REVOLUTIONARY DIAGNOSTICS – NONTRADITIONAL APPROACHES FOR DEVELOPING BREAKTHROUGH CAPABILITIES AGAINST EMERGING THREATS

Optimizing Portable Metal Oxide Nanosensors To Analyze Exhaled Volatile Organic Compounds (vocs)

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Volatile organic compounds (VOCs) in breath have been identified as biomarkers for emerging viral and bacterial infections. Gas chromatography-mass spectrometry (GC-MS) is generally used to quantitatively profile VOCs. The results from GC-MS can be used to develop electronic nose (e-Nose) devices integrated with metal oxide (MOx) sensors that are highly stable, sensitive to a broad range of VOCs and offer rapid detection and portability for point of care applications. To fully optimize and qualify MOx sensor arrays for breath analysis, the current study explored different operating parameters including heater voltage, sensor voltage, sensor housing, breath fractionation, and exhalation volumes. Experimental findings show high process efficiency and reproducibility when exhaling into the sensing system. The optimized sensor array has shown high reproducibility for intraday analysis (relative standard deviation (RSD) of sensor response equal to 4.8%). Additionally, the sensor system could completely distinguish VOC signatures of healthy and disease simulated breath samples. Results from the degradation study showed the sensors had a stable response when exposed to breath samples over the course of more than 100 uses. The qualified MOx sensor array will be used to measure healthy VOC baselines, and the sensor results will be correlated with GC-MS analysis to attribute sensor responses and features to specific breath biomarkers. Ultimately, the MOx sensor array can be integrated into portable and scalable systems to provide sensitive, rapid, and noninvasive diagnostics for emerging infectious diseases and other medical conditions.

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