

Title Ultraviolet inactivation and optimized recovery strategies for viruses on fresh produce
Author Viviana Fino and Kalmia E. Kniel
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Abstract

Fresh fruits and vegetables have been associated with an increasing number of foodborne illnesses, including those caused by norovirus and hepatitis A virus. The ability of ultraviolet (UV) light to inactivate viruses is well established; however, research on inactivation of foodborne viruses on produce is not well understood. This study investigates the UV inactivation and the optimization of recovery methodology of three viruses on: green onions, lettuce, and strawberries; which have varying surface topography and have previously causing foodborne outbreaks. The viruses used in this study include: feline calicivirus (FCV), a surrogate for norovirus; as well as hepatitis A virus (HAV), and Aichi virus (AiV).

Produce samples were exposed to UV-C light at varying doses (40-240 mWs/cm²). To test the efficiency of methodology in the recovery of these viruses on the different produce surfaces, inoculation times (0.5, 4, and 12h), routes (immersion and spot inoculation), and recovery methods (physical removal and extraction/blending) utilizing three different recovery eluents (media, beef extract, and PBS) were compared.

UV light results showed reductions of 4.62, 5.58, and 2.6-logs of HAV; 5.59, 2.49 and 1.87 of AiV; and 4.62, 3.88 and 2.28 of FCV on lettuce, green onions, and strawberries, respectively, with a dose of 240 mWs/cm². Results from optimization of recovery methodology, suggested that incubation time did not significantly affect the survival of HAV on green onions and strawberries while a significant decrease was observed after 4h of incubation on lettuce. HAV showed no differences in percent of recovery from lettuce and green onions independent of the three eluents tested. In general spot inoculation was more effective than immersion; the percent of recovery was significantly higher on HAV on lettuce or green onions. Comparison of HAV recovery by physical removal methods showed no significant differences; however the percent recovery was greater using the extraction/blending methodology.

Overall, this study shows that UV is an effective means for reducing pathogenic viruses on fruits and vegetables. The study regarding optimization of recovery methodology provides guidance to optimize recovery of viruses from fresh produce after comparing results from incubation times, routes of inoculation, recovery eluents, and recovery techniques.