

## Volatile Organic Compound Detection

Defiant Technologies is developing a handheld system to detect volatile organic compounds in air and water. Figures 1 and 2 show results on our handheld system for BTEX and TCE. The system is comprised of a tortuous path micro preconcentrator, a two meter LIGA fabricated micro GC column, and a SAW sensor. The red trace in each graph shows the power on the preconcentrator. When the preconcentrator is energized or fired, it releases all of the chemicals it collected during sample collection. The blue trace shows the response from the SAW. The data in figure 1 shows results for a one minute sparge of water spiked to a concentration of 50ppb BTEX. As can be seen from the data, the GC analysis is completed in approximately 2 minutes. This means that the entire analysis cycle including sparging the

water takes 3 minutes. For figure 1, the GC was ramped from 30 °C to 90 °C over the 2minute analysis cycle. The flow rate is approximately 2milliliters per minute. For figure 2, the GC was ramped from 45 °C to 90 °C with a flow rate of 3 milliliters per minute. Thus far, Defiant has tested the system with vinyl chloride (VC), cis-1,2-dichloroethene (cisDCE), trichloroethene (TCE), tetra-chloroethene (PCE), benzene, toluene, ethylbenzene, and xylenes (collectively BTEX).

Microsystems can be emplaced where regular bench top analysis systems cannot. A microsystem for VOCs can be packaged to fit down well to detect contaminants in situ. The system is low power enough to operate in remote locations with remote power solutions.

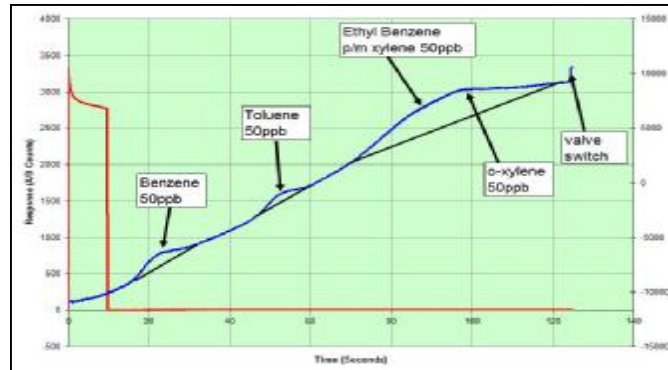


Figure 1: 50 ppb BTEX was sparged from 5mL water in one minute and detected by our microsystem.

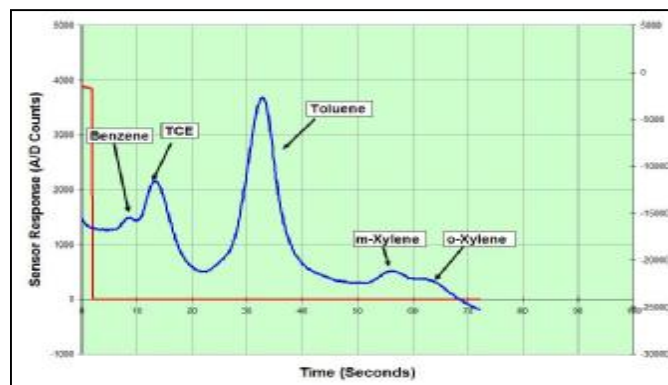


Figure 2: This is a gas phase collection of BTEX and TCE. Benzene can be distinguished from TCE using this microsystem.

## Smart Sample Collection

This prototype represents the first of Defiant's products that intelligently collects a sample. What is intelligent sample collection? The system takes a small initial sample and analyzes it to determine the sample volume for a complete GC analysis cycle. Therefore, if the concentration is high, the system will automatically collect a smaller sample volume for GC analysis. If the trial sample concentration is small, the system can collect for a longer period of time. Therefore, the system as a whole is protected from high concentrations to minimize

down time and auto dilution for samples to keep the results within the system calibration range. Figure 3 shows the gas module used to collect the data shown in figures 1 and 2.

Intelligent sample collection is something that can be applied to many chemical analysis problems and some of those applications are already under development.

Defiant can provide this gas module for OEM applications.

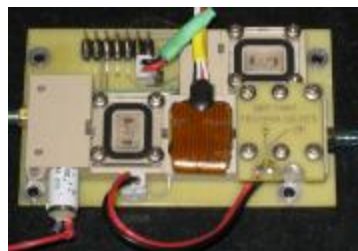


Figure 3: Above is the gas module used to collect the data shown in figures 1 and 2. This module uses 2 SAW detectors: one in the bypass collection sample train and one in the GC analysis train.

### Special points of interest:

- Detection of VOCs in water samples
- Detection of VOCs in air samples.
- Intelligent sample collection to prevent overwhelming the system with high concentrations.
- BTEX, TCE, PCE, VC, cisDCE have been successfully tested on the system.
- Ambient air is the carrier gas, no need for specialty gases.

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