E34 A Vapochromic Colorimetric Sensor for the Cross-Contamination of Volatile Organic Compounds (VOCs)

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Learning Overview: After attending this presentation, attendees will be more aware of the developments with novel colorimetric sensors that can be used to determine cross-contamination of VOCs that may occur through canine training aid storage.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by introducing a novel, inexpensive, field-portable vapor sensor that will allow for the improved storage and implementation of training aids, resulting in increased efficiency and reliability of canine teams.

Similar chemicals are often stored together in enclosed spaces with little thought to possible cross-contamination. In most cases, the contamination of trace levels of VOCs is not a significant cause for concern. However, it is relevant in the case of canine scent training, as a canine's superior sense of smell is very likely to detect this contamination, even at trace levels, while humans often remain unaware of the contamination, contributing to inefficient training. Canine training aid kits contain multiple chemicals stored at a variety of temperatures and conditions that could lead to cross-contamination of co-located training aids, and subsequent use of these aids may eventually result in less reliable canine units. Thus, the need for a simple, field-portable, vapochromic sensor to determine the cross-contamination of VOCs within canine training aid kits is addressed.

The development of a vapor sensor is proposed, which produces a rapid colorimetric change when in the presence of certain volatile chemicals. Solvatochromic compounds, which change color when dissolved in solvents with different polarities, are used as indicators and deposited onto a cellulose substrate. This substrate was chosen due to its wide availability, biodegradability, low cost, and ease of use and disposal. The sensors' solvatochromic properties are then translated to vapochromic capabilities by exposing it to the vapors of the analyte of interest, instead of directly interacting with a solvent. The indicator reacts with a VOC that is similar in vapor pressure to the most volatile compound inside the canine training kit of interest to produce a rapid change in color visible to the naked eye. To increase vapochromic response and device sensitivity, the solvatochromic compound can be incorporated into an adsorbent matrix that would allow the VOC to condense and concentrate near the indicator. This design will allow the sensor to present a comprehensible and unambiguous visible response to the release of VOCs within a closed container, which is indicative of possible cross-contamination of adjacent canine training aids. It can be readily incorporated into existing training kits and will function as a straightforward reminder of when training aids need to be changed or a new containment system should be considered. Moreover, this sensor has the potential to be implemented in other enclosed spaces with the need to determine cross-contamination, such as food storage areas, industrial storage units, and law enforcement evidence lockers.

Colorimetric Sensors, VOC Cross-Contamination, Solvatochromic/Vapochromic

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