Detection of volatile sulfur compounds

R+D Result

Patent

Knowledge Area

- Analytical Chemistry
- Safety
- Health
- Ambient Air Testing

Collaboration

- Technology available for licensing
- Other collaborations

Ref. OTRI
201605R-Molins, C.

Passive sensor for detection of volatile sulfur compounds

Inventors:
Pilar Campins, Carmen Molins, Yolanda Moliner, Rosa Herráez, Jorge Verdú, Neus Jornet and Ana Isabel Argente (Universitat de València).

Background: Volatile sulfur compounds such as hydrogen sulfide (H_2S), methyl mercaptan (CH_3SH) and dimethyl sulfide ($(CH_3)_2S$) are toxic gases, harmful to the environment and health. The main amounts of hydrogen sulfide and other volatile sulfur compounds are generated as a result of industrial activities such as processing and refining of oil / natural gas, wastewater treatment plants, landfills, etc. They also can be found in biological samples, such as breath, being responsible of halitosis.
For the determination of volatile sulfur compounds in situ and in real time, one possibility is to use active sampling techniques such as commercial colorimetric tubes. These dispositives require an external source of energy, thus an additional cost of energy and money needs to be considered. Regarding passive sensors, few options exist for detecting volatile sulfur compounds because some drawbacks such as excessively high detection limits, low reproducibility or the toxicity of the reagents employed. For halitosis detection a halitometer is used, which is a portable instrument that measures quantitatively the volatile sulfur compounds found in the mouth but it is inaccessible to the consumer due to their high cost.

The invention: Researchers at the University of Valencia have developed a **passive colorimetric sensor for in situ detection of volatile sulfur compounds** with detection limits of 45 ppb, making it suitable to use in the detection of sulfur compounds in real atmospheres. The sensor is passive so does not need any pretreatment, or power supply or external instrument. The sensor is further characterized by its safety to the environment, its stability against a wide range of temperatures and to humidity and solar radiation, and its resistance to reversion, so that the sensor response is stable over time. The sensor is useful for the determination of volatile sulfur compounds in any type of matrix in which volatile sulfur compounds are present or generated, allows in situ and in real time monitoring and with good sensitivity. Moreover, the sensor has an appropriate selectivity since other volatile compounds such as amines, ethanol or acetone have been found not to interfere with the detection. Once the sensor is colored, the color intensity can be monitored by i) visual inspection, ii) digital analysis of the values of red, green and blue (RGB) from a photograph of the sensor obtained by a recording device or image capture as a mobile phone, iii) absorbance measurement by diffuse reflectance.

Applications: The sensor developed is applicable as method of point of needed for the detection of bad breath that may be associated with periodontitis or gingivitis and **environmental control** systems for the detection of hydrogen sulfide in critical locations (wastewater treatment plants, landfills, drains, pipes, oil processing, etc.).

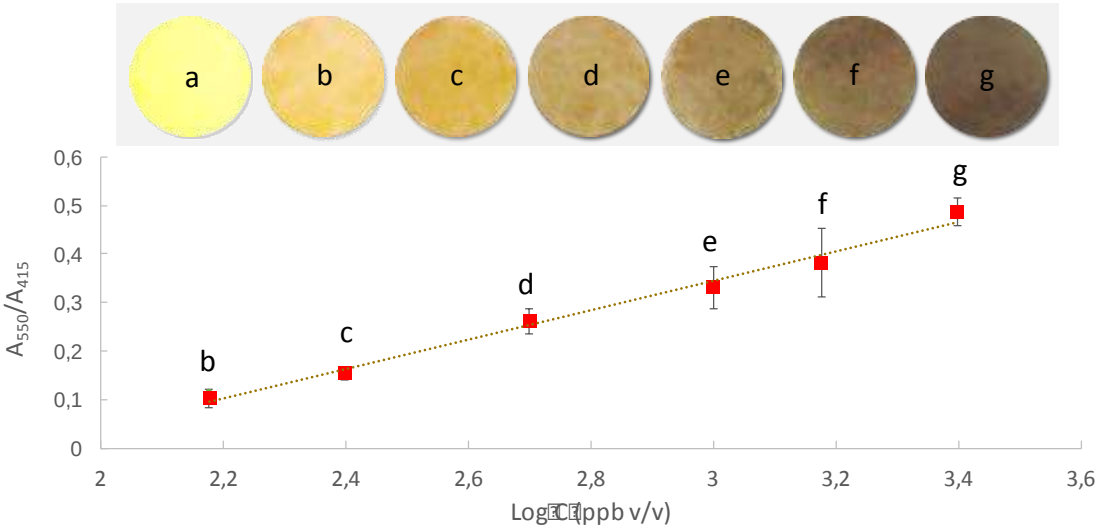
Advantages: The main advantages provided by the invention are:

- **Simplicity and ease of use**: it is a passive colorimetric sensor that does not require any kind of pretreatment or power supply or external instrument.
- **Low cost**: simple fabrication process without high costs.
- **Low detection limits**: of the order of 45 ppb v/v.
- **Quantitative detection**: direct quantitative detection can be carried out by diffuse reflectance of the sensors.
- **Stability**: the sensor remains stable for a period of 3 months. Reversion resistance.
- **In situ and in real time monitoring**: the response of the sensor is obtained in just 10 minutes.

OTRI oficina de transferència de resultats d'investigació

Avda. Blasco Ibáñez, 13
46010 Valencia (España)
Tel. +34 96 3864044
otri@uv.es
www.uv.es/otri

Additional information



Sensor's photographs and calibration curve

Sensor Specifications	
Gases measured	Volatile sulfur compounds (H_2S, CH_3SH, $(CH_3)_2S$))
Detectiion limit	45 ppb [a] 75 ppb [b]
Membrane material	Nylon with AgNPs
Response Time	10 min
Operating Temperature	Room Temperature
Dimensions	d = 0.45 mm
Determination	UV/Visible Reflectance[a] Digital imagen analysis [b]