EVALUATION OF SELECTED PORTABLE SOLUTIONS FOR ASSESSMENT OF INDOOR AIR QUALITY

1. Introduction and objectives

- The interest in indoor air quality (IAQ) has increased over the past years because of awareness of its direct relationship with the health and comfort of building occupants [1].
- This trend is reflected in the increasing number of commercially available sensors aimed at monitoring air purity and characterizing the levels of pollutants in air [2].
- Although a huge variety of sensors are available on the market, appropriate selection of sensors remains challenging, particularly for measurement of pollutants at low concentrations [3].
- The present project aimed to select some relevant transportable solutions that allow online analysis of selected IAQ markers, by evaluating commercially available sensors and direct reading technologies with appropriate analysis selectivity.

2. Evaluation approach

In order to assess the impact of smoke-free products on IAQ, an environment-controlled exposure room was built at the PMI facility and equipped with an analytical platform (4 validated and accredited methods covering 28 analytes) [4–7]. This facility was used for the assessment of real and near real time sensors.

3. Near-real-time observations

- Good agreement with reference values determined for highly polluted environments (e.g., ETS of MLG; 3 CC/N).
- Near-real-time profile for BTEX chemicals.
- Not sensitive enough to measure BTEX at very low concentrations (e.g., EA of THS 2.2, background samples).
- New sensors were also added to the platform: 
  - Electrochemical sensor: CO
  - Light scattering: particles
  - PTR-MS chemical profilerelease

4. Real-time results – snapshot & observations

- Average results show good correspondence with reference values.
- Bias observed at higher concentrations.
- Dedicated development enabled establishment of a control methodology for calibration of the electrochemical sensor.
- Good reliability of two real-time PM2.5 sensors, with similar results in a low pollution environment and good agreement with the reference findings.
- Sensor A showed good alignment with the reference methodology in a polluted environment.
- Sensor B showed bias relative to the reference methodology in a highly polluted environment.
- PTR-MS chemical profile release:
  - Allows emission profiling of a broad range of volatiles of different nature (usually requires analysis by different analytical techniques).
  - Although the quantification results showed differences from the reference results, the technique allows a good estimation of the concentration ranges of pollutants present in air.
  - Transportable solution rather than portable.
  - Expensive equipment.

5. Conclusion

Online or near-real-time quantitative analysis of pollutants at low levels in indoor air remains a challenge. However, as this technological field evolves rapidly, the limitations observed today might be overcome tomorrow.

The approach used in this study enabled selection and characterization of transportable solutions and can now be used to complement the current analytical capability for IAQ assessment.

A portable solution was identified for CO analysis.

The portable GC-MS instrument offered an opportunity to monitor the presence and abundance of volatiles, even at low concentrations, and enabled their identification.

PTR-MS allowed the monitoring of a wide range of chemicals, including highly volatile compounds such as formaldehyde.

References

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