Effects of pH on the Potential of Chlorine Disinfection Against Pathogenic Bacteria in Broccoli Using Compact Dry Test Kit

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ABSTRACT

The potential of chlorine disinfection against pathogenic bacteria depends on several factors, especially the pH of the chlorine solution. Therefore, studying the relationship between pH and the appropriate pathogenic bacterial disinfection of chlorine is important in the food production process. This research aimed to study the optimal pH of chlorine at 5, 7, and 9 for disinfecting *Listeria monocytogenes, Salmonella* spp., and *Escherichia coli* in the washing process of fresh broccoli prepared by the Catering Department of Thai Airways International Public Company Limited. The broccoli was washed with chlorine at a concentration of 50-100 ppm for 5 minutes, and the bacteria were then enumerated using Compact Dry LM, SL, and EC test kits with 3 replicates for each pH value. Statistical analysis was performed using One-Way ANOVA at a 95% confidence level.

The results showed that chlorine could inactivate *L. monocytogenes* in all samples, whereas *Salmonella* spp. contamination was found in all samples due to cross-contamination during the experimental procedures. For *E. coli*, it was found that a pH of 7.04±0.10 was the most effective in disinfecting the bacteria, with a remaining bacterial count of 2.90±0.05 Log CFU/g. This was followed by a pH of 5.02±0.07 with a remaining bacterial count of 3.16±1.19 Log CFU/g, and a pH of 9.07±0.14, which had the highest remaining bacterial count of 3.21±0.13 Log CFU/g. However, statistical analysis showed that washing broccoli with different pH levels resulted in no statistically significant difference (p>0.05). Therefore, it can be concluded that a neutral chlorine solution (pH 7) is effective in reducing the amount of *E. coli* for the fresh broccoli washing process from the Catering Department. Thus, clean water can be used to prepare the chlorine solution for washing without the need to adjust the pH, which helps reduce time and costs in solution preparation.

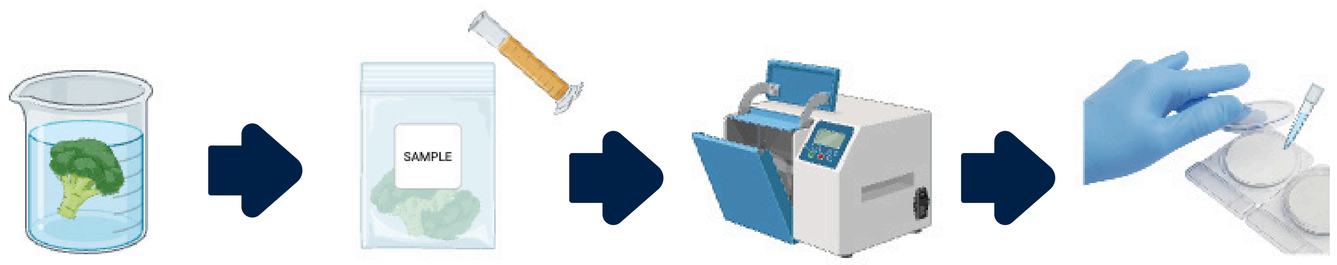
INTRODUCTION

According to IFSA food safety standards, washing fruits and vegetables is a Critical Control Point (CCP). While sodium hypochlorite is the primary sanitizer used in catering, its efficacy drops significantly in alkaline (high pH) conditions, which led to the increase in risk of bacterial survival and premature spoilage. Therefore, this study investigates the impact of pH levels on the bactericidal efficacy of chlorine against foodborne pathogens on broccoli.

OBJECTIVES

- To study the disinfectant efficacy of chlorine at constant concentrations at pH 5, 7, and 9.
- To determine the optimal pH range of chlorine for disinfecting pathogenic bacteria in broccoli.

METHODOLOGY



Wash sample with NaOCl solution

Weigh the sample into a stomacher bag and add a buffer

Homogenize using a stomacher

Pipette the homogenate onto Compact Dry

The bacteria were counted using Compact Dry LM, SL, and EC test kits with 3 replicates for each pH value. Differences between means were analyzed using One-way ANOVA, followed by mean separations were performed using Fisher's Least Significant Difference (LSD) test at a confidence level of 95%.

RESULTS & DISCUSSION

Table 1 Chlorine solutions' efficiency at pH values of 5, 7, and 9

treatment	*L. monocytogenes* (Log CFU/g)	*Salmonella* spp. (positive/negative)	*E. coli* (Log CFU/g)
control	Ab	positive	3.98±0.13
pH 5	Ab	positive	3.16±1.19
pH 7	Ab	positive	2.90±0.05
pH 9	Ab	positive	3.21±0.13

note positive = detected *Salmonella* spp., or negative = not detected *Salmonella* spp., and Ab = bacteria absent

- All treatments effectively eliminated *L. monocytogenes.*
- *Salmonella* spp. was detected under all treatments due to cross-contamination.

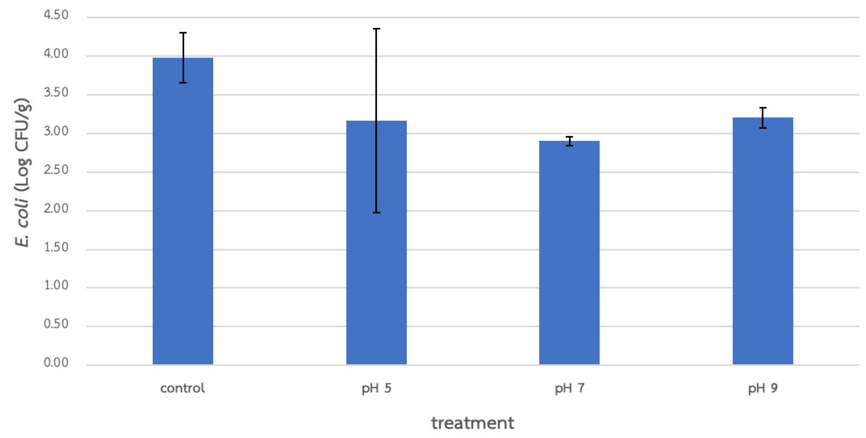


Figure 1 Chlorine's efficiency for disinfecting *E. coli* at pH 5, 7, and 9

For *E. coli*, all pH conditions reduced the bacterial counts compared to the control, with pH 7 showing the lowest value.

CONCLUSIONS

Pathogenic bacteria on broccoli is effectively reduced by pH 7 chlorine, which also follows IFSA, efficient and secure for preparing raw materials. Neither damaging to equipment and safer for staff than acidic solutions. and gentle enough maintain fresh produce's original color and quality.

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