FoodEngineering

Innovation: Engineering R&D

Defense technology now applied in the food industry

October 7, 2014 *– By Wayne Labs, Senior Technical Editor*
MIT-Lincoln Laboratory research into rapid screening for anthrax and other dangerous pathogens has found its way into the food industry to detect both airborne and surface pathogens.

Remember the anthrax-tainted letters soon after 9/11? "Five Americans were killed, and 17 were sickened in what became the worst biological attacks in US history," states the FBI article, Amerithrax or Anthrax Investigation. Postal workers suffered most of the consequences since they handled the tainted mail before anyone else. Something needed to be done — and fast — to find a way to quickly detect biological agents that could be sent through the mail or released into buildings.

The Department of Defense (DOD) secretly contracted researchers at MIT Labs to find detection solutions that were sensitive enough to spot killer bugs such as anthrax or ricin, and to spot them before people were exposed to them. In the same way consumers enjoy products that have come out of high-tech research for the military, this new technology has found its way into commercially available products that spot both airborne and surface bacteria, which are especially problematic to the food industry.

PathSensors, Inc., an environmental testing company, licensed some of this MIT technology and has been developing tests to find pathogens quickly in the infectious disease and bio-defense sectors. Located at the University of Maryland BioPark in Baltimore, the new company was awarded a $5 million contract in January 2011 by the DOD to monitor interior building environments so people could take action if biological agents were released.

Since then, the technology has grown rapidly and now consists of hardware, software and biosensors. Already well established in applications outside the food industry, it seemed natural that the technology could be applied within the food industry—first to monitor the environment for airborne pathogenic bacteria and then for food contact surfaces and food products. FE met with PathSensors' CEO Ted Olsen at BNP Media's Food Safety Summit to discuss what this technology can do today and where it is headed. Olsen has 35 years of experience managing new product development, as well as building and expanding high-technology manufacturing companies. He is a member of the Maryland Life Sciences Advisory Board and on the board of advisors at the Pennsylvania State University School of Engineering.

Ted Olsen, president and chief executive officer, PathSensors, Inc. Source: PathSensors.

PathSensors' Zephyr pathogen identifier incorporates CANARY technology and provides rapid, sensitive and specific identification of biological threat agents (bacteria, viruses and toxins) from surface samples. Source: PathSensors.

FE: How did PathSensors get started?

Olsen: PathSensors was founded in November 2010 in Baltimore. We choose Baltimore due to the availability of a highly skilled workforce and the ability to collaborate with the researchers at the University of Maryland School of Medicine. PathSensors has an exclusive license for CANARY® technology, which was developed by MIT-LL under a DARPA [Defense Advanced Research Projects Agency] research contract. CANARY is an acronym for Cellular Analysis and Notification of Antigen Risks and Yields.

FE: You originally provided equipment to government agencies concerned about biological attacks in their buildings. What was the original product and how does it work?

Olsen: Our first customer was the DOD. We supply systems that detect and identify the presence of biological agents in the air. CANARY's rapid time to results and high levels of sensitivity allow near-real-time identification of a biological release. The rapid test results can prevent a repeat of the consequences associated with the 2001 anthrax release at the US Capitol.

CANARY is a genetically engineered biosensor that has been modified to produce surface-bound antibodies against specific targets. The biosensor has also been engineered to produce a calcium-sensitive bioluminescent protein. When the CANARY biosensor comes into contact with its target, a signaling cascade is triggered within the cell, which causes the release of intracellular calcium and the activation of the bioluminescent protein, aequorin, to produce light.

The key advantages of CANARY are the speed of detection [two minutes] and the sensitivity [10s to 100s of cfu/pfu] provided by signal amplification.

FE: What specific technology did you license from MIT Labs?

Olsen: The family of CANARY patents licensed from MIT includes biosensors and the BioFlash instrument, which is an aerosol sampler/identifier.

FE: Once you acquired the biosensor, how did you build hardware around it to make it simple to use?

Olsen: MIT developed a prototype aerosol collection and identification system that is the design basis for the BioFlash. A year of extensive collaboration between MIT and PathSensors' engineering team yielded a small form factor, cost-effective commercial instrument. The BioFlash is as easy to use as the compact disc player in your automobile. A number of patents, which are licensed to PathSensors, have been issued on the BioFlash.

FE: How does the hardware work?

Olsen: In the presence of its conjugate pathogen, the biosensor luminesces at 460nm [the same color that a jelly fish glows in the ocean after dark]. The instruments measure the light emission and run that data through an algorithm that determines whether the sample is positive or negative.

FE: Does the existing hardware monitor environmental air in food/beverage industry facilities without any adaptations?

Olsen: The technology works the same way whether the application is food, agricultural or plant testing, screening mail or protecting a building.

FE: What pathogenic bacteria can you now monitor in food applications?

Olsen: We have biosensors for Salmonella, Listeria and E. coli and are finishing development on a Campylobacter product.

FE: Do you have tests for food contact surfaces and food products?

Olsen: Our Zephyr product line is designed for swab samples from food contact surfaces as well as enrichment broth from food matrices. Due to the sensitivity of our biosensor, much shorter enrichment times are required to identify a fraction of a cfu in a food sample.

FE: How fast are the tests for food contact surfaces and food product compared to airborne tests?

Olsen: Recently completed third-party validation testing of our anthrax powder assay confirmed a five-minute time to results and a 500 cfu limit of detection [LOD]. No immunoassay or PCR product on the market delivers those levels of sensitivity in five minutes. Our food products have similar levels of performance.

FE: How many different bacteria can you monitor at once with the food contact surface/food product test?

Olsen: The BioFlash collects 16 identical samples in a test cartridge, which is configured for the pathogens of interest to the customer. Typically, a cartridge includes a positive and negative control and sufficient reagents for up to seven agents. Normally, a test is performed in duplicate in the cartridge, making our false positive rate less than 0.0005 percent.

FE: How quantitative are these tests?

Olsen: Our instrumentation is designed to detect the presence or absence of a pathogen. In some applications, we are determining high versus low levels of contamination. The system is not designed to be quantitative.

Food processors determine test protocols based on their operations and FDA regulations. We supply the tools to execute the test protocols.

For more information, visit www.pathsensors.com