ENVIROTECH
an Arxada company

CASE STUDY

Effectiveness of BioSide™ HS 15% in Reducing Shiga Toxin-Producing *Escherichia coli* on Blueberries

The Challenge

In July 2026, frozen blueberries were recalled due to potential contamination with *Escherichia coli* O145:H28, a Shiga toxin-producing *E. coli* (STEC) serogroup associated with foodborne illness. The U.S. Food and Drug Administration (FDA) and Centers for Disease Control and Prevention (CDC) investigated the associated multistate outbreak. Given the public health significance of STEC contamination in fresh and frozen produce, processors continue to seek effective antimicrobial interventions that can reduce microbial contamination while maintaining product quality.

As produce processors face increasing food safety scrutiny, validated antimicrobial interventions are critical for reducing contamination risks while maintaining product quality.

Objective

Evaluate the efficacy of peroxyacetic acid (PAA) treatments in reducing STEC populations on blueberries and compare performance against water washing alone.

Study Parameters

KEY RESULT

- 4.89 $\log_{10}$ Reduction of STEC
- Achieved with 300 ppm **Bioside™ HS 15%** in a 60-second wash treatment.

- **Test Substance: BioSide™ HS 15%** (Peroxyacetic Acid)
- **Target Organism:** *Escherichia coli* O157:H7 (STEC)
- **Application Method:** Immersion Wash Treatment
- **Exposure Time:** 60 Seconds
- **Treatment Concentrations:** 150 ppm and 300 ppm PAA
- **Maximum FCN Allowance**: 500 ppm PAA
- **Highest Reduction Achieved:** 4.89 Log_{10} STEC Reduction
- **Exposure Temperature:** ambient (approximately 21°C)
- **Relative Humidity During Drying:** 40%
- **Mixing Rate:** 200 rpm agitation
- **Market Segment:** Fruit & Vegetable Processing

Regulatory Note: Enviro Tech's Food Contact Notification (FCN) 2291 allows the use of peroxyacetic acid up to 500 ppm in process water or ice used for washing or chilling fruits and vegetables.

Methodology

Treatment solutions consisted of 300 ppm PAA, 150 ppm PAA, or sterile deionized (DI) water. PAA treatment solutions were prepared by diluting **BioSide™ HS 15%** into sterile DI water and verified using a Kemio electronic meter. Measured concentrations were 331 ppm and 151 ppm, respectively.

Blueberries were obtained from a local grocery retailer and aseptically portioned into approximately 30-gram aliquots. Each aliquot was inoculated with STEC (*E. coli* O157:H7) through immersion and subsequently dried in a humidity chamber maintained at 36°C and 40% relative humidity.

Following drying, inoculated blueberries were immersed in their assigned treatment solution while stirring at 200 rpm for 60 seconds. Treated berries were then transferred into a neutralizing solution, serially diluted, plated onto tryptic soy agar, and incubated for 48 hours prior to enumeration. Four treatment groups were evaluated to compare the effectiveness of conventional water washing with **BioSide™ HS 15%** peroxyacetic acid treatments.

Table 1. Treatment Summary

Treatment	Measured Concentration	Weight Range (g)
300 ppm PAA	331 ppm	30.63–31.19
150 ppm PAA	151 ppm	30.30–31.55
DI Water	N/A	30.30–31.27
Untreated Control	N/A	31.19–31.36

Average blueberry weight across all treatments was 30.89 g.

Results

Following treatment, recoverable STEC populations were enumerated and compared against untreated controls. Table 2 summarizes average microbial recovery and the corresponding reductions achieved by each treatment.

Table 2. Average Log_{10} CFU/mL Recovery and Reduction

Sample	Log Recovery	Log Reduction
Untreated Berries	7.64	N/A
DI Water Treated	5.74	1.90
150 ppm PAA Treated	3.32	4.32
300 ppm PAA Treated	2.75	4.89

DI water treatment achieved a 1.90 Log_{10} reduction relative to the untreated control, demonstrating that immersion and agitation alone contributed to the physical removal of STEC from blueberry surfaces. However, both PAA treatments provided additional reductions beyond those achieved through water washing alone.

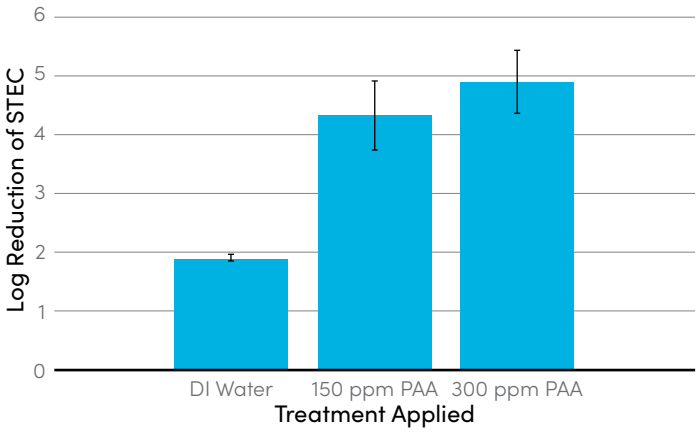
Treatment with 150 ppm PAA achieved a total reduction of 4.32 Log_{10}, representing an additional 2.42 Log_{10} reduction beyond DI water treatment. Treatment with 300 ppm PAA achieved the greatest overall reduction at 4.89 Log_{10}, corresponding to an additional 2.99 Log_{10} reduction compared with water washing alone.

Visual assessment of the blueberries during and after treatment showed that PAA concentration did not adversely affected berry color or visible texture.

The results demonstrate a clear concentration-dependent response, with increasing PAA concentration resulting in greater reductions of recoverable STEC. While water washing reduced microbial recovery, substantially greater reductions were observed when PAA was incorporated into the wash treatment. Figure 1 illustrates the relative performance of each treatment evaluated in the study.

The improved reduction observed at 300 ppm relative to 150 ppm is consistent with a concentration-dependent antimicrobial response within the evaluated treatment range.

Figure 1. Average Log_{10} Reduction of STEC on Blueberries



Conclusion

These findings demonstrate that **BioSide™ HS 15%** is an effective antimicrobial intervention for reducing STEC contamination on blueberries under the conditions evaluated. While water washing alone reduced recoverable STEC populations by 1.90 Log_{10}, treatment with **BioSide™ HS 15%** increased reductions to 4.32 Log_{10} and 4.89 Log_{10} at 150 ppm and 300 ppm, respectively.

Among the treatments evaluated, 300 ppm PAA provided the greatest antimicrobial effect while maintaining blueberry appearance and visible quality. These results support the use of peroxyacetic acid as an effective antimicrobial intervention for fruit and vegetable processing applications and further demonstrate the effectiveness of **BioSide™ HS 15%** when used within applications permitted under FCN 2291.

Key Results

BioSide™ HS 15% achieved up to a 4.89 Log_{10} reduction of STEC on blueberries in a 60-second wash treatment, significantly outperforming water washing alone while maintaining berry appearance and quality.

*The data presented in this study were obtained under controlled laboratory conditions and are provided for informational purposes only. Results may vary under commercial operating conditions. Users are responsible for determining the suitability of **BioSide™ HS 15%** for their specific application and for complying with all applicable regulatory requirements and label directions.*

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