

Machine learning analysis of phage oxidation for rapid verification of wash water sanitation

Hemiao Cui, Reza Ovissipour, Xu Yang and Nitin Nitin

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Abstract

The current approaches for process verification during sanitation of fresh produce and other minimally processed products are limited to point measurements of sanitizer concentration at discrete locations and lack rapid biological measurements to assess effectiveness of sanitation. To address this gap, this study evaluates immobilized T7 phage on anodisc membrane as a surrogate for process verification. Fourier Transform infrared (FTIR) spectroscopy results suggested that both chlorine and peroxyacetic acid (PAA) caused phage DNA damage and protein oxidation. The Gradient Boosting Algorithm was employed to develop predictive model for sanitizer concentration levels and *Escherichia coli* O157:H7 inactivation. The machine learning model predicted both the effective sanitizer concentration level and bacterial reduction with receiver operating characteristic curve (ROC) values between 0.86 and 0.93. Overall, this study identified spectral measurement of phage particles in combination with machine learning approach as an effective tool for process verification.