Project Title: Electrostatic Antimicrobial Application to Beef Trim and Poultry Parts

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Category: Post-Harvest

Published: Unpublished to date.

Objective: The objectives for Study 1 (preliminary proof of concept study) were: i) to evaluate peroxyacetic acid (PAA), Beefxide (BX), and lactic acid (LA) as antimicrobial intervention applications when applied electrostatically to determine the efficacy and critical operating parameters in reducing inoculated populations of non-pathogenic *Escherichia coli* biotype I, serving as surrogates for pathogenic *E. coli* and *Salmonella* spp. on beef trim and poultry parts, and ii) to evaluate the use of static electricity to maximize coverage of the antimicrobial solution on the poultry part and beef trim surface areas while limiting the volume to minimize weight gain. The objectives for Study 2 (preliminary proof of concept study) were: i) to evaluate PAA and LA as antimicrobial intervention applications when applied electrostatically to determine the efficacy and critical operating parameters in reducing surrogate populations on poultry parts, and ii) to evaluate the use of static electricity to maximize coverage of the antimicrobial solution on the poultry part surface areas while limiting the volume to minimize weight gain.

Experimental Design & Analysis:

Both studies were designed as paired comparisons. The first preliminary study included 4 treatments with n = 3 per treatment for both beef and chicken samples. For the first study, BX was applied with an electrostatic spray gun at 2.5% and microbial samples taken after 10 seconds of treatment. A 4% concentration of LA was applied with an electrostatic spray gun and microbial samples taken after 10 seconds of treatment. Additionally, PAA was applied to poultry samples at 1200 ppm and beef samples at 400 ppm. Study 2 included 3 treatments with n = 3 per treatment. For the second study, LA was applied with an electrostatic spray gun at 10% and PAA was applied with an electrostatic spray gun at 2200 ppm and microbial samples were taken for each treatment. Data were analyzed using the Mixed Procedure of SAS version 9.3 and expressed as least squares means with differences reported using a significance level of α = 0.05.

Key Results:

For Study 1, bacterial counts were reduced ($P < 0.05$) from 6.57 log CFU/g to 6.07 log CFU/g after treatment with 2.5% BX, 5.89 log CFU/g after treatment with 4% LA, and 5.5 log CFU/g after treatment with PAA. There was no significant difference between BX and LA, but these treatments were significantly different from the control. For study 1, all antimicrobial treatments were significantly different from the untreated control for poultry and all antimicrobial treatments were significantly different from untreated control besides BX applied at 2.5% for beef. For Study 2, after receiving either LA or PAA electrostatic spray treatment, bacterial populations were reduced ($P < 0.05$) when compared to the control samples. **This information provides proof of concept for a new antimicrobial application method** that could potentially save money and water due to better coverage of poultry parts and beef trimmings. It could also potentially be used for carcasses.

Study 1

Table 1. Pooled least-square means of bacterial counts (Log CFU/g) on Tryptic Soy agar with rifampicin from surrogate inoculated beef and chicken samples treated by electrostatic antimicrobial application.

Treatment	Log CFU/g
UNTREATED CONTROL	6.57[a]
BEEFXIDE, 2.5%	6.07[b]
LACTIC ACID, 4%	5.89[b]
PEROXYACETIC ACID[*]	5.50[c]
SEM	0.1363

[abc] Means without a common superscript differ ($P < 0.05$).

[*] PEROXYACETIC ACID was applied on chicken samples at 1200ppm and beef at 400 ppm.

Table 2. Least-square means of bacterial counts (Log CFU/g) on Tryptic Soy agar with rifampicin from surrogate inoculated beef and chicken samples treated by electrostatic antimicrobial application.

Treatment	Log CFU/g
Chicken[*]	
UNTREATED CONTROL	6.42[a]
BEEFXIDE, 2.5%	5.83[b]
LACTIC ACID, 4%	5.76[b]
PEROXYACETIC ACID, 1200 PPM	5.18[c]
SEM	0.1771
Beef	
UNTREATED CONTROL	6.73[a]
BEEFXIDE, 2.5%	6.31[ab]
LACTIC ACID, 4%	6.02[bc]
PEROXYACETIC ACID, 400 PPM	5.82[c]
SEM	0.2071

[abc] Means without a common superscript within species differ ($P < 0.05$).
* Log CFU/ml

Study 2

Table 1. Least-square means of bacterial counts (Log CFU/g) on Tryptic Soy agar with rifampicin from surrogate inoculated chicken samples treated by electrostatic antimicrobial application.

Treatment	Log CFU/ml
UNTREATED CONTROL	6.41[a]
LACTIC ACID, 10%	5.85[b]
PEROXYACETIC ACID, 2200 ppm	5.28[c]
SEM	0.09813

[abc] Means without a common superscript differ ($P < 0.05$).