

## **SPECTROSCOPIC ANALYSIS OF SUPRAMOLECULAR XANTHOPHYLL AGGREGATES**

The aim of the project is to describe and understand the basics of a new optical phenomenon i.e. resonance enhancement of the Raman scattering of circularly polarised light induced by aggregation of carotenoids. The subject of research is a series of chiral xanthophylls (oxygenated carotenoids), differing in their chemical structure (number of stereogenic centers, amount of the conjugated double bonds and symmetry). Xanthophylls as well as other carotenoids possess high antioxidant activity due to the presence of long conjugated double bonds chain in their structure, that prevent against reactive oxygen species, which in consequence leads to the protection against cardiovascular, immune, inflammatory and neurodegenerative diseases. Bioavailability and antioxidant activity of xanthophylls may depend on the form of occurrence (as monomers, aggregates). That is why it is extremely important to study aggregation processes.

Planned study will include the spectral analysis of the chiral xanthophylls (e.g. neoxanthin, fucoxanthin, zeaxanthin, antheraxanthin), both in monomeric form, as well as chiral supramolecular aggregates. Structure of monomers will be studied in the solid state as well as in the various solutions. Aggregates will be synthesised and measured in various water-organic solvents mixtures.

Research tools used in the presented project will be six spectroscopic techniques, including three standard ones: infrared spectroscopy, UV-Vis spectroscopy and Raman spectroscopy; and their chiroptical counterparts: Vibrational Circular Dichroism (VCD), Electronic Circular Dichroism (ECD) and Raman Optical Activity (ROA). Experimental results will be supported by theoretical calculations that will lead to broader analysis of obtained spectra. As it turns out, xanthophyll aggregation leads to strong resonance enhancement of Raman Optical Activity intensities, that could revolutionize the study of chirality of biomolecules.

Examination of the influence of factors related to the aggregation process and the impact of structural parameters of monomers as well as the environment on the final structure of aggregates of xanthophylls will allow for broader understanding of this phenomenon in model systems. The results obtained for model systems can be extrapolated to biological systems. The results will also have an impact on the development of Raman Optical Activity. ROA is a relatively young technique but is already proven to have a great potential in context of study of chiral substances, particularly those of biological importance. Furthermore, proposed project will allow for the significant development and understanding of the effects of the resonance enhancement of ROA signal induced by aggregation.