

COLORIMETRIC SENSOR FOR DETECTING HYDROGEN CYANIDE

DESCRIPTION OF THE INVENTION

Both cyanide anion in solution (CN⁻) and hydrogen cyanide as a gas (HCN) are contaminant molecules, extremely toxic and dangerous in physiological systems as well as in the environment. Currently there are many colorimetric sensors for detection of CN⁻, however they generally do not offer adequate selectivity in the presence of other pollutants. Regarding the detection of HCN, colorimetric systems marketed so far use an indirect route for the detection, with a pH indicator which detects the HCl generated by the reaction of HCN with HgCl₂. The use of this type of mercury salts generates a significant pollutant load, what makes especially interesting looking for new effective and environmentally friendly alternatives.

Researchers from Universitat de València have designed new colorimetric sensors for CN⁻ and HCN, which have excellent selectivity and detection limits within the commonly accepted security ranges. For both applications, the invention is based on the use of a diphenylmethane-quinone compound. For the specific case of HCN gas, the compound is deposited on a solid support of basic nature. The correct choice of the compound has allowed obtaining a carbon center with electrophilicity suitable for the cyanide anion. This compound, unlike other similar commercial molecules, maintains its characteristics and reactivity once deposited on a suitable solid support. Thus, researchers have designed the first colorimetric sensor for gaseous HCN, with direct reaction.

BUSINESS APPLICATION SECTORS

Chemistry and safety: The invention is applicable to the fabrication of sensing devices, especially as personal protection systems. These systems are useful in various industrial sectors that generate HCN (wood, plastic, steel, jewelry, mining, petrochemical, etc.) as well as in public buildings susceptible to attacks (stations, airports, etc.)

TECHNICAL ADVANTAGES AND BENEFITS

The main advantages provided by the invention are:

- **Detection Limits:** The direct reaction between the sensor and the HCN leads to a marked color change with detection limits below 1 ppm.
- **Selectivity:** in the presence of other gases such as CO, HCl, NH₃, H₂S, at concentrations up to 50 ppm
- **Environmentally friendly:** no heavy metals used.
- **Reversibility:** The reaction is reversible by irradiation with UV light so it can be reused in successive cycles
- **Minimizing false positives:** Regeneration by UV radiation occurs only if the sensor reacted with HCN.

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DEVELOPMENT STATUS

The technology has been validated in laboratory, and currently the research group is working on its development and scaling.

INTELLECTUAL PROPERTY RIGHTS



















The technology is protected through the following patents:

Spanish patent application P201201271, titled "Método colorimétrico de detección del anión cianuro".

COLLABORATION SOUGHT

- License agreement, manufacturing or marketing.
- R & D project to complete the development or apply to other sectors.
- Subcontracting agreement with another company.
- Possible spin-off (looking for partners)

RELATED IMAGES

Blank	Qty. of 1 ($\mu\text{mol}/\text{cm}^2$)	HCN	H ₂ S	CO	HCl	NH ₃
	25					
	2.5					
	0.25					

Color differences for 3 sensors with different concentrations of diphenylmethane-quinone compound, with samples of HCN, H₂S, CO, HCl and NH₃.

CONTACT

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