

On-Line and Off-Line Reprocessing In-Plant Trial Data Analysis

Abstract:

The FSIS Office of Policy and Program Development (OPPD), Risk, Innovations and Management Division (RIMD) analyzed company- submitted on-line and off-line reprocessing data collected from poultry slaughter establishments. The data were submitted by companies conducting in-plant trials on the effectiveness of their on-line and off-line reprocessing systems. The data included microbial counts on poultry carcasses both before on-line and off-line reprocessing system use and after on-line and off-line reprocessing system use. RIMD analyzed on-line and off-line reprocessing data from eleven on-line reprocessing (OLR) systems and the only two off-line reprocessing (OFLR) systems. The eleven OLR systems are the most recent OLR systems that are operating under waivers granted by FSIS. The data show an average reduction in aerobic plate count (APC), *E. coli*, coliforms and *Salmonella* on poultry carcasses after using an on-line or an off-line reprocessing system. The data generated from the in-plant trials demonstrate that the technologies used in these studies have been successful yielded definite improvements.

Introduction:

Since 1978, one traditional procedure for treating contamination on poultry carcasses has been to reprocess them offline or away from the main processing line using chlorinated water containing 20 ppm available chlorine. This procedure is described in 9 CFR 381.91 *Contamination*.

In the late 1980s, Rhône-Poulenc, which was renamed Rhodia, conducted studies to explore the efficacy of various processes utilizing an antimicrobial on raw poultry carcasses for the purpose of reducing the incidence of various pathogenic bacteria commonly found on poultry carcasses. Other companies soon joined Rhône-Poulenc in conducting studies. One procedure, which proved feasible, was to treat the contaminated carcasses while still on the main processing line with an antimicrobial spray. This procedure, called on-line reprocessing (OLR), had the added benefit that all poultry carcasses whether contaminated or not were treated with an antimicrobial spray before entering the chill tank.

As the companies' study methodologies evolved from 1998, FSIS recommended that they challenge their entire OLR system by microbiologically comparing "passed" poultry carcasses against "contaminated" carcasses before and after entering the antimicrobial spray system. A "passed" poultry carcass was inspected by Federal inspection personnel and did not require reprocessing. A "contaminated" poultry carcass was inspected by Federal inspection personnel and required reprocessing because the inspector observed visible digestive tract contamination inside the carcass cavity. They tested for APC, Coliform, *E. Coli* and *Salmonella* at poultry slaughter establishments. To analyze the efficacy of OLR

systems, the companies compared microbial test results from “passed” poultry carcasses with the results from “contaminated” carcasses before and after carcasses entered the antimicrobial spray system.

In 2010, two companies conducted studies at poultry slaughter establishments. on the efficacy of replacing chlorinated water containing 20 ppm available chlorine with an antimicrobial in offline reprocessing. They compared microbial test results from “passed” poultry carcasses with the results form “contaminated” carcasses before and after the carcasses entered the antimicrobial spray system. They tested for APC, Coliform, *E. Coli* and *Salmonella*.

Material and Methods:

Eleven OLR companies and two off-line reprocessing companies conducted their studies at poultry slaughter establishments by comparing “passed” poultry carcasses with “contaminated” carcasses before and after entering the antimicrobial spray system. As poultry carcasses were inspected by Federal inspection personnel, “contaminated” carcasses were marked. Samples were taken randomly from “passed” and “contaminated” carcasses prior to entering the re-processing system. The same process for selecting additional “passed” and “contaminated” carcasses were used when the carcasses exited the system.

The OLR samples were collected during 2005 through 2010, in most cases, by four categories: 1) Clean before OLR; 2) Clean after OLR; 3) Dirty before OLR; and 4) Dirty after OLR. Two of the eleven companies did not differentiate between clean and dirty during their studies. A “clean” carcass is a “passed” carcass and a “dirty” carcass is a “contaminated” carcass. The sample results were sent to the RIMD, which grouped the results by antimicrobial system, categories, number of samples and microbiological test. The RIMD received from 823 to 1990 samples per microbiological test. Using weighted averages, the RIMD calculated the average Log_{10} levels per microbiological test for pre-OLR and post-OLR. Also, the RIMD calculated the average percent positive for *Salmonella* for pre-OLR and post-OLR.

The off-line reprocessing samples were collected by two categories: 1) Pre-recondition and 2) Post-recondition. A “pre-recondition” carcass is a “contaminated” carcass before treatment, while a “post-recondition” carcass is a “contaminated” carcass after treatment. The RIMD received from 205 to 210 samples per microbiological test in 2010. Using weighted averages, the RIMD calculated the average Log_{10} per microbiological test for “pre-recondition” and “post-recondition.” Also, the RIMD calculated the average percent positive for *Salmonella* for “pre-recondition” and “post-recondition.”

Results:

Online Reprocessing

Specifically for the OLR studies, FSIS granted waivers from 9 CFR 381.91(b)(1), which provide that any poultry carcasses accidentally contaminated during slaughter with digestive tract contents shall not be condemned if promptly reprocessed at an approved reprocessing station away from the main processing line. The regulations permit FSIS to waive regulatory requirements for a limited period of time to permit experimentation (9 CFR 381.3(b)). FSIS used the data collected from the eleven OLR systems to calculate the average reduction of microorganisms commonly found on poultry carcasses for OLR during 2005 through 2010.¹

Table 1: On-line Reprocessing Pathogen Reduction 2005-2010 Results

Testing Condition	Avg. Log ₁₀ APC	Avg. Log ₁₀ E. coli	Avg. Log ₁₀ Coliforms	Salmonella Positive
Pre on-line reprocessing	3.73	2.45	2.3	39.2%
Post- on-line reprocessing	2.89	1.82	1.65	29.0%
Reduction	0.84	0.63	0.65	10.2%

Offline Reprocessing

Specifically for offline reprocessing, FSIS waived the section of 9 CFR 381.91(b) (1) requiring all surfaces of the carcass shall be treated with chlorinated water containing 20 ppm available chlorine. FSIS used the data from the two offline reprocessing systems to calculate the average reduction of microorganisms commonly found on poultry carcasses for online reprocessing in 2010².

Table 2: Off-line Reprocessing Pathogen Reduction 2010 Results

Testing Condition	Avg. Log ₁₀ APC	Avg. Log ₁₀ E. coli	Avg. Log ₁₀ Coliforms	Salmonella Positive
Pre off-line recondition	4.67	2.54	2.37	21.0%
Post off-line recondition	3.43	1.66	1.47	14.0%

¹ See attachment 1

² See attachment 2

Reduction	1.24	0.88	0.90	7.0%
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Conclusion:

- ❖ The data generated from the in-plant trials demonstrated that the technologies used in these studies have been successful and yielded definite improvements.
- ❖ Both OLR and OFLR reprocessing in-plant trials demonstrated an average \log_{10} reduction for APC, *E. coli* and coliforms.
- ❖ Both OLR and OFLR demonstrated a percent positive reduction for *Salmonella*.
- ❖ OLR sample size range: 823 – 1990.
- ❖ OFLR sample size range: 205 – 210.
- ❖ Although OFLR had demonstrated a larger average \log_{10} reduction for APC, *E. coli* and coliforms than OLR, the larger sample size for the OLR studies demonstrates the higher confidence that the OLR systems would achieve a definitive improvement for average \log_{10} reduction.
- ❖ OLR had a better *Salmonella* positive reduction than OFLR.

Attachment 1

Poultry Online Reprocessing (OLR) System Microorganisms Reduction Data

Antimicrobial System	Company's Testing Condition	No. Samples	Average Log ₁₀ APC	Average Log ₁₀ E. coli	Average Log ₁₀ Coliforms	Salmonella (+)	% Salmonella Positive
Cecure	Pre-Cecure (clean or dirty) Visibly Contaminated After	40	4.1	2.5	2.6	35	
Cetylpyridinium chloride	Cecure Visibly Clean After Cecure	40 40	0.1 0.1	0 0	0 0	0 0	
CitriLOW (Precure)	Clean before OLR Technology	90	3.71	2.16	2.1	69	
Mixed Acid	Clean after OLR Technology	90	2.9	1.64	1.58	73	
	Dirty before OLR Technology	90	3.76	2.6	2.53	77	
	Dirty After OLR Technology	90	2.74	1.56	1.48	76	
FCN 887 OLR	Clean- Before OLR	109	3.7	2.88		75	
	Clean- After OLR	109	2.42	1.64		24	
	Dirty - Before OLR	109	3.79	2.93		69	
	Dirty - After OLR	110	2.52	1.74		33	
FCN 887 OLR	Clean- Before OLR	100	3.8	2.04		23	
	Clean- After OLR	100	3.16	1.74		9	
	Dirty - Before OLR	100	4.02	2.53		46	
	Dirty - After OLR	100	3.46	2.01		26	
FCN 887 OLR	Clean - Before OLR	100	3.33	2.2		5	
	Clean - After OLR	99	3	2.19		4	
	Dirty - Before OLR	100	3.8	2.82		7	
	Dirty - After OLR	99	3.48	2.75		6	
Chlorosan	Clean - Before OLR	120	4.348	2.551	2.784	44	
	Clean - After OLR	120	3.84	2.429	2.546	62	
	Dirty - Before OLR	120	4.3	2.702	2.84	44	
	Dirty - After OLR	120	4.079	2.49	2.61	62	
FCN993	Before OLR	60	4.72	3.18		5	
	After OLR	60	3.68	2.11		1	
SYNTRx	Visually Clean After OLR	118 47	0.36	0.18			

		59			0.2	
	Visually Contaminated	115	0.43			
	After OLR	84		0.23		
		89			0.26	
SYNTRx	Visually Clean Before OLR	131	2.42			
		58		1.48		
		73			1.59	
	Visually Contaminated	131	2.35			
	before OLR	58		1.56		
		70			1.76	
Microtox 5P	Clean - Before OLR	180	4.02	2.34		44
	Clean - After OLR	180	3.73	1.88		29
	Dirty - Before OLR	180	4.01	2.34		43
	Dirty - After OLR	180	3.73	2.09		35
Hypochlorous Acid	Clean - Before OLR	90	3.63	2.3	2.49	43
	Clean - After OLR	90	3.25	1.79	1.93	34
	Dirty - Before OLR	90	3.78	2.33	2.67	44
	Dirty - After OLR	90	3.59	2.17	2.38	34
FMC Spectrum - Perasafe	Clean - Before OLR	20	3.72	2.32	2.17	1
	Clean - After OLR	20	4.82	3.04	3.37	1
	Dirty - Before OLR	20	4.91	3.39	3.61	0
	Dirty - After OLR	20	3.43	2.05	2.23	1
	Pre - OLR	1980	3.73			
		1834		2.45		
		823			2.30	
		1718				39.2%
	Post - OLR	1990	2.89			
		1888		1.82		
		868			1.65	
		1757				29.0%
	Reduction		0.84	0.63	0.65	10.2%

Attachment 2

Poultry Offline Reprocessing (OffLR) Microorganisms Reduction Data

Company's Testing Condition	Establishment	Count	Average Log₁₀ APC	Average Log₁₀ Coliform	Average Log₁₀ E. Coli	Salmonella Positives	% Salmonella Positive
Pre-recondition	One	50	4.3516			10	
		47		1.1142	0.9386		
		50	4.1955	1.9497	1.8833	7	
	Two	50	4.904	3.2315	2.9895	13	
		57	5.1775				
		58		3.6221	3.4156	13	
Post-recondition	One	50	3.6581	1.4707	1.2545	12	
		50	2.8254	1.0431	0.9315	1	
	Two	50	3.6954	1.997	1.8339	9	
		60	3.5369	2.0454	1.8117	7	
Pre-recondition		207	4.6747			43	21%
		205		2.5439	2.3700		
Post-recondition		210	3.4341	1.6584	1.4747	29	14%
Reduction			1.2407	0.8855	0.8953		7%