

Detection of Pathogenic Agents Using the Integrating Waveguide Biosensor

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The Integrating Waveguide Biosensor allows for the detection of presumptive pathogenic agents via an immunassay. Agents are captured on the inner surface of glass capillary tubes and subsequently detected utilizing a secondary fluor-labeled antibody, with the capillary tubes serving as waveguides for the emitted fluorescence. To date, methods have been developed for the detection of *Escherichia coli* O157, *Salmonella enterica* var. Typhimurium and *Bacillus anthracis*. The sensitivity of the biosensor is approximately 10 cells of *E. coli* O157 using a Cy5 (or 1 cell using quantum dots) and approximately 10 cells of *Salmonella* using Cy5. Utilizing a novel immunoassay technique in which *B. anthracis* spores are incubated with antibodies prior to capture in capillary tubes, the sensitivity of the biosensor is 2000 spores. Since there is a linear relationship between cell number and fluorescence signal, results are quantitative. The absolute sensitivity of the biosensor is dependent on the volume of sample circulated through the capillary tubes. Research is in progress to optimize the efficiency of cell capture from a flowing sample stream. The biosensor is readily compatible with PCR assays. Since antibodies may lack adequate specificity, the use of PCR for confirmation of presumptive pathogenic agents can be critical. Lysis of captured *E. coli* O157 cells in capillary tubes, followed by PCR confirmation, has been demonstrated. Capillary tubes can also serve as incubation vessels for the germination/growth of bacterial agents to establish viability, or prior to PCR confirmation. For example, an incubation assay was developed which allows for germination of captured *B. anthracis* spores within 10 min, followed by PCR confirmation. In conclusion, the biosensor is a versatile platform suitable for detection of a wide variety of food-borne, water-borne, and air-borne pathogenic agents.