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ABSTRACT

FIRST DEVELOPMENT OF A GAS SENSOR ARRAY FOR MONITORING AMMONIA SURFACE EMISSION FLUX FROM GRASSLANDS

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Summary

Nitrogen is used in agriculture to fertilize croplands. During the spreading of fertilisers, a substantial part of Nitrogen is lost by volatilization of ammonia (NH_3). These emissions are responsible for unpleasant odours but are also mainly precursors of particulate matters (PM). In Europe, agriculture is one of the main source of nitrogen-composed PM. There is a need to collect more emissions data to understand better this activity impact. Measurement techniques of NH_3, used for ambient air quality monitoring, are expensive and heavy to manage for the agricultural sector. Other techniques, less expensive, like passive sampling are also used to estimate ammonia flow but these are not adapted for a continuous monitoring. It's why we suggest to customise our usual e-nose devices to ammonia emissions from fertilized grasslands.
The sensor array is built using seven commercial metal oxide semiconductor sensors. The sensors are inserted radially and evenly into a small size cylindrical PTFE chamber. Five of the selected sensors are sensitive to ammonia, one is sensitive to VOC and the last one is for combustible gas. The sensor conductance, the temperature and the humidity are recorded. A pump is used to suck air out of the sensor chamber, the flow being regulated at 100ml/min.
The methodology is firstly developed in the lab. In order to test the basic properties of the array, we perform experiments with known NH_3 concentration (40ppm in gas cylinders, Westfalen). Ammonia is fed into a system using mass flow controllers and commercial analytical air cylinder to dilute the gas down to the ppb level. Synthetic air is humidified at different values and at various temperatures. After the steps with synthetic gases, real samples are considered. They are collected in Nalophans bags disposed at the exit of a wind tunnel. The tunnel is deposited on the grasslands before and after fertilizer spreading. At least 4 bags are collected simultaneously: one for the sensor array, two for NH_3 colorimetric measurement after bubbling in acid and after passage on acid coating filter paper and the last one for dynamic olfactometry.
Sensors raw data are pre-treated using a code written in R language. Afterwards, multivariate analyses are used for the quantitative and qualitative evaluation of the array performances.
The preliminary results show that the array is able to discriminate samples with various compositions and NH_3 concentrations (validated by colorimetric analysis). Furthermore, the relationships between NH_3 and odour concentration is also studied.

Indicate preference of kind of presentation

☐ Oral Communication

Indicate topic of your work for the conference:

☐ Odour/VOC measurement, monitoring&sensor technologies.
☐ Odour/VOC from waste water, sewer systems and livestock.