

Raman spectroscopy is a technique of studying matter, based on registration of photons inelastically scattered by a studied sample irradiated with incident light of given energy. Raman Optical Activity (ROA) is a variant of Raman spectroscopy, based on observing the difference in Raman scattering intensity for left minus right circularly polarized incident and/or scattered light. This difference is non-zero only when a studied entity (a molecule, ion, macromolecule, etc.) is chiral. The word chirality comes from the Greek word *cheir*, meaning hand, and refers to one of its features, i.e. the impossibility of superimposing a hand with its mirror image. This is due to the existence of hands in the "right" and "left" versions. Similarly, some molecules, ions, or macromolecular units are characterized by chirality, that is, they are non-superimposable with their mirror images. Chemical entities that are each other mirror images are called optical isomers. Chirality is very important in nature, e.g. many of the key metabolic processes are chiral, among others due to the fact that many biological molecules building living organisms are homochiral (that is they exist only as one optical isomer). For example, naturally occurring amino acids occur only in the L configuration, and naturally occurring sugars - in D form. Not only the molecular structure can result in chirality. Chirality may also be related to larger systems, e.g. a tertiary structure of proteins is a source of macromolecular chirality. DNA is one of the most important, from the point of view of life on Earth, chiral entities. The source of supramolecular chirality is in this case a helix twist, and the predominant form of DNA is the right-handed helix. For some time it has been known that chirality can be induced. For example chiral environment, by blocking the rotation of a molecule may impose its given orientation in space and this way make a molecule chiral. The phenomena of chiral induction are extremely important as they are associated with transmission of chiral information and chiral recognition. Although there are methods of studying chirality, for example ROA, or Electronic or Vibrational Circular Dichroism, they have some limitations. In particular, the commonly used Electronic Circular Dichroism does not have conformational specificity, i.e. it does not recognize very well the different conformations of molecules. Vibrational Circular Dichroism (VCD) and ROA, however, are relatively less sensitive. In order to improve the sensitivity of ROA method, it is possible to apply resonance enhancement that occurs when the chemical entity absorbs energy in a range close to the energy of the excitation light used, and, moreover, when absorption is associated with the chiral system. Then significant improvement in the sensitivity of the method is obtained, as demonstrated, among others, for supramolecular aggregates of carotenoids in mixed solvents [G. A., Kaczor, A. Pallares, Zazo, J. Mlynarski, M. Dudek, M. Baranska, *J. Phys. B*, 2016, 120, 4028]. In addition, the strong chiral signal observed in such aggregates has made it possible to observe the induced chirality in the solvent molecules, which were achiral *per se*. The aim of the proposed project is to obtain and study (using ROA, VCD and ECD) supramolecular systems that induce chirality. Various combinations of achiral/chiral molecules within supramolecular systems structurally designed so that the resulting ROA signal is resonantly enhanced, will be studied. VCD will be used to verify conclusions obtained using ROA. Ultimately, it is planned to obtain universal supramolecular units inducing chiral signals. Such systems can be used to analyze interactions in biological systems, to selectively detect molecules in complex mixtures, such as body fluids or to test new, functional materials based on nanofibers. Better understanding of mechanisms of chiral induction is a key aspect of the project and may translate into future systems used to transfer chiral information and in chiral recognition.