

Technology Brief

A platform sensor technology for analysis of volatile organic compounds

VOCSense Overview

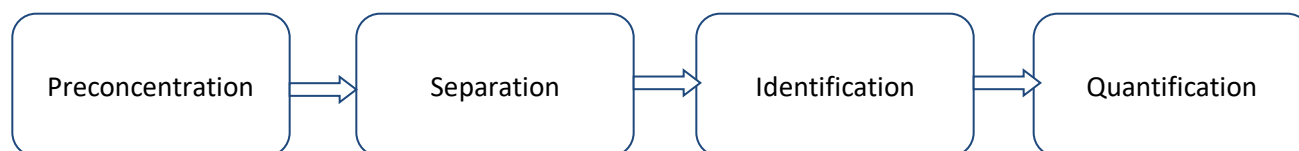
Volatile organic compounds (VOCs) are carbon containing molecules that have low boiling points and high vapor pressures causing them to evaporate into gas phase at ambient conditions. A wide range of VOC analysis devices are used in various industries for occupational exposure monitoring, environmental monitoring, process control, detection of explosive compounds, and medical diagnosis. Gas chromatography mass spectrometry (GCMS) is the gold standard method for analysis of VOCs. However, these systems are bulky, expensive, and sophisticated laboratory instruments that require skilled professionals for operation. ProTech's VOCSense is a sensor-based analysis technology that resembles the functionality of a gas chromatography mass spectrometry system. VOCSense can identify and quantify individual VOCs from normal air samples.

Benefits

- Enables VOC analysis in multiple form factors: fixed location, handheld, and wearable
- Identifies concentrations of individual VOCs in a complex sample
- Provides near real-time sample analysis
- Allows for operation by untrained personnel
- Present minimal interference from humidity

Key Differentiator

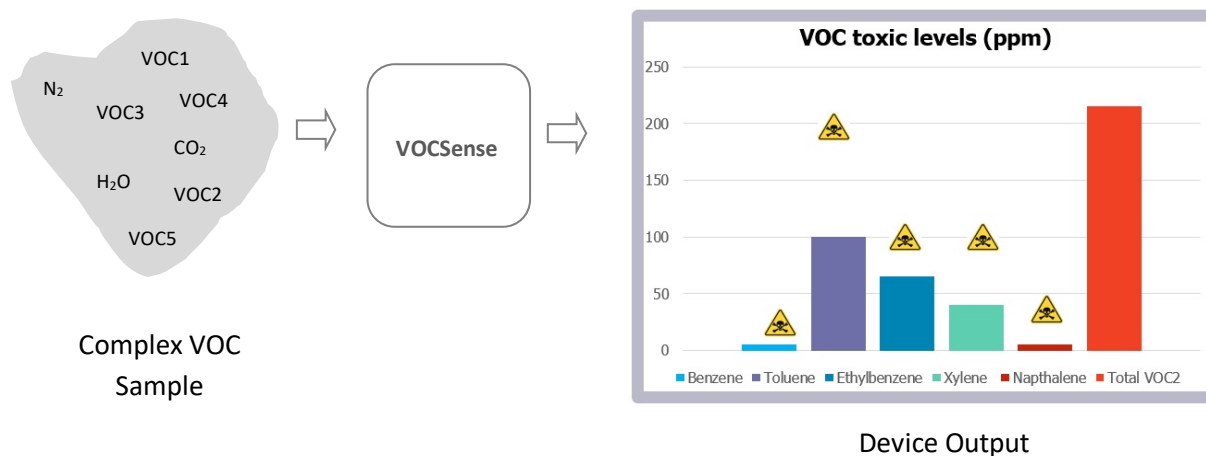
Analysis steps of VOCSense are shown below.



Analytical steps of VOCSense are similar to the processes in gas chromatography mass spectrometry (GCMS) method. However, the technological approach used in VOCSense differs from the GCMS and these steps are performed on a single chip with the assistance of external supporting electronics (Note: VOCSense is not a miniaturized GC). Other state-of-the-art sensor technologies (such as PIDs) do not

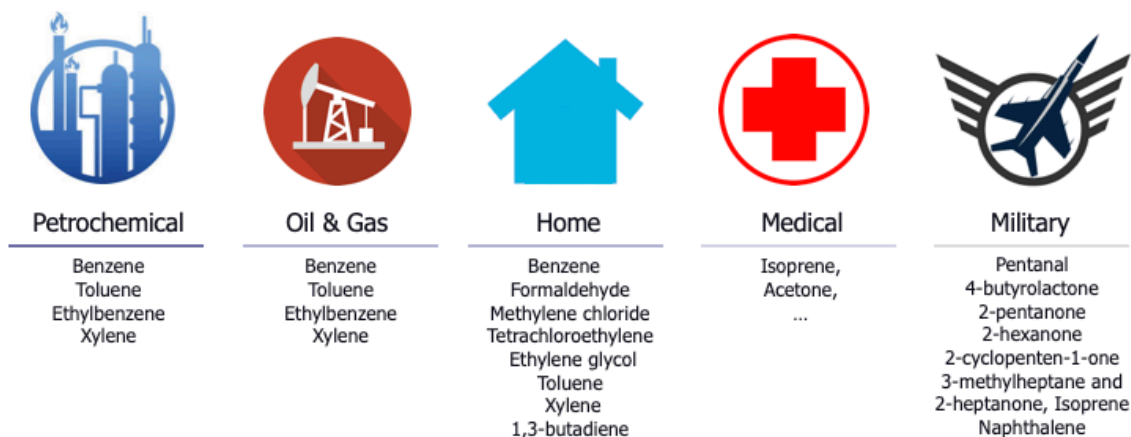
have the ability to separate and identify individual compounds. This is the key differentiator of VOCSense device compared to the existing sensor-based technologies. Due to this limitation of the current sensors, a GCMS is used as a standard method of analyzing VOC samples.

A typical VOC sample consists of a multiple unknown VOCs at trace level concentrations. Following illustration shows the high-level functionality of VOCSense.



VOCSense Potential

VOCSense is a platform technology that can be used to detect a wide variety of VOCs in various applications. VOCSense is a transformative technology that can be applied to the sensing needs for home health, industrial processes, and exhaled breath analysis. Preliminary research indicates that the sensor can be easily configured to identify the following compounds. However, more work is needed to fully evaluate its capabilities.



Sensor Evolution

	Laboratory Prototype	Optimized Gen2 Prototype	Miniaturized Prototype
	<i>August, 2018</i>	<i>July, 2020</i>	<i>June, 2021</i>
Limit of Detection	~1ppm	~0.1ppm	<0.1ppm
Cycle Time	~1 hour	~5 minutes	<60 seconds
Complex Mixtures	Yes	Yes	Yes
Fabrication Method	Off-the-shelf components	Custom design Off-the-shelf components	MEMS
Form Factor	Benchtop	Stacked PCB ~60mm x 80mm x 50mm	~60mm x 30mm x 10mm
Power Source	24V, 1A wall adaptor	12V, <500mA wall adaptor	3.7V LiPO Battery