Use of an array of MOS sensors coupled to SPME for the characterisation of wines. Analysis of the role of the carrier gas.

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The detection of alcoholic beverages with arrays of resistive sensors is a challenging problem due to the notorious sensitivity of resistive gas sensors towards water and ethanol present in the headspace of the samples [1]. Several works have been published where sampling methods (such as Solid Phase Microextraction) that work using inert gases have been combined with an electronic nose [2]. However, oxygen plays a key role in the mechanism of detection of MOX sensors and the behaviour of the sensors in the absence of oxygen is not yet well understood.
This paper investigates the response of MOX sensors upon exposure to wines in the presence of different gas carrier backgrounds including air, nitrogen and helium. The influence of the gas in the resistance of the sensors, and in the intensity, kinetics, repeatability and reproducibility of the responses has been analysed.
Sensors exposed to nitrogen or helium increased their conductivity drastically due to the displacement of the oxygen adsorbed at the surface of the sensors. In contrast, the intensity of the responses (expressed as % R/Ro) is similar in the presence of the three carrier gases. The carrier gas plays an important role in the kinetics of the response, and signals registered under oxygen background are faster than those observed in the presence of N_2 or He, indicating that it is easier to displace the oxygen than the inert gases from the sensor surface. Finally, the presence of inert gases cause irreproducibility of the responses, particularly in the case of helium that decreases drastically the lifetime of the sensors. These results demonstrate that the presence of oxygen in the sensor chamber is necessary to the good performance of the array of sensors.
A system has been developed that allows a previous desorption of the volatiles under an inert gas, followed by an injection of air. This method makes possible that mixtures air/inert gas reach the sensor chamber instead of the pure inert gas. Using gas mixtures a drastic improvement of the performance of the array of sensors has been attained; and the kinetics and the reproducibility are clearly improved with respect to the use of pure nitrogen or helium. The array of MOX sensors coupled to Solid Phase Microextraction has demonstrated a good-quality ability in discriminating wines elaborated from different varieties of grapes.

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