Biofortification and modelling of enzymatic browning in low-processed food *via* post-harvest application of functional extracts of natural origin

Recent scientific research confirms indisputably that fruits and vegetables should be the basis of human nutrition. They are a source of many valuable components, e.g. macro- and microelements, vitamins, and polyphenolic compounds; hence, regular consumption thereof significantly reduces the incidence of diabetes, cancer, or cardiovascular disease. Unfortunately, their share in the diet is usually relatively low. This is associated with many factors, including the time-consuming preparation of meals from vegetable raw materials, lack of culinary skills, or lack of possibility of pre-processing of raw materials (e.g. at work). Therefore, in recent years, there has been a continuous increase in the so-called minimally processed food, i.e. ready or almost ready for direct consumption. This strategy results in shortening the time of meal preparation and maintenance of the high nutritional value, health-enhancing properties, and sensory quality of products.

Unfortunately, due to microbial growth and the activity of endogenous enzyme systems, this type of products is characterised by a short shelf life and the need for storage in refrigeration conditions. This results in e.g. a year-by-year greater increase in the quantity of discarded food, which generates huge economic losses. Such food becomes difficult to accept for the consumer. Deterioration of its sensory quality (development of browning, negative changes in the flavour and odour) and a decline in health-enhancing properties of stored low-processed foods (reduction of vitamin and polyphenolic compound levels) is largely generated by the activity of endogenous enzymes from the class of oxidoreductases, mainly polyphenol oxidase (PPO) and peroxidase (POD).

The project assumes that the quality of low-processed products can be maintained or improved by the application of natural plant extracts characterized by high anti-microbiological, antioxidant and anti-inflammatory properties and at the same time are a source of compounds with ability to reduce enzymatic browning. Preliminary studies have confirmed the positive correlation between polyphenol oxidase and peroxidase activity and the browning index value. Furthermore, it has been demonstrated that the post-harvest application of ascorbic acid, citric acid, and cysteine significantly inhibits the activity of this enzyme and reduces enzymatic darkening during storage. Importantly, this strategy yielded an increase in the content of low-molecular antioxidants (polyphenols, vitamin C) in the product, which was positively correlated with the increase in antioxidant activity.

The new strategy is targeted at enhancement of the stability of low-processed food and improvement of its consumer quality. The goal will be achieved at many levels and include:

- inhibition of the enzymatic browning process,
- enhancement of microbiological purity,
- improvement of health-enhancing properties (enrichment of products with polyphenolic compounds, macro- and micronutrients, and vitamins).

We assume that the post-harvest treatment of model products with functional solutions of plant origin will not only reduce losses related to enzymatic browning and development of undesirable microflora, but also improve the composition and bioactivity of food via induction of endogenous metabolic pathways and direct fortification with functional extract ingredients (polyphenols, metal ions, and peptides).