Infrared Sensors for Rapid Identification of Living vs. Dead Select Microbial Foodborne Contaminants

- PI: Dr. L. Mauer
- Co-PI's: Dr. M. Cousin, Dr. B. Reuhs, Dr. J. Gore
- Research Associates: Dr. Sol Kim, Y. Burgula, J. Stratton

Project Milestones

1. Develop FT-IR methods and analytical approaches to differentiate between living and dead cells of Salmonella and E. coli O157:H7 in water, cultural media, and foods.

2. To build and validate an IR sensor based on identification of the live bacterium.

Spectral Differences by Treatment

- To investigate effects of the following treatments on detection of E. coli K12
  - Heat
    - Sterilization treatment 121°C for 15 min
  - UV
    - Exposure for 2 h
  - Alcohol
    - Expsoure to 70% v/v EtOH for 30 min
  - Salt exposure
    - Suspended in NaCl (0.9%)
  - Control
    - Live cells

Milestone 1: Development of analytical methods to discriminate between Live and Dead cells

Based on spectral differences
Based on spectra of growth

Results

Conclusion

- Processing treatments influence FT-IR spectra
- Within each processing treatment
  - Pathogenic and non-pathogenic microorganisms can be separated
- Differences in absorbance occur in the
  - Amide II region (1589-1493 cm⁻¹)
  - Fatty acid region (3000-2800 cm⁻¹)
Spectral Differences on Beads

- To capture live and dead cells of *E. coli* O157:H7 onto Dynabeads and analyze using
  - Discriminant Analysis
  - SEM Imaging

Results

Results (cont.)

E. coli O157:H7 with beads (No H.T)  E. coli O157:H7 with beads (with H.T)

Spectral Differences by Growth

Dead vs Live Cells, ~900 cells at time 0 (6th dilution)
Dead vs. Live Cells: ~90 cells at time 0 (7th dilution)

Microbial Growth Curve

- Live and dead cell spectra are clearly differentiated in the Amide II region.
- Live bacteria on beads were detected at a concentration of 4.3 log CFU/mL and greater at the end of 6 h incubation.
  - Compared to 6.0 log CFU/mL and greater at the end of 6 h incubation using filtration.
- Decreased time for detection using beads vs. filtration starting with same number of cells.

Presentations

Presentations (cont.)

Publications

Questions?