Optimization of Atmospheric Cold Plasma Device for Food Decontamination

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Introduction:

Postharvest decontamination treatment is a critical step in reducing food safety risks associated with produce and many commodities. As a dry and non-thermal treatment, atmospheric cold plasma (ACP) has emerged as a new potential decontamination technology.

Purpose:

Our research team has constructed a prototype ACP device and preliminary studies demonstrated its inactivation capability on major foodborne pathogens. The purpose of this study is to optimize the device to improve its killing efficacy.

Methods:

Sterile glass coverslips were spot-inoculated with a five-strain-mixture of *Salmonella enterica*, air-dried, and treated by APC under various conditions. The variables for optimization were electrode width, the gap distance between the electrodes, the treatment time, and the distance of actuator from the item being treated. A control was also performed, where the inoculated coverslips were not treated by APC. After treatment, the coverslips were washed in 0.1% sterile peptone water and enumerated for remaining *S. enterica* cells. The cell counts were converted to logarithmic (log) values and log reductions were obtained by comparing to controls. The data were analyzed with a Wilcoxon sign rank test.

Results:

Salmonella inactivation efficacy was significantly (p-value = 0.0003) affected by the electrode width, treatment time and the distance between the actuator and the item being treated. More than 3.8 log reduction of *Salmonella* was achieved with 5 min APC treatment at 2 cm distance. Further evaluation of the device's operational parameters including power input and pulse interval will be performed.

Significance: The results of this study will greatly help the industry be more efficient with the use of cold plasma technology.

Key words:

Atmospheric cold plasma, Food decontamination, Foodborne pathogens, device optimization