Comparison of Cellulose and PUR™ Polyurethane Sponges for the Collection of Microbiological Environmental Surface Samples from a Fresh Produce Processing Facility

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Abstract

Environmental surfaces within food processing companies are routinely sampled to assess hygienic microbiological status. Quantitative tests on surface samples for aerobic plate count (APC) organisms, yeast and mold, Enterobacteriaceae bacteria, coliforms, and *Escherichia coli* allow companies to measure changes in counts over time and to identify locations within the facility that need special attention. This study evaluated the performance of the 3M™ Sponge-Stick[a], incorporating a cellulose sponge, and the World Bioproducts EZ-Reach™ Sponge Sampler[b], incorporating a polyurethane sponge, for recovery of APC and Enterobacteriaceae. Fifty-five different sites were sampled in a fresh produce processing facility. At each site, two samples were collected from 1 ft^2 areas, one sample with each device. Results of this study revealed that the polyurethane sponge consistently recovered higher numbers of both APC and Enterobacteriaceae organisms than the cellulose sponge.

Introduction

Environmental monitoring is an essential part of safe food production. Sampling the environment with devices such as swabs or sponges allows for verification of sanitation practices, detection of pathogens, and the generation of data to assess the level of microbiological control in the food processing environment. This is particularly important in fresh produce facilities .

One of the first publications on the use of cellulose sponges for sampling surfaces in a food production environment was authored by Gabis and Silliker in 1975[1]. Since then, cellulose sponges have been routinely used to sample a diverse range of areas including beef, pork, and poultry carcasses[2,3], as well as production floors, ceilings, drains, and equipment. Alternative materials to cellulose sponges have been studied over the years. These materials include polyurethane sponges[4,5], medical gauze, cotton and synthetic wipes[6,7].

The purpose of this study was to compare the performance of cellulose and polyurethane sponge collection devices for the collection of environmental surface samples from a fresh produce processing facility.

Materials & Methods

Sampling Location and Sites: Fifty-five sites in a fresh produce processing facility were sampled.

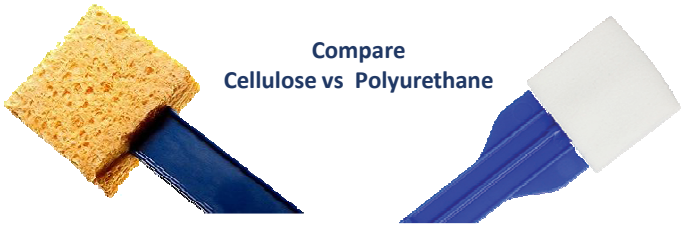
Collection and Transportation: At each site, a 1 ft^2 area was sampled with a cellulose sponge hydrated with 10 ml of Letheen Broth (3M™ Sponge Stick) and a separate but contiguous 1 ft^2 area was sampled with a polyurethane sponge hydrated with 10 ml of HiCap™ Neutralizing Broth (World Bioproducts EZ-Reach™ Sponge Sampler). A total of 110 samples were collected. All samples were shipped overnight in coolers with ice packs to an independent laboratory for analysis.

Sample Processing: Upon arrival, 9.9 ml of 0.1% peptone water was added to each sponge and masticated for 1 minute at 260 RPM. Aerobic plate count (APC) for each sample was determined by pour plating 1.0 ml and 0.1 ml aliquots with Standard Methods Agar and incubating plates at 37° C for 2 days. Enterobacteriaceae counts (EB) were determined by pour plating 1.0 ml and 0.1 ml aliquots with Violet Red Bile Agar with Glucose with an additional overlay of Violet Red Bile Agar with Glucose and incubating plates at 37° C for 2 days.

Results & Discussion

It is difficult to evaluate differences in the effectiveness of sampling devices when studying real-world paired samples. While the samples were taken from adjacent sites on the same piece of equipment, during the same sampling event, it cannot be assumed that the microbial populations were evenly distributed across the surfaces. In this study, the mean CFU values for each type of device were compared. Additionally, results for each pair of samples were compared to measure the frequency in which one device provided higher counts than the other device.

Higher Counts for Polyurethane: The EZ-Reach Sponge Sampler with polyurethane produced higher average counts for both APC and EB than the 3M Sponge-Stick with cellulose (Figure1). Similarly, the EZ-Reach Sponge Sampler with polyurethane provided higher APC results 4.5 times more often and higher EB results 9 times more often than the 3M Sponge-Stick with cellulose (Figure 2).



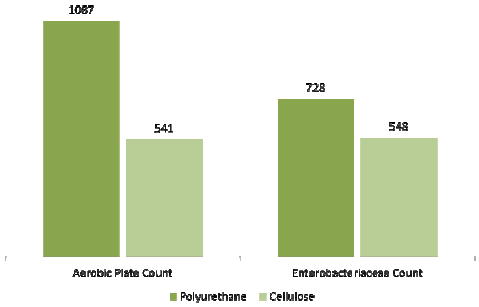


Figure 1
Average counts for Aerobic Plate Count and Enterobacteriaceae with each sampling device.

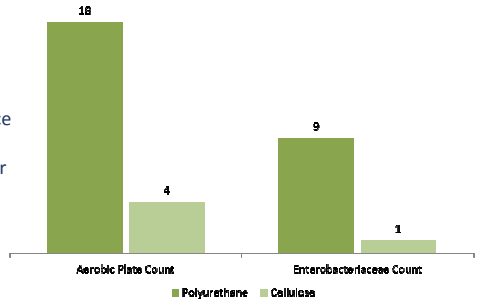


Figure 2
Number of times a device provided higher counts than the other device for paired samples.

Conclusion

The EZ Reach sponge sampler with a polyurethane sponge consistently demonstrated a higher recovery of APC and EB organisms from the surfaces tested. The precise reasons for this difference were not determined. However possible explanations include, better collection of organisms from the surface, better preservation of the organisms once collected, and better release of the organisms from the sponge prior to plating.

[1] Silliker, J.H. and D.A. Gabis, 1975, A cellulose sponge sampling technique for surfaces. J.Milk Food Technol. 38:504

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[3] W.J. Dorsa et al. 1997, Food Microbiology, 14:63-69

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[5] Llabres, C.M. and B.E. Rose, 1989, Antibacterial properties of retails sponges. J. Food Prot. 52(1):49

[6] Kirschner, L.E. and J.R. Puleo 1979. Wipe-rinse technique for quantitating microbial contamination of large surfaces. Appl Environ Microbiol. 72:4429

[7] Valentine, N.B. et al. 2008. Evaluation of sampling tools for environmental sampling of bacterial endospores from porous and nonporous surfaces. J. Appl. Microbiol. 105:1107

[a] 3M and Petrifilm are trademarks of 3M, St. Paul, MN

[b] EZ Reach and HiCap are trademarks of World Bioproducts, Woodinville, WA