The "ODOR-GC" Project: real-time detection of odorous molecules by means of a MEMS-based gas-chromatographic system.

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Odors strongly affect people's daily life and health: although they do not represent a risk for human health, bad smells can cause both physiological symptoms (respiratory problems, nausea, headache, etc.) and psychological stress.

A careful investigation of the odors issue requires odorous air measurement and analysis, by applying standardized scientific methods: instrumental approaches to the characterization of odorants are based on the evaluation of the odorous air chemical composition.

At this purpose, the "ODOR-GC" Project deals with the development of a sensing system that falls in to the category of the so-called IOMS (Instrumental Odor Monitoring Systems), whose technical requirements are established by the National Regulation UNI 11761:2019. Going into detail, the system is a miniaturized gas chromatograph capable to perform continuous, real-time and in-situ measurements, in order to achieve the chemical composition of the gaseous mixture by means of the detection and quantification of the single compounds.

The system architecture (see Fig. 1) is based on the general-purpose platform "Compact-GC" [1], developed at the Bologna Section of the Institute for Nanostructured Materials (ISMN) and its main feature is represented by an analytical "core" entirely based on MEMS (Micro-Electro-Mechanical-Systems) silicon components (injection system, pre-concentration unit and separation column). The measurement chain of the device is therefore capable to operate at working temperatures that can reach up to 150°C, thus allowing the detection of volatile compounds characterized by high boiling points.

Preliminary results obtained in laboratory showed that the "ODOR-GC" device (illustrated in Fig. 2), equipped with a 10.6 eV photoionization detector (PID), was capable to successfully detect more than 30 different compounds (aromatics, aldehydes, alkanes, ketones, etc.), by sampling the headspace of lab standards. Some of them were characterized by boiling points higher than 150°C, such as 1-Hexanol (B.P. 157°C) and Pinene (B.P. 166°C).

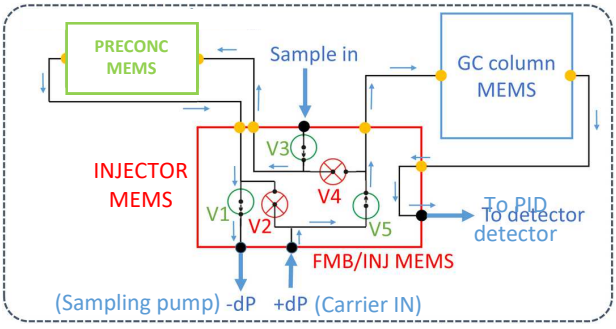

Fig. 1: "ODOR-GC" system architecture.

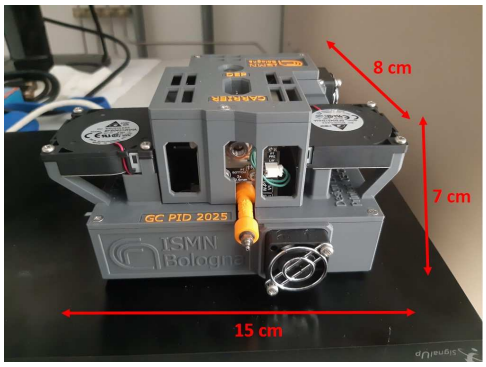

Fig. 2: "ODOR-GC" mini gas chromatograph.

References

[1] S. Zampolli et al. (2020). Compact-GC platform: A flexible system integration strategy for a completely microsystems-based gas-chromatograph. *Sensors and Actuators B: Chemical*. Vol 350, 127444.