

Epidemiological studies have demonstrated that dietary intake of plant-derived foods rich in natural antioxidants is correlated with reduced risk of coronary heart disease. Recently, natural, bioactive compounds including betalains gained much attention due to the increasing society awareness of the positive impact of natural products on human health. Literature data show that antioxidants have the ability to prevent or delay the development of cardiovascular disorders and even cancer which are the leading cause of death worldwide. Betalains are unique, natural, non-toxic plant pigments which can serve not only as safe food additives with prominent coloring attributes but also as biologically active nutraceuticals which exhibit a wide variety of therapeutic, anti-carcinogenic, anti-inflammatory and antioxidant properties. It has been shown that betalain-rich extracts are proven to be an effective inhibitors of growth and apoptosis inducers of ovarian and cervical epithelial cell lines. The limited cytotoxicity has also been demonstrated for bladder and breast cancer cell lines. Showing several favorable effects against lipid oxidation and inflammation, betalains might possibly regulate cardiovascular risk factors. Recently, the research and characterization of alternative, betacyanin-rich, edible plant sources for the design of new functional foods, nutraceuticals, or drugs, has been intensified. Due to easy accessibility, low price, high resistance to unfavorable growing conditions and above all possible disease-preventing effects caused by presence of antioxidants such as betalains, *Atriplex hortensis* var. *rubra* has attracted considerable attention as potential alternative source of betacyanins complementary to the popular *Beta vulgaris* L. beetroot. *A. hortensis* is an annual, edible plant, belonging to the same subfamily (Chenopodioideae) as vegetable spinach and quinoa. *A. hortensis* var. *rubra* contains mainly special betacyanins with glucuronosylated system, amaranthin and its acylated derivatives (celosianin I and celosianin II) which await the first studies. Due to unexplored nature, *A. hortensis* var. *rubra* is an intriguing plant material, worth detailed research.

The main objective of this Project is to determine and characterize betalain pigments present in the extracts of *A. hortensis* var. *rubra* fruits and leaves and evaluate their biological properties such as antioxidant activity and/or potential pro-oxidant activity (the ability to convert compounds into free radicals which leads to the damage of cells and tissues) as well as cardioprotective and cytotoxic properties. Research will be especially focused on isolated and thoroughly purified betalain pigments as well as on their oxidized derivatives presuming their role in the prevention of various heart diseases and other human ailments. Study on antioxidant/pro-oxidant properties will be performed using spectrometric and electrochemical techniques. We will also electrochemically trace the oxidation phenomena of isolated and purified betalain pigments in order to confirm the enzymatic and non-enzymatic oxidation pathways of betacyanins proposed by our group as a result of our previous studies as well as to determine electrochemical nature and antioxidant and/or potential pro-oxidant properties of betalain oxidized derivatives which have never been studied before. Electrochemical techniques are a very useful tool to imitate reactions similar to those that occur in the human body. The main advantage of using electroanalytical techniques is that they provide rapid, simple and low-cost analysis of bioactive compounds. Another important aspect of the Project is to study protective effect of betalains as well as betalain-rich extracts on heart cells (cardiomyoblast) viability. Search for new compounds with cardioprotective activity is an extremely valuable research direction due to the fact that current therapeutic strategies, despite their effectiveness, have serious side effects for the patients. One of the most serious drug-induced complications is cardiotoxicity. This problem particularly affects patients undergoing chemotherapy and very often results in discontinuation of treatment

First preliminary studies on evaluation of potential cardioprotective activity of betalains will enable further much more comprehensive studies on betalain implementation to nutritional-based and pharmacological therapies to prevent and reduce cardiovascular risk. It is also an interesting issue whether betacyanins can act as efficient antioxidants without adverse pro-oxidant effects. Reports on this scientific problem can not be found in the literature, but it is extremely important to investigate. *A. hortensis* var. *rubra* offers a huge potential in the food, animal feed, pharmaceutical and nutraceutical industries because of its functional, bioactive components. The chemical composition of the leaves and fruits as well as their nutritional value provide huge potential for commercialization of this plant. In this context, identifying bioactive dietary constituents present in *A. hortensis* var. *rubra* as well as their pro-health properties may substantiate its potential as a new functional food. We expect that the results obtained within the Project will be helpful in the development of new functional food to supplement daily diet in betalains in order to avoid the development and progression of cardiovascular disorders such as atherosclerosis and even cancer. Detailed research on *A. hortensis* var. *rubra* fruits and leaves, their antioxidant and biological activities, especially concerning their cardioprotective role are pioneering and have never been performed before.