

Bactericidal Activity of Electrolyzed Water

Sook-Hee Park, Yoon-Mi Choi, Dong-Suck Chang* and Il-Shik Shin

Faculty of Marine Bioscience and Technology, Kangnung National University
Division of Food Science and Biotechnology, Pukyong National University

Introduction

Electrolyzed chlorous solutions, or electrolyzed oxidizing water [EW(+)] has attracted much recent attention as a low cost, but high-performance, new technology of potential use by food industry. the term EW(+) is used to describe an aqueous disinfectant produced by the electrolysis of a chlorine containing solution under a low-voltage direct current (Suzuki et al., 2002). Venczel et al. reported EW(+) as an effective disinfectant for *Cryptosporidium parvum* oocysts and *Clostridium perfringens* spores. The antimicrobial properties of EW(+) are reported to be due to the presence of hypochlorous acid, HOCl (Nakagawara et al., 1998).

In this study, we investigated the bactericidal activity of electrolyzed water on 4 strains of food-borne pathogenic bacteria and two kinds of vegetables for use in food-hygiene management.

Materials and Methods

Generation of the Electrolyzed Anode and Cathode NaCl solution: A diaphragm batch-scale electrolysis device (Super Water Mini, JED-007, I-Water Co., Tokyo, Japan) equipped with a platinum chloride electrode was used. Electrolysis (12 min. at room temperature) of dilute NaCl solutions were conducted with 0.1% NaCl dissolved in deionized water. Voltage was automatically controlled between 9 and 11 V of direct current. After electrolysis, strong acidic solutions (pH 2.2 to pH 2.6) with available chlorine contents of about 35 ppm, this is equivalent to 0.65 mM HOCl and oxidation reduction potentials (ORP) above + 1,000 mV, formed in the anode compartment. In contrast, strong alkaline solutions (pH 11.6 to pH 11.8) and ORP below -880 mV formed in the cathode compartment. For evaluating the disinfectant properties of the electrolyzed NaCl solution, both anode and cathode solutions were produced immediately before use.

Culture of food-borne pathogenic bacteria: Four strains of food-borne pathogenic bacteria, *Bacillus cereus* KCTC 1012, *Escherichia coli* O157:H7 ATCC 43889, *Vibrio parahaemolyticus* ATCC 2210001 and *Vibrio vulnificus* KCTC 2989 were cultured in Brain heart infusion broth (Difco Co.) at 37°C for 48 h.

Assay of bactericidal activity: Bactericidal activities on 4 strains of food-borne pathogenic bacteria were assayed by mixing the 20 volumes of electrolyzed waters to bacterial culture (3.0×10^9 CFU/ml) for 60 sec. Lettuce and Sesame leaf were purchased from market and washed with 100 ml of electrolyzed waters and tap water for 60 sec.

Results and Summary

1. Bactericidal activity on 4 strains of food-borne pathogenic bacteria: 4 strains of food-borne pathogenic bacteria with initial bacterial count of 3.0×10^9 CFU/ml were not detected by treating of the strong acidic solutions for 60 sec. However, no disinfectant effects were observed in treating of the strong alkaline solutions.
2. Disinfectant effects on lettuce and sesame leaf: The bacterial count of Lettuce with initial bacterial count of 2.0×10^5 CFU/g) and sesame leaf with initial bacterial count of 4.0×10^4 CFU/g were reduced to 1.2×10^2 CFU/g (lettuce) and 5.5×10^1 CFU/g (sesame leaf), respectively by washing with strong acidic solutions for 60 sec after washing with strong alkaline solutions for 60 sec.

References

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