



# The evaluation of disinfection system with steam mediated against *Salmonella* Typhimurium

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## Introduction

The outbreaks of two notorious infectious diseases such as high pathogenic avian influenza (HPAI) and food and mouth disease(FMD) occurred in Korea from late falls in 2014 to early spring this year. For last 5 years, AI and FMD outbreaks occurred during winter with monthly averages -3 to -4°C. In case of HPAI, the epidemiological studies were conjectured that the migratory wild birds were the source of infection and then secondary spreads were due to the inanimate related such as vehicle, equipments and fomites. To reduce the secondary transmission into livestock farms or premises, strict biosecurity program should be adopted by farm level and government quarantine. The disinfection with chemical agents is an important element on biosecurity program.

However, the efficacy of disinfectants in a field is complicated due to low temperature during winter season. Moreover the disinfectant solution is rapidly frozen at the moment when sprayed in a field. Hence the novel disinfection system has been required. This study aimed to evaluate disinfection system with steam for the vehicles to come in and out at livestock farm

## Methods

### Materials

- Target organism : *Salmonella* Typhimurium
- Disinfectants :Citric acid(1:600), Triple salts(1:1000)
- \* Working concentrations were based on manufacturers' recommendations
- Space : Parking lot
- Disinfection system with steam : Patented by Seogwang in Korea
- Application of disinfection system
  - Direct way : diluted disinfectants were boiled by system
  - Indirect way : diluted disinfectants were sprayed with steam

### Methods

#### - Active ingredients analysis

Active ingredients	Analytic method
Citric acid	HPLC - Mobile phase : 0.1% phosphoric acid - Column : X-bridge C18 - Wavelength : 210nm (UV)
Triple salts (Active oxygen)	Iodometry Titration - Titrant : 0.1N sodium thiosulfate

## Results

### Active ingredients analysis (Direct way)

Active ingredients	Before system	After system
Citric acid (200g/L)	204g/L (102%) pH 3.8	75g/L (37.5%) pH 6.3
Triple salts (2.5% as active oxygen)	2.10% (84%) pH 2.9	Not detected pH 5.9

### Efficacy test with tube (Direct way) \* No growth tubes / Total inoculated tubes

Active ingredients	Before system	After system
Citric acid (200g/L)	4/5*	0/5
Triple salts (2.5% as active oxygen)	4/5	0/5

### Active ingredients analysis (Indirect way)

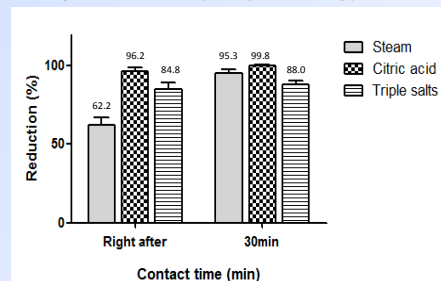
Active ingredients	Before system	After system
Citric acid (200g/L)	186.6g/L (93.3%) pH 3.9	107.2g/L (53.6%) pH 5.2
Triple salts (2.5% as active oxygen)	2.85% (114%) pH 2.8	1.02% (40.8%) pH 4.5

### Efficacy test (Indirect way)

Active ingredients	Before system	After system
Citric acid (200g/L)	5/5	0/5
Triple salts (2.5% as active oxygen)	5/5	0/5

## Results (Continued)

### Efficacy test with coupon (Direct way)



### Efficacy test with coupon (Indirect way)

Triple salts product was considered as not suitable for this boiling system, thus further study was conducted with citric acid based product by indirect way.

Condition of system	Dilution Ratio (+ ; organic load)	Log Reduction		
		Right after	10min	30min
10sec Steam treatment	1 : 600	4.83	4.80	3.80
	1 : 50	4.92	4.71	3.04
	1 : 50(+)	6.25	5.43	6.04
	1 : 25(+)	6.19	5.35	6.00
	1 : 600	4.83	4.83	3.84
Control	1 : 50	4.92	4.71	3.04
	1 : 50(+)	6.25	5.43	6.04

## Discussion & Conclusion

At the first time, the way of steaming disinfectants was that diluted disinfectants were passing boiling coil directly. The results of active ingredients analyzing showed that the content of citric acid and active oxygen in the product of triple salt was decreased and broken down by heat in the steam machine.

The efficacy test results also indicated these disinfectants were not effective against *Salmonella* Typhimurium at all after boiling in the steam machine. Hence the diluted disinfectants were adopted after changing water to steam to prevent from inactivation by heat. The efficacy of steamed disinfectants was increasing. The difference between the results from suspension test(using tube) and carrier test(using coupon) may come from environmental temperature. The suspension test was conducted under 4°C however, carrier test was conducted at the field, average temperature over 25°C. As changing the steaming application, the efficacy of disinfection system was increasing however, this system can inactivate specific chemicals used in disinfectants. Further studies are required to find out the unaffected material by heat and to maintain the disinfectant activities without freezing or evaporation during winter season.

## References

- Benjamin D. Tanner. Reduction in infection risk through treatment of microbially contaminated surfaces with a novel, portable, saturated steam vapor disinfection system . American Journal of Infection Control, 37, 20-27, 2009.

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