Development of a real-time biosensor to detect foodborne pathogens in leafy greens production environments

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Abstract

The purpose of this study was to refine the biosensor prototype (Phoenix Biometrics Inc.) with upgraded optics to increase sensitivity and evaluate detection of foodborne pathogens and background microflora for generating preliminary data, to feed artificial intelligence (AI) computer algorithms for sensor curve pattern matching. The biosensor was upgraded with new optic filters, focusing on the 15 nm bandwidth range that detected bacteria as demonstrated from preliminary data, compared to the original 900 nm from original filters. This upgraded biosensor was tested with concentrations of 1,000 cells/ml of *Escherichia coli* O157:H7, *Salmonella,* and *Listeria monocytogenes,* with 200 trial measurements per bacteria at a response rate of 0.025 seconds. Analysis by Quantiphi at 100 iterations demonstrated that AI was able to clearly differentiate *E. coli* O157:H7 from *Salmonella* and *L. monocytogenes*, with minor overlap between *Salmonella* and *L. monocytogenes,* reaching 99% minimum sensitivity and 98% minimum specificity. Next steps include further iterations and feeding data unknown to the AI (AI company is not informed which bacteria or concentration) to assess accuracy of differentiation by the AI and determine future implementation roadmap. Initial analyses confirms use cases of AI of this upgraded biosensor for classification of type of bacteria, concentration (inoculum levels) prediction, real-time bacterial detection and facility monitoring.