Development of Smart RoMS for Monitoring of NH$_3$ in Deodorization system for Restrooms using MOX based gas sensor and signal analytics

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ABSTRACT

Objective: Detection and monitoring of ammonia (NH$_3$) in the restrooms is necessary for the smart toilets. To maintain the cleanliness in the restroom various gaseous needs to be monitored, among these gaseous ammonia is the major gas for pungent odur. It is reported in the literature that if the ammonia level crosses beyond certain threshold (10 ppm), then it is considered as bad odur and indicates need of cleanliness in the restroom. This work presents the signal conditioning and electronic interface developed for Figaro's Metal Oxide based ammonia gas sensor (TGS-2444). The requirement of the deodorization unit is that the ammonia concentration to be monitored in the restroom and if the ammonia concentration goes beyond the threshold then signal should be generated to actuate the UV lamp (to deodorize the ammonia).

Methods and materials: The Tin oxide (SnO$_2$) based sensing element is heated by the in-built Ruthenium oxide (RuO$_2$) based heater for more than 2 days. The sensor requires application of a 250 ms heating cycle, which consists of high state (4.8V) applied to heater for the first 14 ms, then followed by low state (0V) pulse for the remaining 236 ms. The sensing cycle comprised of 0 volt for the first 2 ms, then 5 V for next 5 ms and finally 0 volt for the remaining 243 ms. For achieving optimal sensing, the detection point is measured after the midpoint of 5 ms pulse.

Results: The developed RoMS system consists of sensor activation pulses. The sensor is exposed to three different concentrations of ammonia gas i.e. 10 PPM, 20 PPM, 30 PPM and the response of the sensor for these concentrations is studied for monitoring the bad odur in the restrooms.

Conclusions: A complete embedded system named RoMS for the detection of NH3 gas using a MOX based Figaro's gas sensor (TGS-2444) has been developed at CSIR-CEERI, Pilani. Every part of the system has been characterized and tested in laboratory.

Keywords: Restroom odur monitoring system (RoMS); MOX based gas sensor;