The aim of the project is to investigate the impact of selected phenolic compounds, systems of phenolic compounds and food salts on modifying the structure, functionality and health properties of starch gels from native potato starch. The impact of the created systems on the functionality and safety of model processed meat products will be also analysed.

Functional additives are a large group of compounds used in many branches of the food industry. They can be classified according to the functions they perform in the product. Among the texturing agents, starch stands out. In the case of many food products, especially processed meat, it is an indispensable element that allows to create an appropriate, stable structure. Its popularity is due to many factors, but the most important is the ability to gelatinize in excess of water at higher temperature. During the storage of starch gel, it undergoes a spontaneous recrystallization process, referred to as retrogradation. Retrogradation is a technologically unfavorable process because it leads to a loss of structural stability and separation of water from the gel, which results in poorer food quality. In turn, in terms of nutrition, this phenomenon increases the amount of resistant starch, i.e. not digested by the human body and classified as dietary fibre.

The properties of starch gel depend on several factors, including: the ratio of starch polysaccharides (amylose and amylopectin) or the presence of other compounds during gelatinization, e.g. proteins, lipids, food salts. Starch and gel characteristics can also be modified by certain physical, chemical or enzymatic treatments. One of the methods of modification is the use of chemical reagents, e.g. during gelatinization of starch. Phenolic compounds can be used to modify starch. Phenolic compounds constitute a very wide group of chemical compounds of plant origin. Most of them show strong antioxidant and anti-radical properties, thus creating an antioxidant defense system. Their presence in food inhibit the oxidation of food ingredients, while supplementation with the diet protects the human body against oxidative stress caused by the presence of excessive amounts of free radicals. Due to the properties of phenolic compounds, their use as starch modifiers seems interesting, especially in terms of giving starch gels a health-promoting character.

Properties of modified starch depends on the concentration of the modifier and the occurrence of interactions between the modifier and starch polysaccharides. They can be of different nature and result from the occurrence of van der Waals forces, the formation of hydrogen bonds and the formation of characteristic inclusion complexes. As a result of their occurrence, the characteristics of the starch gel change, starting from the gelation temperature, through physicochemical properties, ending with the susceptibility to enzymatic hydrolysis. Also the presence of thermally stable phenolic compounds gives the gels antioxidant properties.

The project will examine the impact of selected phenolic compounds and a mixture of food salts and phenolic compounds on the functionality of native potato starch and the possibility of their use in the production of processed meat products. The developed research plan will allow to determine the nature of interactions occurring inside starch gel systems with food salts and selected phenolic acids, as well as to determine the impact of the presence of these compounds on the thermal, rheological properties and stability of starch gels. The preparation of model food products will allow to determine the potential of using the proposed systems in meat products and their impact on the functionality of the products and their safety.

The following research methods will be used during the project:

- Basic analysis of starch and starch gel (including determination of the amount of amylose, amylopectin, phosphorus, swelling power),
- Differential scanning calorimetry (DSC),
- Rheological tests using a rotational rheometer,
- Analysing the storage stability of gels,
- Analysing the antioxidant properties and digestibility of the gels,
- Study of the structure of gels using a scanning electron microscope (SEM), a polarized ligh microscope, X-ray diffraction (XRD), nuclear magnetic resonance spectroscopy (1H-NMR), Fourier transform infrared spectroscopy (FTIR), near infrared spectroscopy (NIR) ,
- Analysis of processed meat products (including determination of the thermal leakage, storage leakage, colour stability, texture analysis),
- Testing the antioxidant properties of products and the amount of free nitrites.