Title Modeling critical factors to optimize the treatment of selected fruits and vegetables with chlorine dioxide gas using a miniaturized industrial-size tunnel system

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Abstract

There has been an increase in the number of foodborne illness outbreaks associated with fresh produce in recent years. This indicates that the disinfection procedure employed in lowering the number of microorganisms on ready-to-eat produce is inadequate. These facts have prompted industry and regulatory agencies to seek alternative microbial intervention treatments. Our research has shown that chlorine dioxide gas (ClO_2) is an effective surface antimicrobial agent. Use of ozone and traditional sanitation technologies such as chlorinated water are unable to cause a greater than three log reduction of microorganisms on the fresh produce surface. Gaseous ClO_2, on the other hand, showed a greater than a 5 log reduction of microorganisms on selected fresh produce with diverse surface characteristics. This is consistent with the recommendations of the National Advisory Committee on Microbiological Criteria for Foods (NACMCF).

However, in order to apply ClO_2 gas technology on an industrial scale on contaminated fresh produce, the technology must be evaluated for its impact on the quality parameters such as nutritional content and visual rating of the fresh produce being treated. Thus to study the feasibility of the ClO_2 gas technology as a surface disinfectant for the fresh produce, the long term objective of the study was to evaluate the inactivation of pathogenic bacteria and a non-pathogenic bacterial surrogate on the surface of 3 fresh produce surfaces and to integrate quality data with microbiological data to obtain equivalent/optimum processing parameters for ClO_2 gas. The specific objectives were to: (1) Obtain the inactivation kinetics of bacteria [pathogens (*Listeria monocytogenes* and *Salmonella enterica*) and surrogate (*Hafnia alvei*)] on fresh produce surface (tomatoes, oranges, sprouts) using ClO_2 gas. (2) Evaluate the effects of ClO_2 gas treatments (0.1 mg/l to 5 mg/l) on the quality attributes of produce.

The overall objective of this research was to develop a mathematical model and a rubric that takes into account various parameters (type of microorganisms, type of fruit/vegetable, ClO_2 gas concentration and time) and correlates them with shelf life data for the decontamination of whole fresh produce surface.