutical aspects.