Microencapsulation with the use of carriers is more and more often used as a process of stabilizing labile bioactive compounds (such as vitamins or phenolic compounds), creating a barrier against unfavorable factors (oxygen, temperature or pH changes). Green plant pigments are one of the most labile pigments, and chemical conditions during food processing accelerate the process of their degradation, which leads to a color transformation from green to an unattractive brown. The methods of their stabilization so far use mainly chemical methods consisting in the exchange of Mg^{2+} ions in the pyrrole ring with Cu^{2+}. Current European legislation allows the use of two natural green dyes: E140 (chlorophyll or chlorophyllin) and E141 (copper complexes of chlorophyll and chlorophyllin). The lack of scientific data on the absorption, distribution, metabolism, excretion and toxicity of E140i and E141ii makes it impossible to assess them in terms of safe use as food additives and the establishment of Acceptable Daily Intake (ADI) levels. Hence the need to search for alternative methods of stabilizing green dyes that are not chemically modified, together with the determination of their bioavailability and bioavailability in terms of potential benefits for the human body.

Chlorophylls have long been used in high school medicine as compounds with therapeutic properties. They play an important role in the prevention of chronic diseases, demonstrating antioxidant, chemopreventive, antimutagenic, antigenotoxic and anticancer effects. However, there are no data on the anti-diabetic properties of green plant pigments in the literature so far.

Diabetes is one of the four majors chronic noncommunicable diseases, i.e., cardiovascular disease, cancer and chronic respiratory disease, and is currently one of the major topics in the context of current and future global public health. In 2019, approximately 32.3 million adults in the European Union were diagnosed with type 2 diabetes, and this is not almost a double increase in the last 20 years. Globally, high blood glucose kills about 3.4 million people annually, and WHO data show that this number will double by 2030. The short-term effects of chronic hyperglycemia include mild inflammation of the blood vessels of the heart, eyes, nerves, and kidneys. In the long term, they can cause systemic complications such as stroke, ischemic heart disease, diabetic retinopathy, nephropathy and neuropathy and other comorbidities. Type 2 diabetes is largely preventable, and even when it is diagnosed, it is often a manageable disease if we control and change our diet and lifestyle. One strategy to fight and prevent type 2 diabetes is to interrupt or slow down the digestion of starch in the food to reduce the rate at which sugar is absorbed into the bloodstream. Currently, this is achieved through the use of synthetic inhibitors of enzymes involved in the regulation of blood glucose (α-amylase, α-glucosidase and dipeptidyl peptidase-4). Nevertheless, the goal is to find natural, plant substances that can inhibit enzymes key in the prevention of type 2 diabetes, in order to avoid the side effects of using these drugs. There are many confirmed studies that fruit and vegetables are a rich source of secondary metabolites with anti-diabetic properties, while research on chlorophylls has not been conducted so far.

The research concept assumes the analysis of changes occurring during microencapsulation of chlorophyll extract (from spinach leaves) in relation to the chlorophyll extract stabilized with Cu^{2+} ions in order to check how and whether the induced chemical modification affects the properties of chlorophyll microcapsules and whether the microencapsulation process will be an alternative to stabilization with metal ions.

The scientific goal of the project will be to determine the possibility of using microencapsulation and its impact on the stability of chlorophyll and the formation of their derivatives (including chlorophyllides, pheophytins and pheophorbides) as a factor significantly shaping the stability, bioavailability and bioaccesibility in the model system *in vitro* in relation to their anti-diabetic properties (inhibition of α-amylase, α-glucosidase and dipeptidyl peptidase-4).