



RESEARCH SUMMARY • PEER-REVIEWED STUDY

DZ 9450 Reduces *Listeria* on Fresh Apples & Blocks Cross-Contamination

An independent, peer-reviewed study found that mineral oxychloride (DZ 9450) delivered a dose-dependent kill of *Listeria monocytogenes* on apples and, like neutral electrolyzed water, fully prevented pathogen transfer to clean fruit during washing.

3.8

LOG₁₀ CFU/APPLE MAX *LISTERIA* REDUCTION — 0.50% DZ 9450, 2-MIN WASH

0 / 10

CLEAN APPLES CONTAMINATED AFTER A DZ 9450 WASH (VS. 10 / 10 WITH WATER ALONE)

~3.8

LOG₁₀ CFU/APPLE TRANSFERRED TO CLEAN FRUIT BY A PLAIN-WATER WASH

— Study at a glance

Objective. Evaluate the antimicrobial efficacy of two sanitizers — mineral oxychloride (DZ 9450) and neutral electrolyzed water (NEW) — for inactivating *Listeria monocytogenes* on fresh apples, and for preventing cross-contamination between fruit during post-harvest washing.

Pathogen & matrix. A three-strain *L. monocytogenes* cocktail was inoculated onto whole Granny Smith and Fuji apples at roughly 6.2 log₁₀ CFU/apple and held 24–48 h before treatment, mirroring a realistic post-harvest contamination scenario.

Method. Apples were submerged and agitated for 30 sec or 2 min in DZ 9450 (0.125, 0.25 and 0.50%), NEW (22.5–110 ppm free available chlorine), or calcium-hypochlorite chlorine (~100–110 ppm FAC, the industry-standard positive control); deionized water served as the negative control. Surviving *Listeria*, residual pathogen in the wash water, transfer to clean apples, and native apple microbiota were all enumerated. Each treatment was run in triplicate (n = 36 apples per treatment).

INDEPENDENTLY PUBLISHED RESEARCH

Published in *Frontiers in Microbiology* (14 January 2020) by a university food-safety research team, a university post-harvest research program and a tree-fruit research commission.



— Key findings

DZ 9450 reduced *Listeria monocytogenes* on apples in a clear dose-dependent manner. At its lowest dose it matched conventional chlorine; at higher doses it substantially outperformed it. Values below are log₁₀ CFU/apple reductions after a 2-minute wash, 24 h post-inoculation on Granny Smith apples.

WASH TREATMENT	LOG ₁₀ REDUCTION (2-MIN)
Deionized water (negative control)	0.12
Chlorine, ~110 ppm FAC (positive control)	1.15
Neutral electrolyzed water, 110 ppm FAC	0.93
DZ 9450 — 0.125%	1.04
DZ 9450 — 0.25%	2.06
DZ 9450 — 0.50%	3.84

Adapted from Table 2 of the published article (mean, n = 36). Longer contact time (2 min vs. 30 sec) significantly improved efficacy for chlorine and higher DZ 9450 doses.

Cross-contamination fully prevented. A single contaminated apple washed in plain water transferred ~3.8 log₁₀ CFU/apple to a batch of 10 clean apples — all 10 tested positive. After a 2-minute wash with DZ 9450 (0.125–0.50%) or NEW (110 ppm FAC), **no *Listeria* was detected on any clean apple**, and residual pathogen in the spent wash solution fell below the detection limit — blocking both fruit-to-water and fruit-to-fruit transfer.

Native microbiota. Higher-dose DZ 9450 also cut background spoilage organisms: 0.50% DZ 9450 reduced total plate count by 0.65 and yeast & mold by 1.63 log₁₀ CFU/apple, exceeding NEW and chlorine.

— What it means for DZ 9450

The results position DZ 9450 as a credible, dose-adjustable alternative to conventional chlorine for post-harvest apple washing. At an equivalent chlorine dose it performs on par with hypochlorite, but its efficacy scales with concentration — reaching a 3.8-log *Listeria* reduction at 0.50% where chlorine plateaus near 1 log. Critically, DZ 9450 stopped the fruit-to-fruit spread that lets one contaminated apple compromise an entire lot, addressing a core food-safety risk in commercial packing lines.

AUTHORS' CONCLUSION

DZ 9450 and NEW at ~100 ppm FAC successfully prevented *L. monocytogenes* cross-contamination from both fruit-to-water and fruit-to-fruit, and DZ 9450 delivered a dose-dependent reduction of the pathogen on apples — indicating strong potential for post-harvest apple washes.

Full published article: Sheng L, Shen X, Ulloa O, Suslow TV, Hanrahan I and Zhu M-J (2020). Evaluation of DZ 9450 and Neutral Electrolyzed Water in Controlling *Listeria monocytogenes* on Fresh Apples and Preventing Cross-Contamination. *Frontiers in Microbiology* 10:3128. doi: 10.3389/fmicb.2019.03128

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