RTI INTERNATIONAL | Commercialization

Low-Cost Airborne Biological Contaminant Sensor

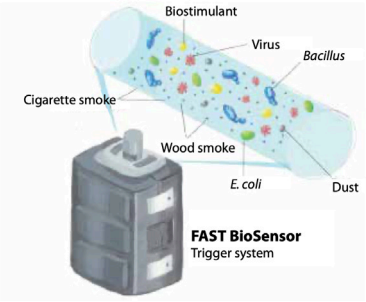
REAL-TIME DETECTION OF BACTERIA, VIRUSES, AND FUNGAL SPORES

THE PROBLEM

Existing contamination identification sensors are too costly for general use

Aerosolized bacteria, viruses, and fungal spores (bioaerosols) represent sources of infection or contamination in several industries—including health care, pharmaceuticals, and food processing. In these industries, air quality monitoring is critical to the health and safety of consumers and employees. However, adequate solutions to monitor the presence of these bioaerosols in a real-time, cost-effective manner do not exist. Current bioaerosol detection solutions using fluorescence techniques can cost tens of thousands of dollars. Cheaper alternatives—such as light-scattering total particle detectors—exist, but their inability to distinguish between inorganic and organic particulates could result in undetected biological contaminants.

The FAST BioSensor provides a means for total aerosol concentration and bioaerosol detection in real time.



THE SOLUTION

Introducing the FAST BioSensor: A low-cost, rapid warning system

Researchers at RTI International have developed a novel, low-cost bioaerosol early-warning device—the FAST BioSensor—that can detect various airborne biological contaminants. Laboratory testing has shown that the FAST BioSensor can signal the presence of aerosols and bioaerosols (e.g., household dust, bacteria, smoke, and some viruses) ranging from 0.15 microns to more than 5 microns (adjustable based on application) in real time. A simple design and low unit cost enables these detectors to be used individually or to be networked in distributed arrays that will enable continuous, real-time monitoring of critical areas for the presence of airborne contaminants.

APPLICATIONS

- Health care
- Operating rooms
  - Isolation wards
  - Formulations and compounding
- Manufacturing
  - Pharmaceuticals
  - Food and beverages
- Hospitality
- Security and threat awareness

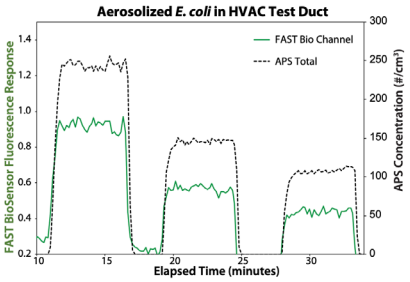
ADVANTAGES

- Passive detection in real time
- Novel capture technique distinguishes between inorganic and organic particles
- High throughput and flow rate
- Small form factor/footprint
- Minimal maintenance (quick monthly cleaning)
- Low cost to operate
- Easy to scale

THE TECHNOLOGY

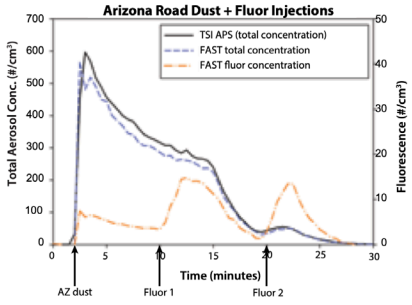
The FAST BioSensor detects airborne biological contaminants through an innovative design that uses a laser and patented technique to easily differentiate between inorganic and organic particles. When illuminated by a laser, bioaerosols that contain bacteria, viruses, or fungal spores emit photons with a characteristic fluorescence signal. Inorganic particles simply scatter the laser light without emitting fluorescent photons. As air passes through the laser inside the FAST BioSensor, fluoresced and scattered photons are collected and counted separately to distinguish bioaerosols—even in the presence of potentially interfering dust and other inorganic particles. The FAST BioSensor's novel design allows for a low-cost sensor that provides high-confidence, high-efficiency detection of bioaerosols with near maintenance-free operation.

Attribute	Current or Target Performance
Weight	4.2 kg
Power	U.S. 3-prong AC outlet with earth ground and power of 120 VAC and peak draw of 8.8 W
Laser	Enclosed 405 nm, 90 mW laser diode
Optical Particle Detection Range	Approximately 0.5 µm to 10 µm in diameter
Detection Sensitivity	250 particles / Liter
Temperature Range	12.8°C to 28°C
Humidity Range	15% RH to 80% RH (non-condensing)
Flow Rate	8 liters per minute (can be adjusted at RTI)
Sampling Interval	15 seconds (can be adjusted at RTI)
Principle of detection	Aerosol nephelometry with laser induced fluorescence for bioaerosol detection
Method of Calibration	Run TSI reference instrument and introduce standard reference materials (i.e. AZ fine test dust and PSL) into well mixed aerosol chamber
Internal Data Storage	Internal data storage capabilities
Remote Monitoring	Wi-Fi hotspot or Ethernet
Estimated Cost	$2,000 ~ $3,000 – can vary depending on required specifications



A preparation of *E. coli* bacteria was aerosolized and injected into a ventilation test duct at three different times and concentrations. In this test, because the bioaerosol used was mostly bacteria, the APS concentration should mirror the bioaerosol detection by the FAST.

In a second test, a high concentration of Arizona Road Dust (standard test dust; AZ dust arrow) was injected into a dynamic test chamber followed by two much smaller injections of bioaerosol simulant (fluorescently tagged microspheres; Fluor 1 & 2 arrows). The FAST detected the fluorescent aerosol despite the high concentration of obscuring dust.



MORE INFORMATION

The FAST BioSensor has a broad range of potential applications—including health care, industrial, food service, and defense.

RTI Commercialization invests in new technologies emerging across the research institute and facilitates industry partnerships to advance these technologies to the marketplace.

To explore partnership opportunities, contact **partner@rti.org**.

RTI International is an independent, nonprofit research institute dedicated to improving the human condition. We combine scientific rigor and technical expertise in social and laboratory sciences, engineering, and international development to deliver solutions to the critical needs of clients worldwide.

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