

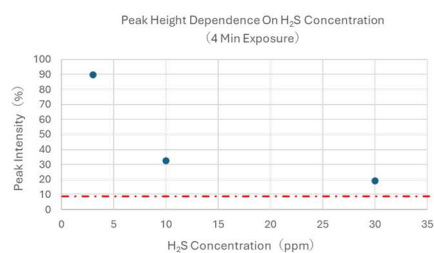
About a year has passed since we reported on the use of a drone for monitoring H₂S in sewage tunnels. Since then, we have been waiting for an opportunity to conduct a real field test. That opportunity came this past March. We were allowed to accompany a drone team inspecting a sewage tunnel at a water treatment plant. As time was critical during such inspections, we were granted only one flight, but it proved to be an extremely valuable opportunity. We mounted a Nano-Kraft SERS substrate onto the drone, which was then lowered into a sewage tunnel through a manhole. Once at the bottom, it was skillfully piloted by a veteran operator (shown on the right). The drone hovered for several minutes at a key junction before returning.



After the flight, we retrieved the substrate and took its spectrum on-site in the trunk of the blue car shown on the right. Incidentally, this vehicle is one of very few hydrogen fuel cars one can buy. The fact that it came with a 100 V outlet proved very convenient for our experiment.



By comparing the acquired data with reference data obtained in our lab, we estimated that the H₂S concentration was slightly above 30 ppm. It was as simple as that, attaching a SERS substrate to a drone, positioning it at a point of interest and taking a SERS spectrum after the flight. Isn't it neat?



While we cannot disclose all technical details at this stage due to an ongoing patent application, it is based on the principle that exposure to H₂S of a SERS substrate affects the performance of the SERS substrate, depending on both concentration and exposure time. Its dynamic range, we estimate, can be tuned from a few ppm to hundreds of ppm. To be sure, it is not a real-time monitoring technique, but it offers a significant weight advantage. Conventional H₂S monitors typically weigh 100 g and more. The drone we used is a compact machine weighing only 243 g to allow it to operate in confined spaces where payload limitations are critical.

We still need to work on a few issues. For example, we aim to obtain data from multiple spots within a single flight. We are thinking of mounting multiple SERS spots that can be sequentially exposed. We also plan to validate our method at various locations with a broader range of H₂S concentration. Furthermore, we must study the influence of other environmental factors. This work has the potential to develop into a highly promising and intriguing project.