

## HOSPITALITY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

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### NAIL BRUSH SANITIZER EFFECTIVENESS STUDY

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#### Introduction

The purpose of this study is to measure the degradation of a common foodservice quaternary ammonium sanitizer, EcoLab / SSDC Super San, at 200 ppm when an in-use nail brush is stored in the solution between uses.

#### Method

Three restaurants volunteered for this experiment. A 1/9 steam table insert with 475 ml of a 220-ppm solution of Super San was used to soak the brush after use (SSDC, Inc.; Carrollton, TX). Super San is a quaternary ammonium sanitizer, with principal ingredients Octyl decyl diemethyl ammonium chloride, Dioctyl diemethyl ammonium chloride, Didecyl diemethyl ammonium chloride, Alkyl (C14, 50%; C12, 40%; C16, 10%) dimethyl benzyl ammonium chloride, and inert ingredients. The pan was put beside the hand sink in a restaurant so that the nail brush could be put in the pan after use.

As employees entered the kitchen, they put soap on their hands and then, washed their hands using the nail brush at the sink. About 2 ml of hand soap was used. The wash-and-rinse time was not controlled, but it took about 15 seconds. The nail brush was then set in 475 ml of quaternary ammonium sanitizer in the 1/9 steam table insert pan. After 30 seconds for reaction of the residual detergent on the nail brush with the sanitizer, the strength of the sanitizer was measured using a quaternary ammonium titration kit (La Motte Company; Chestertown, MD). The titration readings could be determined to  $\pm 10$  ppm. This wash procedure of the nail brush was performed three times, and after each time, the strength of the quaternary ammonium sanitizer was measured by titration.

After three employees had washed their hands and the nail brush was sanitized, three times, the solution was changed, a 1-ml sample was taken, and a 1-to-10-ml dilution made in letheen broth (Biomérieux, Lombard, IL). An aerobic colony count of surviving bacteria was determined.

The hand wash detergent used in each retail food operation was the detergent commonly used in that operation:

Restaurant A: Spartan® Lotionized Liquid Hand Cleaner™ (Spartan Chemical Company, Inc.; Maumee, OH)

Ingredients: Water, Cocamide DEA, Sodium lauryl sulfate, PEG-75 lanolin, Sodium chloride, Quarternium 15, Styrene/acrylates copolymer, Fragrance, D&C Red No. 28

Restaurant B: Digiclean Digits™ (EcoLab; St. Paul, MN)

Ingredients: Active ingredients: Triclosan, 0.3; Inactive ingredients: Water; Potassium cocoate; SD alcohol 40-B; Sodium laureth sulfate; Hexylene glycol; Boric acid; Cocamidopropyl PG; Dimonium chloride phosphate; Tetrasodium EDTA; PEG-75 lanolin;

Cocamine oxide; Fragrance; Methylparaben; Propylparaben; Aloe barbadensis; FD&C blue 1

Restaurant C: Perfect Misty Blue (Masteragents LTD; Elk Grove Village, IL)

Ingredients: Sodium laureth sulfate; Cocamidopropyl betaine; PEG-75 laudyn; Propylene glycol; PEG-24; Glycereth 24; Citric acid; Methylisothiazolinone

The nail brushes used in each operation were:

Restaurant A: 2000 Surgeon's Scrub Brush (Anchor Brush Company; Morristown, TN) and Hand and Nail Brush (Carlisle Foodservice Products; Oklahoma City, OK)

Restaurant B: Hand and Nail Brush (Carlisle Foodservice Products; Oklahoma City, OK)

Restaurant C: Hand and Nail Brush (Carlisle Foodservice Products; Oklahoma City, OK) and 2000 Surgeon's Scrub Brush (Anchor Brush Company; Morristown, TN)

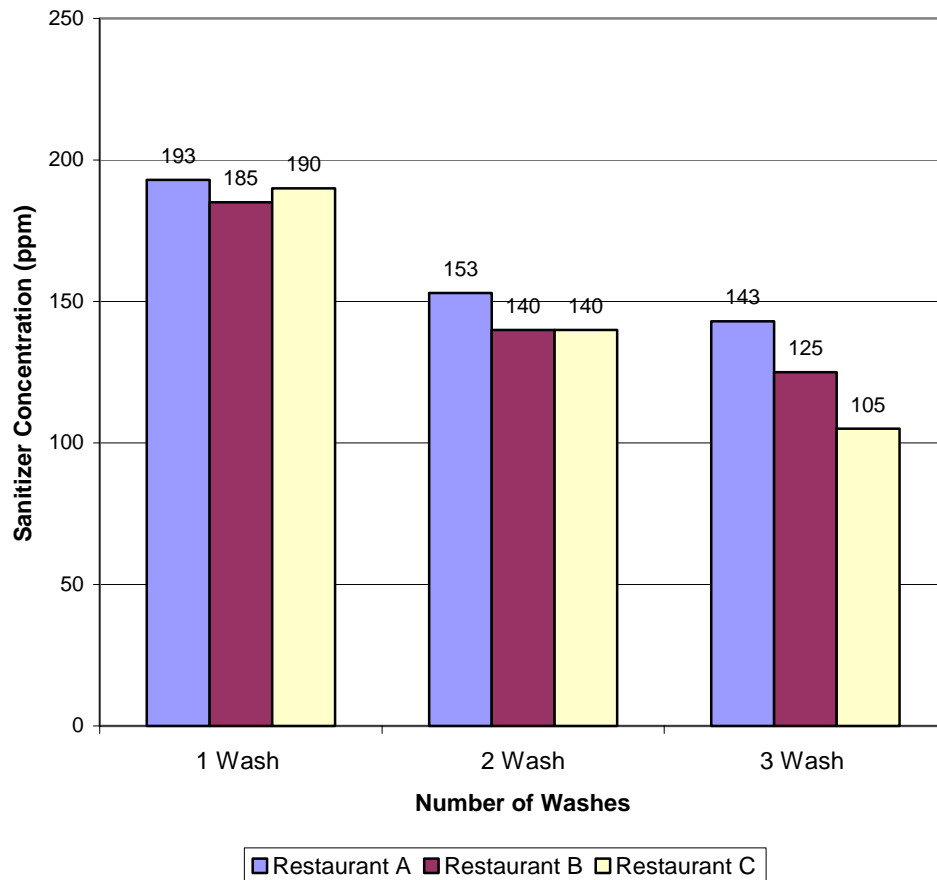
## Results

The degradation of the quaternary ammonium sanitizer is shown in Table 1 and plotted in Figure 1. The starting fresh concentration was 220 ppm.

**Table 1. Degradation of Quaternary Ammonium Sanitizer and APC CFU per ml**

Location	Brush	1 Wash	2 Wash	3 Wash	After 3 wash, APC wash water/ml
Restaurant A					
Sink 1	Anchor	200	160	140	15
Sink 2	Carlisle	190	150	140	
Sink 3	Carlisle	190	150	150	10
Average		193	153	143	
Restaurant B					
Sink 4	Carlisle	180	140	130	<10
Sink 5	Carlisle	190	140	120	<10
Average		185	140	125	
Restaurant C					
Sink 6	Carlisle	190	140	110	<10
Sink 7	Anchor	190	140	100	<10
Average		190	140	105	
Total Average		189	144	124	

**Figure 1. Degradation of Quaternary Ammonium Sanitizer and APC CFU per ml**



## Discussion

Quaternary ammonium compounds are a cationic surfactant, and detergents are an anionic surfactant. Therefore, the detergents act to destroy the effectiveness of the quaternary ammonium compounds by neutralization of the charges. The results show that the first washing of the nail brush reduced the sanitizer by about 30 ppm. The second washing reduced the sanitizer by another 45 ppm. The last washing reduced the sanitizer about 20 ppm. Hence, the reduction basically depends on the amount of detergent hand soap that sticks to the nail brush and is transferred to the quaternary ammonium sanitizer. The chemical reaction taking place is very predictable. By the end of three washings of the nail brush, the quaternary ammonium sanitizer, in all cases, had been reduced to less than 150 ppm, which is an ineffective level.

It should be recognized, however, that there are not very many bacteria actually stuck to the nail brush because of the effectiveness of the washing process. So, the overall results of bacterial counts showed less than 10 bacteria from Restaurants B and C, and less than 15 bacteria per ml, or an insignificant level, in Restaurant A.

## Conclusions

Detergent hand soap neutralizes quaternary ammonium sanitizers and makes them ineffective as agents for the destruction of bacteria. The actual washing process itself reduces bacteria to a low level on the nail brush, and there is really no need for a sanitizer pan for storing nail brushes.

Eventually, with more use, after, perhaps, 10 uses of the nail brush, there will be enough organic build-up in the neutralized sanitizer solution that the bacteria would be expected to begin to grow and, thus, the brush storage sanitizer solution itself would become a source of bacterial contamination in the kitchen.

It is ineffective and, perhaps, a risk to store the in-use nail brush in a sanitizer solution in between uses.