Fast method for pre-testing the safety of new ecological materials used for food packaging.

The global problem of **plastic waste disposal** has led to the implementation of various environmental regulations. One of them is the so-called **Plastic Directive** (in force in the European Union from 2019). **Plant-based materials were introduced to the consumer market as food contact materials (FCMs)**, based on this document. The most popular FCMs include bamboo, palm leaf, wheat bran, sugar cane, paper and polylactide. Nowadays such materials are particularly desirable because they are **biodegradable** or **recyclable**. However, their safety has not been fully considered, as **they may be a source of food contamination with dangerous chemical compounds**, **reducing its quality or changing the taste and smell**. The natural ability of plants to absorb contaminants from the environment means that toxic chemical compounds can be stored in their tissues. **Undesirable chemicals can easily migrate into the food, if a contaminated plant is used to produce FCMs**. Particularly dangerous are low-molecular carbonyl compounds, e.g. **formaldehyde** (according to WHO, it has **carcinogenic properties**). Most of undesirable chemical compounds are harmful even in small concentrations, so **there is a need to monitor the quality of new FCMs and their impact on food.**

Chromatographic methods are widely used in food quality control, which enable the determination of trace amounts of contaminants. However, **their significant limitations** are the time-consuming nature of the analyses, the need to use expensive solvents and specialized, costly equipment. Additionally, commonly used procedures for preliminary sample preparation for testing are usually time-consuming and consist of numerous stages and processes, e.g. derivatization, mineralization, extraction or purification.

Electrochemical sensors are also used to determine the presence of many harmful substances. They can examine vapors of many substances floating in the air. Such sensors have been used for years in fire protection systems (popular detectors), mining (detection of dangerous concentrations of flammable gases) and in air quality monitoring (concentration of PM2.5 and PM10 suspended dust). The advantages of such sensors are: **immediate measurement results, small size, relatively low cost and ease of use**. Unfortunately, they can be sensitive to gases other than the gas tested, have a limited lifetime (not exceeding several years), sensitivity to temperature or humidity, and often discrepancies in readings between different examples. Therefore, they require appropriate calibration against a reference method, e.g. chromatographic method. Preliminary studies already carried out indicate the possibility of using these sensors to test vapors from heated vessels for the release of formaldehyde from them.

In this interdisciplinary project, **it is planned to conduct research on the migration of particularly undesirable chemical compounds from plant vessels to food of various types** (neutral, acidic, alcoholic, fatty and dry) using selected chromatographic methods. **This will allow to identify particularly undesirable food contaminants and select those materials that may pose the greatest risk to consumers.** In addition, a **fast and low-cost method for testing the quality of plant vessels will be developed**. **It will use electrochemical sensors**, e.g. specific for formaldehyde, volatile organic compounds and other environmental pollutants. **So far, this has been overlooked by the scientific community**. The implementation of this goal includes the preparation of a **measurement station** enabling the calibration and validation of selected electrochemical sensors against standard chromatographic methods. Calibrated sensors enable fast, low-cost and pre-testing method to examine the quality of ecological vessels (**Fig. 1**). The proposed measurement station may also be used to test the quality of other environmental samples (plants or soil) in the future.

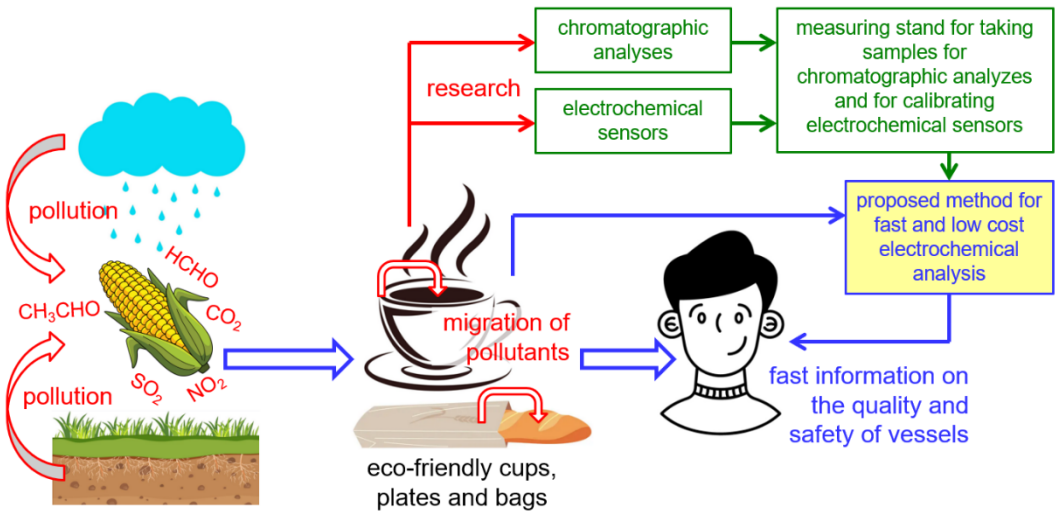

Fig. 1 Scheme presenting the research area of the project