

## **Determination of antioxidant properties of ionic liquids obtained from natural products**

Ionic liquids are chemical compounds containing only ions and having melting point lower or equal to 100 °C. Despite receiving first salt in 1914, the most important discoveries on their characteristics and uses have been published only in the last 25 years. During that time, ionic liquids evolution occurred, started with receiving stable compounds showing unique physical properties (I generation of ionic liquids). Then, ionic liquids with additional chemical (II generation) and biological (III generation) characteristics were described. Ionic liquids, in which certain anion is responsible for certain chemical or biological activity, create currently a huge compounds group. That also applies to ionic liquids that can be used as catalysts, herbicide, carbon dioxide absorbents or anti-inflammatory compounds. Choice of a proper cation can increase anion activity, enables solubility in specific solvents, and adding new properties, such as e.g. anti-bacterial activity. The aforementioned feature, that is, a possibility of influencing specific properties by choosing proper cation and anion caused ionic liquids to be called designer compounds. It should be mentioned that currently, we are not able to accurately assess how many ionic liquids we can synthesise. This number seems to be limited only by the amount of available materials.

New group of ionic liquids consists of compounds containing anion showing antioxidant properties. Antioxidants are compounds which inhibit oxidation processes of other substances. For this reason, they found use as additions prolonging freshness of food due to free radicals neutralisation. However, using ionic liquids as food additions or supplements is very limited due to their toxicity. One of the methods of improving ionic liquids 'green' character is their formation of compounds of natural origin or prepared from renewable materials. An example of such materials can be wastes in the form of protein, cellulose, chitin or lignin which are rich source of cations and anions.

The purpose of the project was to receive and determine properties of new antioxidant ionic liquids containing anion showing antioxidative activity, and cation of natural origin. Significant novelty, described in the project, is using naturally occurring L-carnitine as a source of cation for the synthesis. This compound, besides significant biological properties connected to functioning of human body, shows antioxidative properties. Natural phenolic acids will be the source of anion. They commonly occur in various plants, and are most frequently secondary metabolites, responsible for plants pathogens-resistance and decreasing oxidative stress. The main source of them are fruits, vegetables and various herbs and spices. A limitation in use of phenolic acids is their low solubility in hydrophilic and lipophilic solvents. For this reason, modification of natural antioxidants that allows to receive desired properties is necessary.

All research on antioxidant activity will be conducted using commonly used spectrophotometric methods, allowing to easily assess compounds neutralisation ability of various radicals such as DPPH or ABTS and reactive forms of oxygen and nitrogen in the form of superoxide anion and nitrogen oxide. Their ferrous and cupric ions reduction ability, ferrous ion chelation, and linoleic acid oxidation process inhibition will also be examined. Using such complex research methods will provide vital information on how salt structure influences its antioxidative properties. All received compounds will also be analysed using NMR technique and elemental analysis. Moreover, the basic physicochemical properties significant from the point of view of ionic liquids uses will be measured (viscosity, density, refractive index, water content, thermal stability and phase transitions). Ionic liquids activity towards the enzyme xanthine oxidase responsible for creation of reactive forms of oxygen in the body will be also determined.

Summing up, the presented project combines two significant research subjects – antioxidants and ionic liquids. Received results will be an important step in development of ionic liquids that could be used as supplements or food additions.