Hydrolysates of insect proteins in the formation of microcapsules with phytosterols

Entomophagy (insect consumption) can arouse extreme emotions - for some it is associated with tradition, for others it is a limit not to be crossed. Insects are consumed by about 2 billion people in 113 countries of our globe. Their production is becoming increasingly important in terms of ecology (less use of land, water, and a shorter production cycle) and for nutritional reasons (a rich source of protein with high quality and nutrient density, mineral content, vitamins and an adequate fatty acid profile). The digestibility of insect protein far exceeds that of plant proteins (76% - 98% compared to 52%), for this reason it is most often described in the literature as a valuable enrichment additive in food processing (increase in essential amino acids, increase in protein content). In its natural, unprocessed form, insect protein has low solubility (3-45%), low ability to form and/or maintain emulsions, but these characteristics can be improved using the process of enzymatic hydrolysis.

Phytosterols, on the other hand, are a group of plant sterols and stanols that are widely distributed in various parts of plants (roots, leaves, flowers, fruits or grasses). They exhibit a range of health-promoting properties (anticancer, antioxidant, anti-inflammatory), but have found the widest recognition for their blood cholesterol-lowering effects. Experts in the field of human nutrition unanimously recommend that the daily intake of phytosterols should be at the level of 2-3 grams, which will help reduce the LDL cholesterol content in blood plasma by about 10%. Meanwhile, despite the many sources of phytosterols in the diet, its intake is low, averaging 100-400 mg / day ie 3-10% of the recommended amounts. Despite the low amount and limited bioavailability (0.5-2%) of naturally occurring phytosterols, it is still believed that they can promote cholesterol balance in the body.

Microencapsulation is a technique of coating an encapsulated material into a mixture of materials (coating) to protect the former from external factors (light, oxygen, humidity, temperature). To date, plant polysaccharides (gum arabic, starch, cellulose, chitosan, pectin, inulin), of microbial origin (xanthan gum), as well as proteins of plant origin (from corn, wheat, soybeans), animal origin (gelatin, albumin, beta-lactoglobulin) and from fish have been widely used for microencapsulation of biologically active substances.

To date, no characterization of the properties of insect proteins as a coating substance has been carried out, and no studies have been found that undertake the applicability of insect protein hydrolysates in the microencapsulation of biologically active substances, including phytosterols.

The aim of the project is to determine the applicability of insect protein hydrolysates in microencapsulation of bioactive compounds of plant origin, mainly phytosterols.

The first stage of the project will be the extraction and enzymatic hydrolysis of proteins from insects at different stages of development: mealworm (larva), cricket and locust (adult form). The team of researchers, in cooperation with Jiangsu University, will then determine their functional properties (including solubility, emulsion-forming ability and oil retention).

Research on phytosterols will focus on plant raw materials frequently used by humans and from sources that have not gained wide consumer recognition: rapeseed, hemp and lupin.

The final step will be the process of microencapsulation of phytosterols into insect protein hydrolysates. The microencapsulates obtained by spray drying will be subjected to physical analysis: encapsulation efficiency, bulk density, solubility, hygroscopicity, color, and chemical analysis: antioxidant capacity and allergenic potential.

The presented scope of the project covers many scientific areas. Its implementation, and then the obtained research results will provide a new state of knowledge in the areas: 1/ characteristics of the properties and requirements for insect protein hydrolysates as a coating material in the microencapsulation process, 2/ optimization of the conditions for obtaining insect protein hydrolysates (protein extraction, determination of hydrolysis conditions), 3/ extraction, determination of the phytosterol profile, taking into account plant-origin materials, 4/ analysis of the capacity of protein hydrolysates insect in preventing the health-promoting properties of phytosterols and increasing their bioavailability as a result of microencapsulation.