

## Air Sampling and Pollution Sensing Research at SMART|ATMOSIM\_LAB

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To get better insights of atmospheric air pollution, it is desirable to have high spatial and temporal resolution of analysis, as well as low detection limit and high sensitivity. Research grade equipment have low detection limit, high sensitivity, and usually fast response time, but their spatial resolution is limited. usually they are fixed at location, They can be mounted on ground (cars), sea (boats) or aerial vehicles (zeppelins planes, space satellites) which increase spatial resolution, but still, it is not well suited for example for use in urban environment to evaluate pollution gradient from source (streets). To achieve high mobility, instrument sizes should be much smaller, which will allow their placement on more flexible platforms (such as drones).

Modern miniaturized gas sensors are based on several technologies, which are being developed and advanced rapidly, namely semiconductor, electrochemical catalytic or miniaturized optical-spectroscopic based sensors. They have much lower price than lab equipment, but currently they are lacking sensitivity and selectivity in some cases. Despite these drawbacks, our comparisons show promising results. Also, powerful modelling and machine learning approaches can be used to increase quality of data gathered from sensors [1].

Another disadvantage of research grade instrument is their high price and maintenance costs, which limits their deployment. This limitation could be however somewhat alleviated by using air sampling canisters at desired locations, then bringing them back in the lab to analyze, granted highly active species such as ozone, or other radicals cannot be measured this way, because they will degrade very quickly.

To get representative sample, air should be collected in a certain duration (few minutes to few hours depending on the requirement). Also, it is important, to have relatively constant flowrate inside the canister. Since ordinary needle valves cannot limit flowrate in wide range of values, special flow restrictor frits are used, designed to give fixed filling time for the given volume of sampling canister. Flow restrictor is also often equipped with filters (frit is very sensitive to the dust) and optional pressure gauge. This restrictor works well, but they are quite expensive (on top of expensive canisters itself) also it is not very convenient to vary sampling time. Our approach towards this issue is to use pieces of gas chromatography or capillary electrophoresis capillary columns, which are cheap and convenient in use.

### References

- [1] Jibuti G. Chankvetadze B. Botchorishvili R. Mchedlishvili D. Wahner A. Kiendler-Scharr A. Rohrer F. Application of smart gas sensors for monitoring of atmospheric air quality in urban areas – **Euroanalysis 2019**, Istanbul, Turkey, September 1-5, 2019.

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