Oils of plant origin are an important part of the human diet. They are a source of essential fatty acids and fat soluble vitamins as well as other beneficial to health substances like phytosterols able to reduce blood cholesterol levels or antioxidant phenolic compounds. Rapeseed oil contains 6 – 14 % of α-linolenic acid. α-Linolenic acid is an essential fatty acid that has many health benefits such as the inhibition of eicosanoid production, alteration in the production of several prostanoids, reduction of blood pressure, lowering of serum triacylglycerols and cholesterol levels and retardation of tumor growth. Rapeseed oil contains also relatively high concentration of phytosterols like β-sitosterol, campesterol and brassicasterol. Compared to other vegetable oils, rapeseed oil has a high amount of polyphenols. In turn soybean oil represents one of the most commonly consumed oil in the world. This oil has a high content of vitamin E and is good source of phytosterols. It contains also large amounts of coenzyme Q, which preferably affects the functioning of the heart.

Oxidation of oil lipids leads to quality deterioration by generating off-flavor, nutrient loss, color changes, formation of texture changes, and even generation of potential toxic products. Particularly the highly unsaturated omega-3 fatty acids undergo instantaneous oxidation, which limits their shelf-lives and restricts their applications as health promoting fatty acids in the diet.

Besides triacylglycerols bulk plant oils contain a variety of minor components like free fatty acids, monoacylglycerols, diacylglycerols, phospholipids, sterols and other polar lipids. These amphiphilic substances reduce the surface tension in bulk oils and are able to concentrate at oil-water interface acting as surfactants. At concentration above their critical micelle concentrations (CMC) they self-aggregate and form association colloids. Because plant oils contain small amounts of water, amphiphilic components form reverse micelles. The arising association colloids in bulk oil create oil-water interfaces which could physically accelerate lipid oxidation. This process may be inhibited by antioxidants. The impact of α-tocopherol and its water-soluble analogue Trolox on the lipid oxidation process in bulk oil reverse micelles have been recognized. However, there is lack of information about the antioxidant activity of phenolic compounds in oil association colloids. Phenolic compounds as a relatively hydrophilic substances are able to locate at the oil-water interface and hence they probably significantly influence the oxidation in reverse micelles. The sources of phenolic compounds are rapeseed oil and soybean oil. Hence they may be a good model used to recognize the influence of the phenolic compounds on the lipid oxidation in bulk oil containing association colloids. On the other hand the obtained conclusions may serve to optimize the composition of rapeseed and soybean oils from the viewpoint of oxidative stability.

The aim of the project is to recognize the structure of association colloids formed in rapeseed and soybean oil and determine the influence of the selected native phenolic compounds on the formation and structure of association colloids in bulk oil. Subsequently the effect of selected phenolic compounds on the oil autoxidation in the presence of association colloids will be studied. Thanks to structural and autoxidation studies the relationship between the presence and structure of association colloids and efficiency of the native antioxidant action in rapeseed and soybean oil should be recognized.

To characterize type and structure of the association colloids in plant oil spectroscopic methods (measurements of associates size (hydrodynamic diameter) using dynamic light scattering (DLS), measurements of the steady state fluorescence, fluorescence anisotropy and fluorescence lifetimes) will be used. The influence of native phenolic compounds on the formation and structure of association colloids in bulk oils will be also established.

In the next step of research the influence of association colloids on the native phenolic compounds antioxidant activity in the oil will be recognized. The oil autoxidation experiments will be conducted in different conditions and the products of oxidation like hydroperoxides and oxyphytosterols will be determined. The phenomenon of the antioxidant synergism and/or antagonism between polyphenols and tocopherols in the presence of association colloids will be also evaluated. In addition to this, the structure of association colloids in oxidized oil will be analyzed.

Planned structural and autoxidation studies should improve knowledge concerning oxidation processes in rapeseed and soybean oil. This knowledge may be also used in the development of new products with a high content of compounds beneficial for health and optimization of industrial oil refining process, taking into account the desired amount of amphiphilic minor components and native antioxidants. Developed in this way refining using mild conditions or even minimizing the amount of refining are attractive for a higher retention of health promoting compounds in plant oil, reduction of processing costs and an increase in the sustainability of the oil refining process.