Laser tool speeds up detection of salmonella in food products

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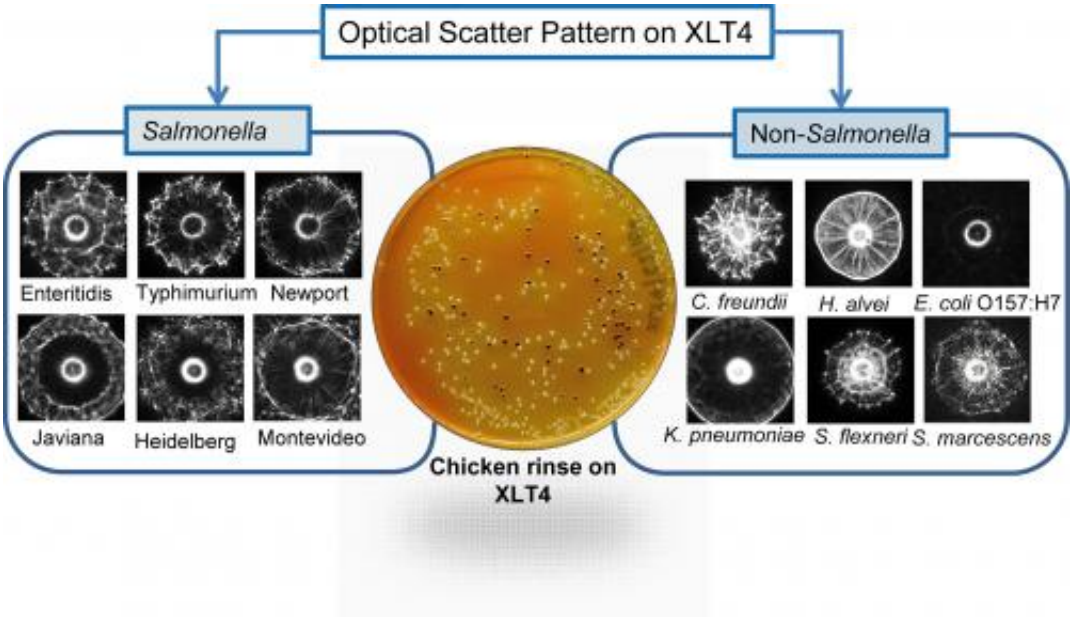

A BARDOT-generated portrait of the microbial community in a sample taken from raw chicken. A laser beam shines through each selected bacteria colony on the plate (center), producing a distinct black and white scatter pattern used to identify the type of bacteria. BARDOT can differentiate Salmonella (left) from non-Salmonella (right) bacteria. Credit: Arun Bhunia and Atul Singh

(Phys.org) —Purdue University researchers have developed a laser sensor that can identify Salmonella bacteria grown from food samples about three times faster than conventional detection methods.

Known as BARDOT (pronounced bar-DOH'), the machine scans

bacteria colonies and generates a distinct black and white "fingerprint" by which they can be identified. BARDOT takes less than 24 hours to pinpoint Salmonella.

"BARDOT allows us to detect Salmonella much earlier and more easily than current methods," said Arun Bhunia, a professor of food science who collaborated with then-Purdue engineer Daniel Hirleman to create the machine. "This could ultimately help provide safer food to consumers."

Salmonella is a major foodborne pathogen that causes salmonellosis, a type of food poisoning with symptoms of diarrhea, fever and abdominal cramps. Salmonellosis can be fatal in young children, the elderly and those with compromised immune systems.

The U.S. Food and Drug Administration has a zero-tolerance policy for Salmonella in food products. If the bacteria is detected, the resulting product recalls can lead to significant financial loss and possible charges of criminal liability for the companies involved.

Current Salmonella detection methods can take 72 hours to yield results and often require artificial alteration of the bacteria colonies. But the BARDOT system

identifies bacteria colonies by using light to illuminate their natural characteristics, preserving the colonies for later study. The machine can be operated with minimal training and used in locations with limited resources, Bhunia said.

BARDOT, short for "bacterial rapid detection using optical scatter technology," uses a red diode laser to scan bacteria colonies on an agar plate. When the light penetrates a colony, it produces a scatter pattern, a unique arrangement of rings and spokes that resembles the iris of an eye.

The pattern is matched against a library of images to identify the type of bacteria.

To test BARDOT's ability to identify Salmonella, Bhunia and his fellow researchers grew bacteria from rinses of contaminated chicken, spinach and peanut butter on agar plates for about 16 hours. After the plates were covered with tiny spherical colonies of bacteria, they placed each plate inside BARDOT - which is about the size of a large microwave oven - and scanned the colonies.

BARDOT identified Salmonella bacteria with an accuracy of 95.9 percent. It also individually distinguished eight of the most prevalent Salmonella serovars - distinct variations within a species of bacteria. Identifying a particular serovar helps trace bacteria to the original source of contamination.

Atul Singh, postdoctoral research associate and first author of the study, said BARDOT could be an effective preliminary screening tool, especially for food processors testing a large number of samples.

"BARDOT screens quickly and inexpensively," he said. "If you get a positive result for Salmonella, you can do a follow-up test. This can help food processors make more informed decisions."

While many tools can only detect a single kind of bacteria, BARDOT picks out multiple types of disease-causing bacteria on a plate with a single scan, Bhunia said. In addition to Salmonella, BARDOT can identify Escherichia coli, Vibrio, Listeria, Bacillus and many more foodborne pathogens.

"That's the beauty of this system," Bhunia said. "It's so versatile. It can find organisms that you didn't even think about."

More information: "Laser Optical Sensor, a Label-Free On-Plate Salmonella enterica Colony Detection Tool." Atul K. Singh, Amanda M. Bettasso, Euiwon Bae, Bartek Rajwa, Murat M. Dundar, Mark D. Forster, Lixia Liu, Brent Barrett, Judith Lovchik, J. Paul Robinson, E. Daniel Hirleman, and Arun K. Bhunia. *mBio* 5:1 e01019-13; Published 4 February 2014, DOI: 10.1128/mBio.01019-13

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