Antimicrobials to control Foodborne Pathogens on Cantaloupe

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Cantaloupe in American diet

- U.S. cantaloupe production (1.8 billion lbs, $314 million)
- Consumption (8.5 lbs/person)
- 20 outbreaks, 1273 illnesses (1973-2012)

  - *Salmonella* spp. (2012, 2011, 2010, 2008, 2006, 2002)
  - *E. coli* 0157:H7 (2008)
  - *L. monocytogenes* (2011)

Salmonella multistate outbreak

- 2012 *Salmonella* cantaloupe outbreak
- *S.* Typhimurium and *S.* Newport
- 261 illnesses
- 51% hospitalization
- 3 deaths

Listeria monocytogenes (LM) multistate outbreak

2011 LM cantaloupe outbreak
147 illnesses, 143 hospitalization, 33 deaths

Processing equipment
Wash Water

Contamination of cantaloupe with pathogens

Production & Harvest Operations

Soil, feces, irrigation water, manure, animals, human handling

Post-harvest Operations

Equipment, human handling, transport container, Vehicle, rinse water

Pre-harvest practices

Cantaloupe washing

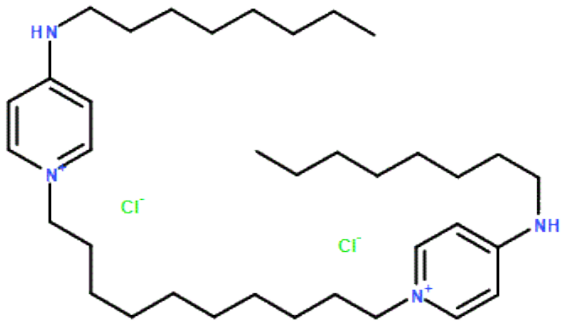
Foodborne infection

FDA Guidelines

Adequate washing & Use of antimicrobials

Alternative Strategy: Octenidine Dihydrochloride (OH)

- Cationic bispyridinamine
- Used in mouth rinses in Europe
- Antimicrobial activities against a wide range of pathogenic microorganisms



Objective 1- Preharvest

Octenidine dihydrochloride (OH) as a pre-harvest spray for reducing *Listeria* and *E. coli* O157:H12 on cantaloupes at farm

Soil preparation and planting

Cantaloupe plants (*Athena* cultivar) grown for 3 weeks in a growth chamber

↓

Transplanted in a high-tunnel and irrigated as required to maintain plant growth

↓

60 cantaloupes with full netting on vine were selected

Inoculation and treatment

Dip-inoculated for 10s in fecal slurry containing *L. innocua* or *E. coli* O157:H12

Air dried for 15 min

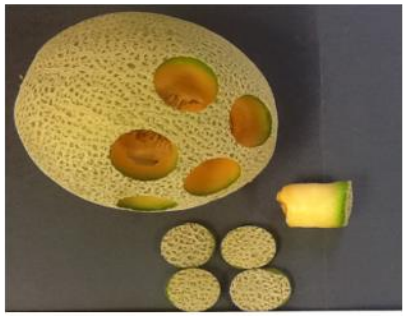
Sprayed 15 ml of ethanol 0.1%, OH 0.1%, OH 0.2%

(Each treatment group = 20 cantaloupes)

Enumerated bacterial populations on cantaloupes on days 0, 14, and 28

(3 cantaloupes were analyzed from each group at each time point)

Bacterial enumeration



Cantaloupe core

21 cores from each cantaloupe

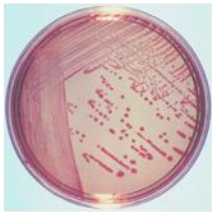
21 cores into 3 whirlpak bags (7 cores each)

50 ml PBS to each bag

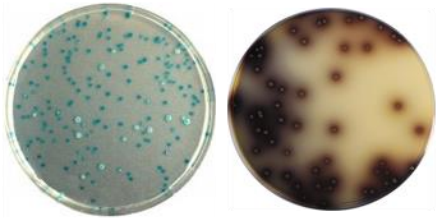
Pummeled for 1 min per bag

Appropriate dilutions of homogenized core samples

Spiral plating on selective agars



MacConkey

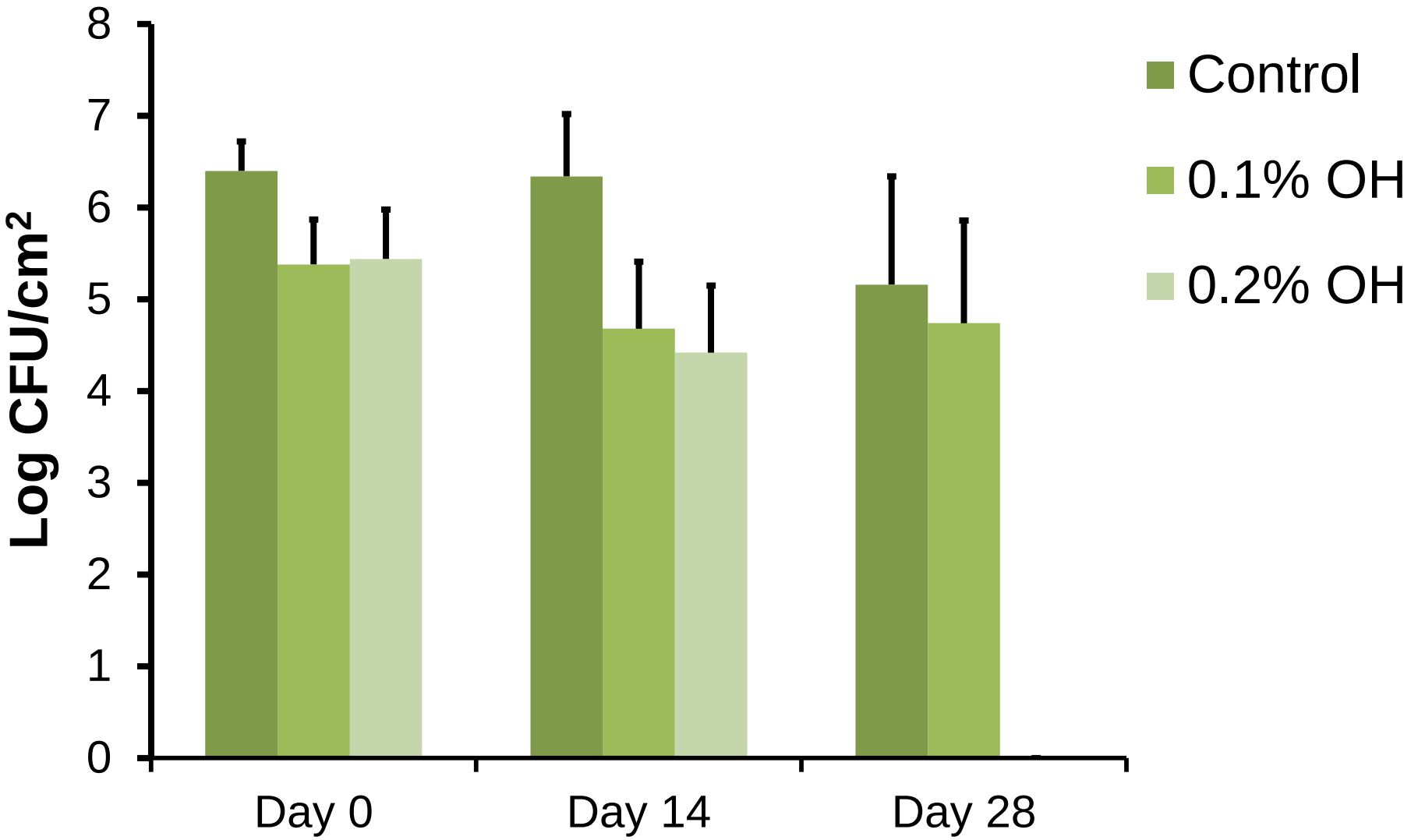


Chrome Oxford

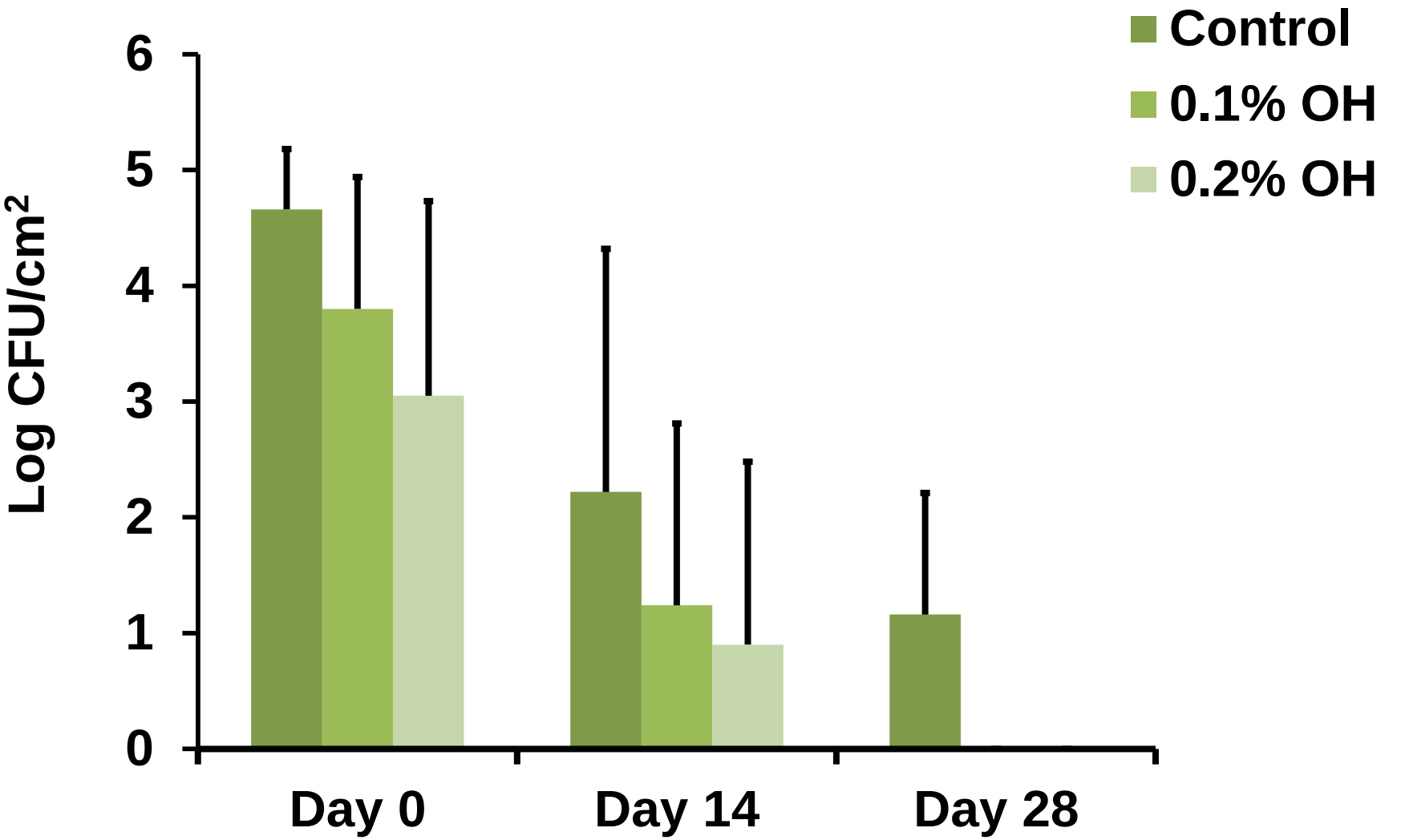
E. coli

Listeria spp.

Effect of OH on *Listeria innocua* on cantaloupes



Effect of OH on *E. coli* O157:H12 on cantaloupes



Objective 2 - Postharvest

OH as wash and coating treatments for reducing *L. monocytogenes*, *Salmonella*, and *E. coli* O157:H7 on whole cantaloupes

OH wash treatment of whole cantaloupes

Dip-inoculated whole cantaloupes in a 3 L of PBS containing *Listeria*, *Salmonella*, or *E. coli* for 5 min (≈ 7 log CFU/ml)

↓ **Attachment time 2 h**

Wash treatment
OH at 0.1% and 0.2%
for 5 min

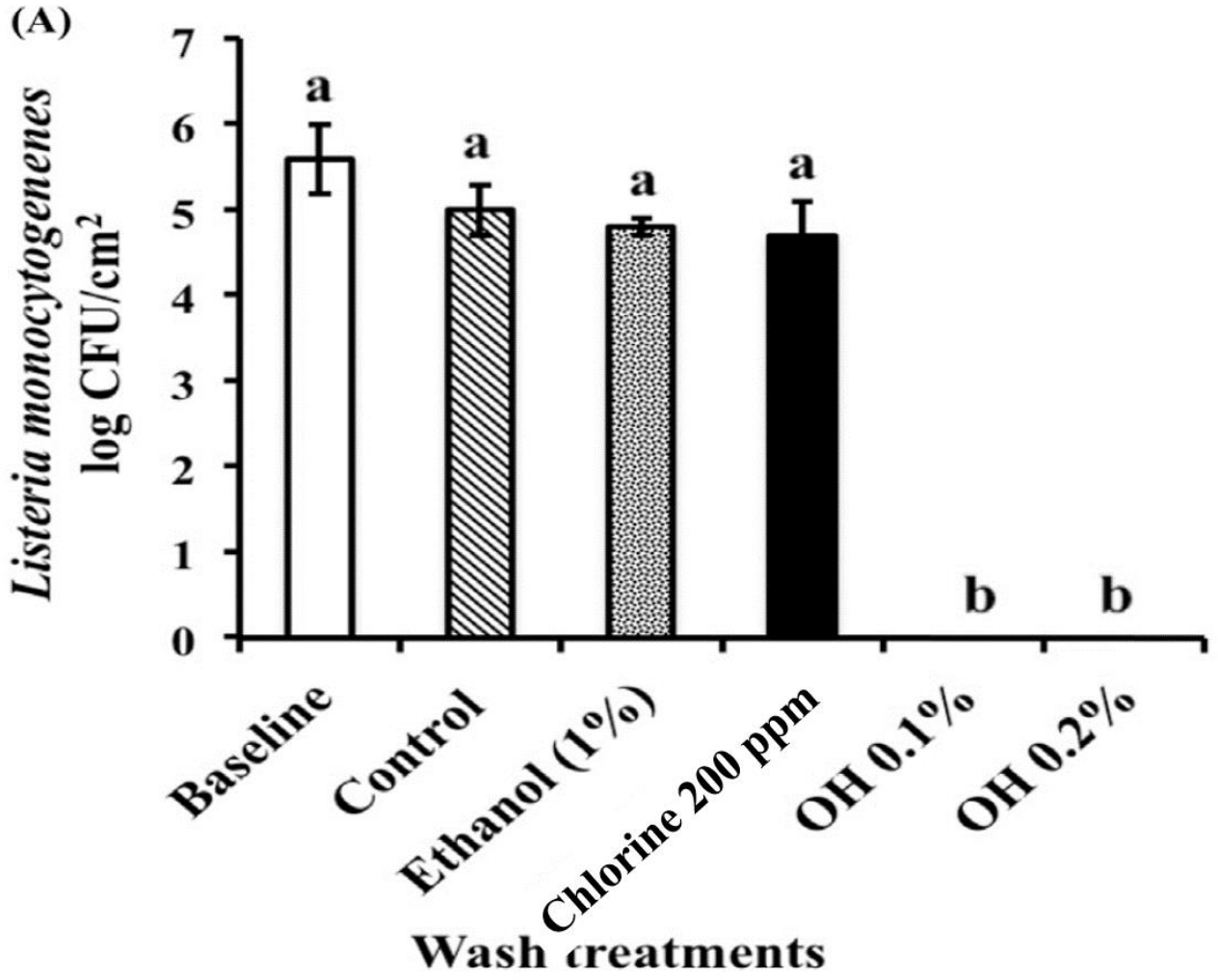
↓

After treatment, cantaloupe cores were aseptically prepared

↓

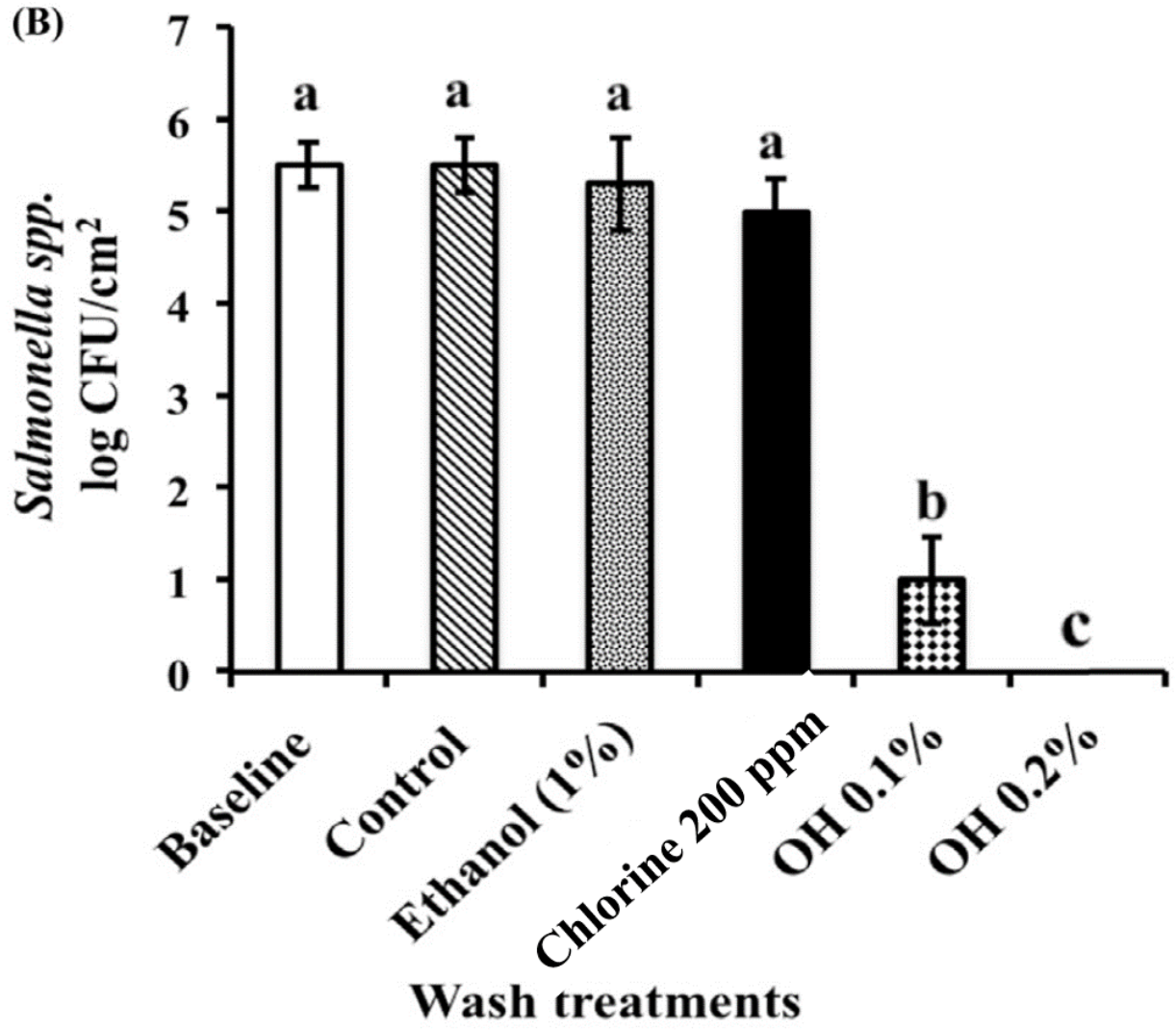
Enumeration of surviving bacteria on cantaloupe surface

Inactivation of *L. monocytogenes* on whole cantaloupes by OH wash



*All treatments were significantly different from the control at P<0.05

Inactivation of *Salmonella* on whole cantaloupes by OH wash



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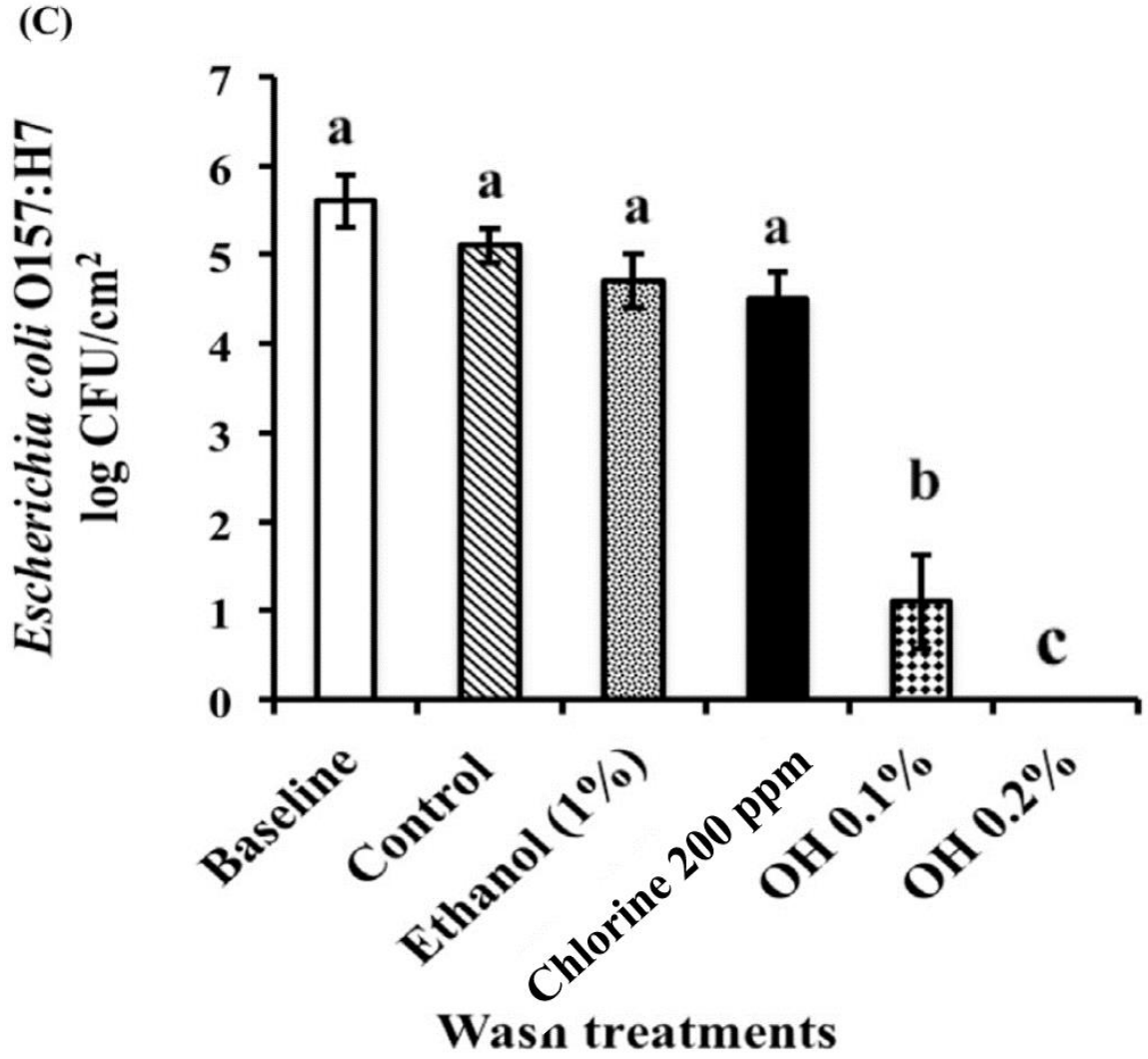
Inactivation of *E. coli* O157:H7 *on* whole cantaloupes by OH wash



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Cantaloupe coating with OH

Dip-inoculation of whole cantaloupes with *Listeria*, *Salmonella*, or *E. coli* (≈ 7 log CFU/ml)

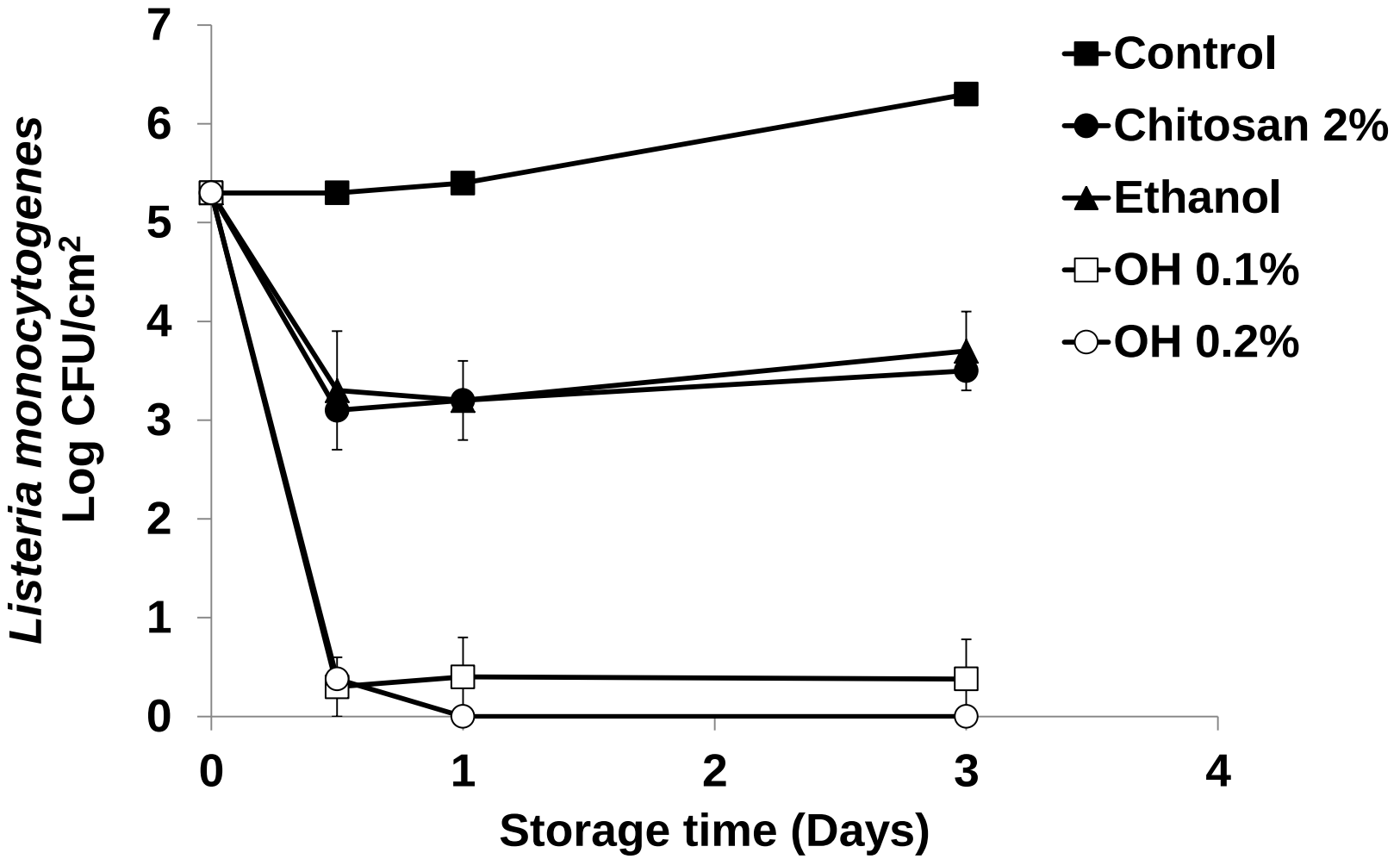
Dipping in OH coating solution 0.01%, 0.05%, 0.1%

Cantaloupe cores

Storage at 4°C for 3 days

Enumeration of surviving bacteria on cantaloupe Day 0, 1, 3

Inactivation of *L. monocytogenes* on whole cantaloupes by OH coating



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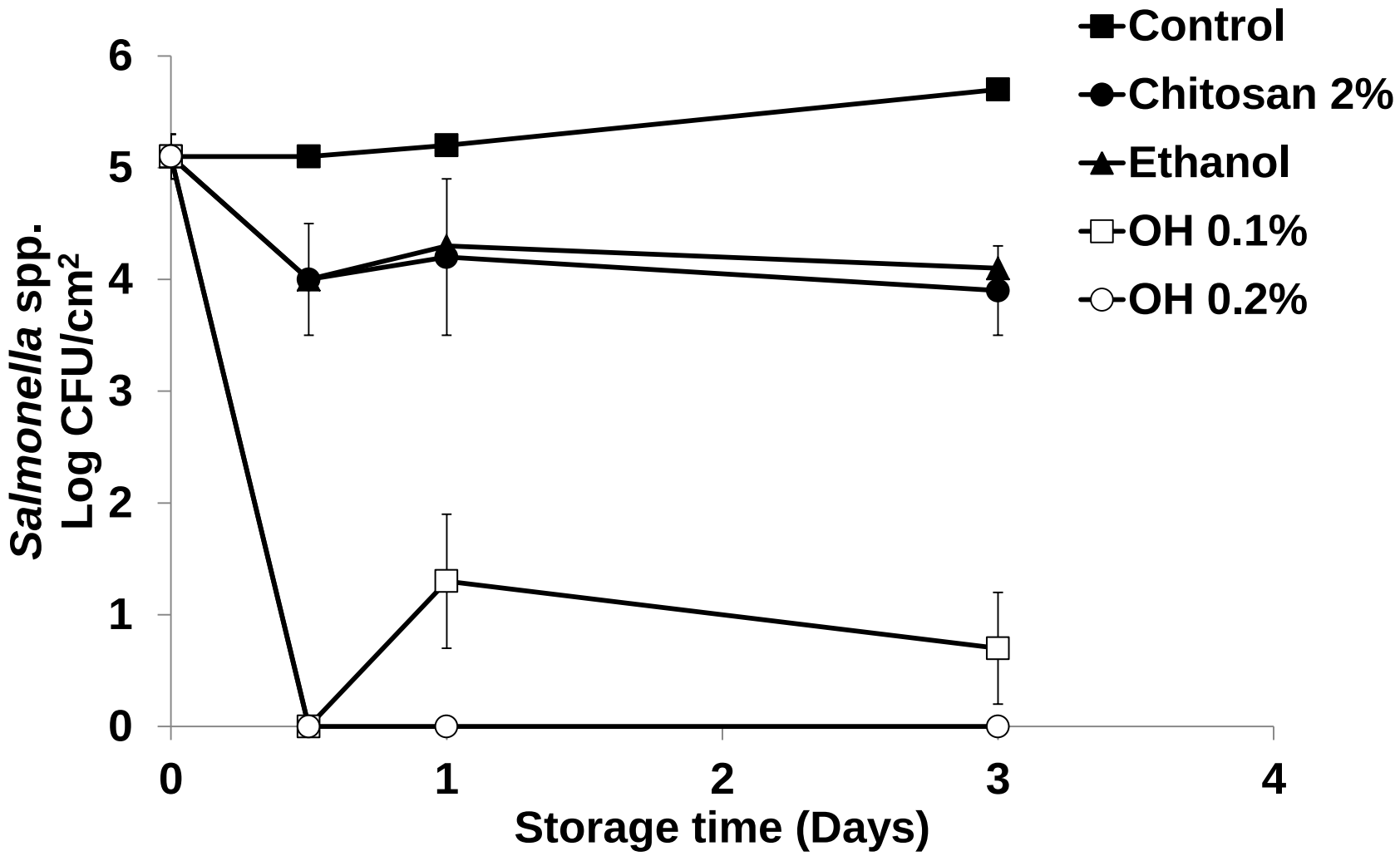
Inactivation of *Salmonella* on whole cantaloupes by OH coating



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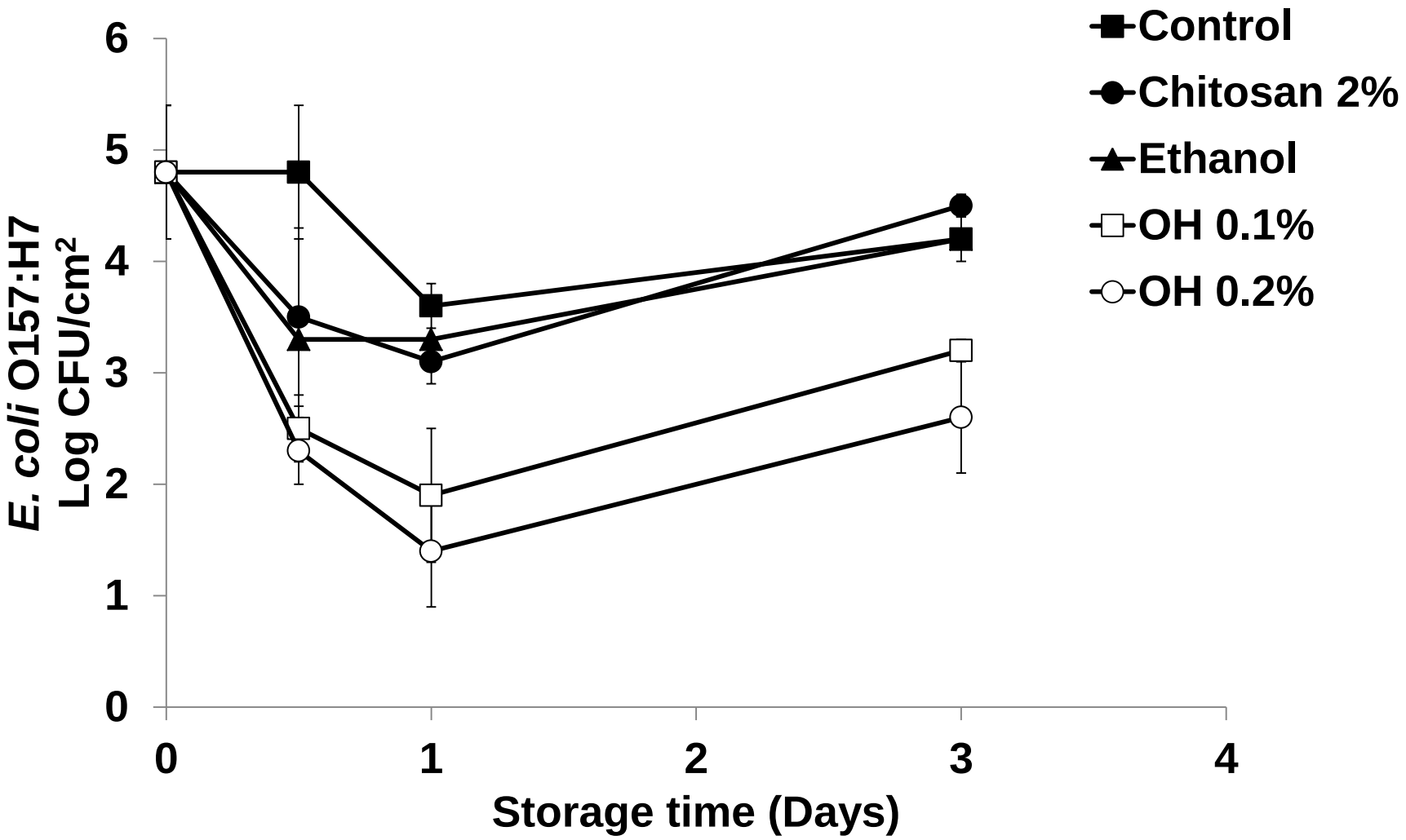
Inactivation of *E. coli* O157:H7 on whole cantaloupes by OH coating



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Biocontrols

- Wash treatment with Lactic acid bacteria (LAB) reduces *L. monocytogenes by* 2-4 log CFU
- LAB are ineffective in controlling *L. innocua* at the farm level
- Screening of additional LAB for preharvest study

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