In recent years, there has been a considerable increase in the interest in metabolomics and chemistry of natural products. Terpenes belong to the group of secondary metabolites produced in plants. These metabolites perform functions that may be necessary to meet threats or survive in the environment, e.g. to repel pathogens or insects, and withstand environmental factors that have a negative impact on the plant. Secondary metabolites are often used to produce medicines of plant origin. They are also used in cosmetics or in the perfumery industry as fragrances, essential oils, etc. Additionally, the food industry's demand for secondary metabolites that improve the taste and smell of food products is constantly increasing. It should also be noted that many secondary metabolites are characterized by bioactive properties. Among volatile substances, it is compounds from the terpene group that have health-promoting effects. Limonene contained in citrus fruits may have antineoplastic activity, and other compounds from the terpene group (pinene, sabinene, terpinene) have antibacterial, antioxidant, anti-inflammatory or antimicrobial properties. Therefore, the inclusion of food products rich in bioactive substances into the daily diet is correlated with a lower risk of many diseases, including cancer or cardiovascular diseases. Although the biological activity of food products is lower in relation to pharmacological agents, when products rich in substances with health promoting effects are regularly consumed in significant quantities, they may have a positive effect on human health. For this reason, it is very important to determine the amount of bioactive substances contained in food products such as citrus fruits, which are particularly rich in terpenes.

In metabolomic research, chromatographic techniques are among those used most frequently. They are characterized by high efficiency of identification of the tested chemical compounds. Unfortunately, they make it impossible to monitor metabolic changes taking place in the tested samples. In addition, terpenes are highly reactive and unstable compounds. For this reason, the need to develop an analytical procedure to monitor the change in concentrations of terpenes in real time is emphasised. Such an approach would allow detailed insight into the processes taking place inside citrus fruits.

The solution is to use equipment that provides the ability to track the concentrations of volatile organic compounds in real time. This type of device is a proton-transfer-reaction time-of-flight mass-spectrometry (PTR-TOFMS). This technique is characterized by high sensitivity, but also difficulties in the precise identification of chemical compounds. In order to solve this problem, the PTR-TOFMS was coupled with multidimensional gas chromatography with time-of-flight mass spectrometry. The use of the GC×GC-TOFMS technique will enable effective identification of the detected chemical compounds. This project proposes a complementary use of both analytical techniques enabling simultaneous qualitative as well as quantitative determination of selected terpenes in citrus fruits.

In summary, the aim of the presented project is to develop an innovative analytical procedure that would allow direct tracking of concentration changes in terpenes in citrus fruits during their storage under different temperature conditions. In addition, metabolic pathways for terpenes in citrus fruits are planned to be developed. The obtained results can be the basis for designing the processes of terpene isolation or obtaining new chemical compounds.