EVALUATION OF EXTERIOR SANITARY GARMENTS FOR MEAT PLANT EMPLOYEES FOR CONTROL OF MICROBIAL CONTAMINATION

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Summary

Disposable frocks, manufactured by Precise Systems, LLC, and made of an innovative clothing material formed by an inner layer of a spun-bond polypropylene material reinforced by an outer layer of polyethylene, were compared with the cotton/polyester materials used in frocks typically worn in food plants today. The growth and absorption of bacteria on these materials were compared as an indicator of the sanitary conditions of the disposable frocks. These materials were cut into 2 x 2-inch pieces and were inoculated with generic *Escherichia coli*, *E. coli* O157:H7, *Listeria monocytogenes*, and *Salmonella* spp. Samples were collected after allowing microorganisms to attach for 0, 1, 2, 4, 6 and 8 hours. In most instances, the cotton/polyester absorbed and maintained the initial inoculation rate over the sampling times. Polypropylene was somewhat absorbent, but contamination rates were slightly lower than on cotton/polyester. Polyethylene material was non-absorbent and performed the best, especially with *Listeria monocytogenes*. The data indicate that the non-absorbent property of polyethylene does not provide a reservoir for microorganisms, allows run-off, and therefore potentially reduces the opportunity for cross-contamination of food products.

Introduction

Cleaning and sanitation in food plants is the most important aspect in obtaining a wholesome product. Plant employees have the potential to spread contamination in a food processing plant. Their personal hygiene practices and sanitation awareness (i.e., clean outer garments and regular cleaning of personal protective equipment) can greatly improve or reduce the overall sanitation of a plant and its products. Every tool and garment of plant employees that come into contact with food or food contact surfaces increases the likelihood of food contamination if sanitation protocols are not properly met. Outer garments of plant employees are subjected to continual contact with fat, blood, and other organic matter that are a source of microorganisms. The loading of garments with a mixture of organic material and water, plus the body temperature of the worker, helps provide an appropriate environment for organisms to survive, or possibly replicate, throughout the working day.

It has proven difficult, if not impossible, to maintain clean outer garments during meat processing. Most food plants distribute one frock per employee during every shift because of cleaning costs and time constraints of distribution. Outer garments possess another potential problem; cotton, the material most frocks are made from, can carry contamination through the laundering process, and it quickly absorbs moisture (water, blood, fat). The cuff, forearm, thigh, chest, and abdomen are the areas most frequently soiled among food plant workers, especially in slaughter and fabrication areas.

Precise Systems, LLC, has developed a new spun-bond, disposable frock with an outer polyethylene layer to provide protection

against absorption of moisture and organic materials, and possibly against microbial contamination. These frocks were microbiologically analyzed and compared with cotton frocks after inoculation with microorganisms and loading with meat purge.

Procedures

Four different bacterial mixtures were used to perform side-by-side testing in the laboratory on disposable and cotton frocks: generic *Escherichia coli, E. coli* O157:H7, *Salmonella*, and *Listeria monocytogenes*.

A clean frock made of cotton/polyester material was cut into 2 x 2-inch pieces and sterilized before inoculation. The polypropylene spun-bond and the polyethylene materials from the disposable frocks were separated and individually cut into 2 x 2-inch pieces with a scalpel while wearing sterile gloves. Pieces of the disposable frock were sampled for bacteria before and after inoculation.

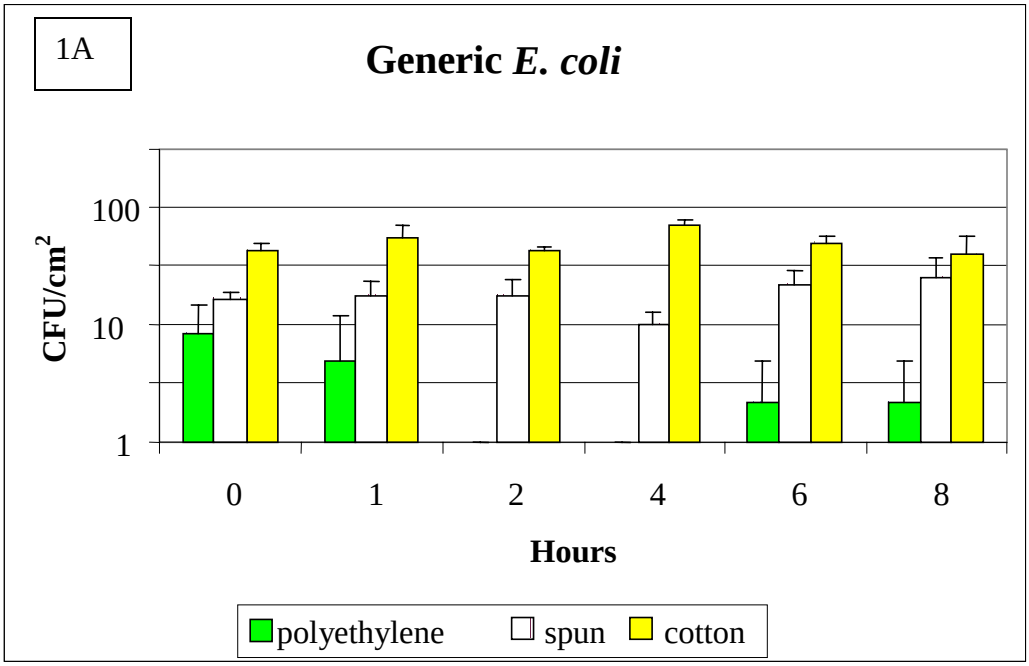
Frock pieces from all materials were suspended on metal hooks inside a spray chamber and then misted with two sprays of inoculum and two sprays of meat purge. To replicate the continual soiling of frocks in a food processing plant, frock pieces were misted every 30 minutes with either one spray of inoculum and one spray of meat purge, or deionized water only (for control), until the designated sampling time.

Microbes on frock material samples were enumerated at 0, 1, 2, 4, 6 and 8 hours to determine amount of pathogen on each material. The entire sample was placed into a sample bag with sterile diluent and mixed thoroughly to dislodge the bacteria from the frock material. Aliquots of the diluent were then plated onto selective agar plates to enumerate each pathogen population.

Results and Discussion

The cotton/polyester pieces demonstrated high absorption, and in most instances inoculation rates were maintained throughout the entire sampling period (Figure 1). No microorganisms were detected on any fresh, disposable frock taken directly from vacuum packaging. The polypropylene spun-bond material was less absorbent to moisture than the cotton/polyester material was, but it was not able to resist continued wetting over time. Microbial counts were slightly smaller for spun-bond samples than for cotton/polyester material for each of the four types of organisms. The polyethylene material showed superior performance in resisting both initial microbial contamination and prolonged contamination over time. Polyethylene is non-absorbent and, therefore, does not allow contamination to penetrate the garment like cotton/polyester or spun-bond materials would. Microbial counts were much smaller for the polyethylene material than for the polypropylene spun-bound and the cotton/polyester materials.

Results indicate that disposable frocks made from polyethylene (exterior) and polypropylene spun-bound material (interior) are superior to cotton frocks with respect to resistance to microbial contamination on the garment. Our data also agree with that generated from the health industry, in which these disposable garments are widely used. Data from other researchers have indicated that disposable gowns made of polypropylene showed less blood absorption and bacterial passage than cotton gowns did.


1A
Generic E. coli
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10
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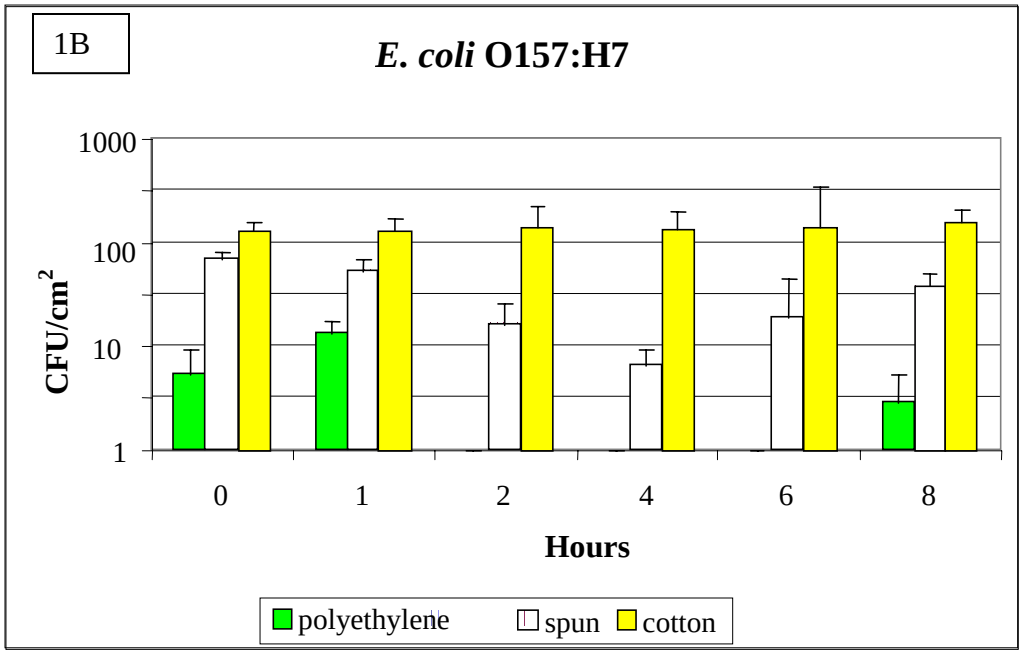
CFU/cm2
0
1
2
4
6
8
Hours
polyethylene
spun
cotton


1B
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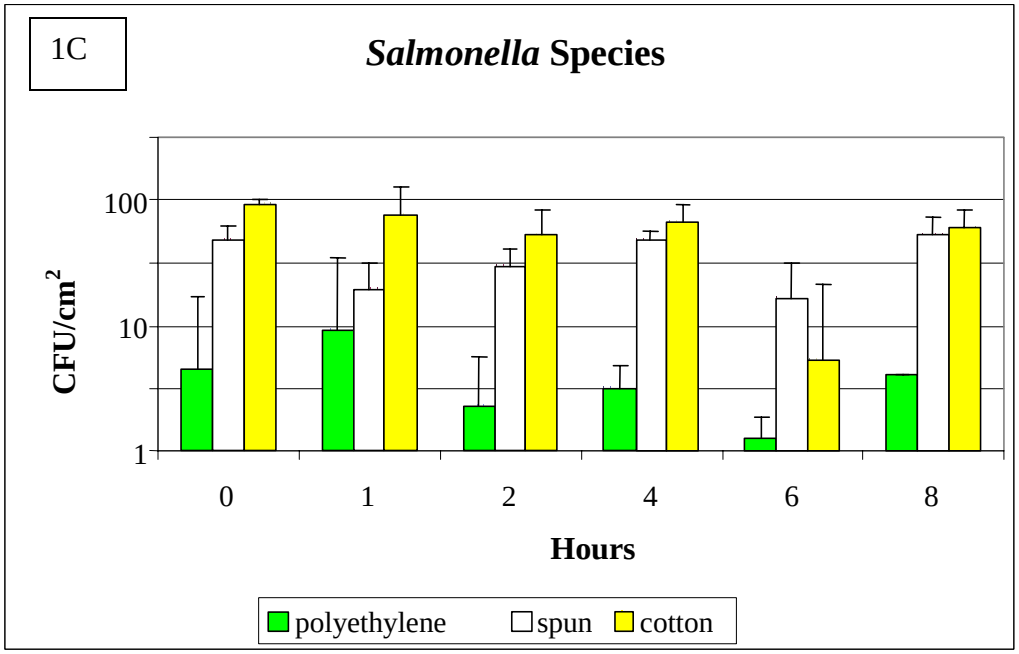

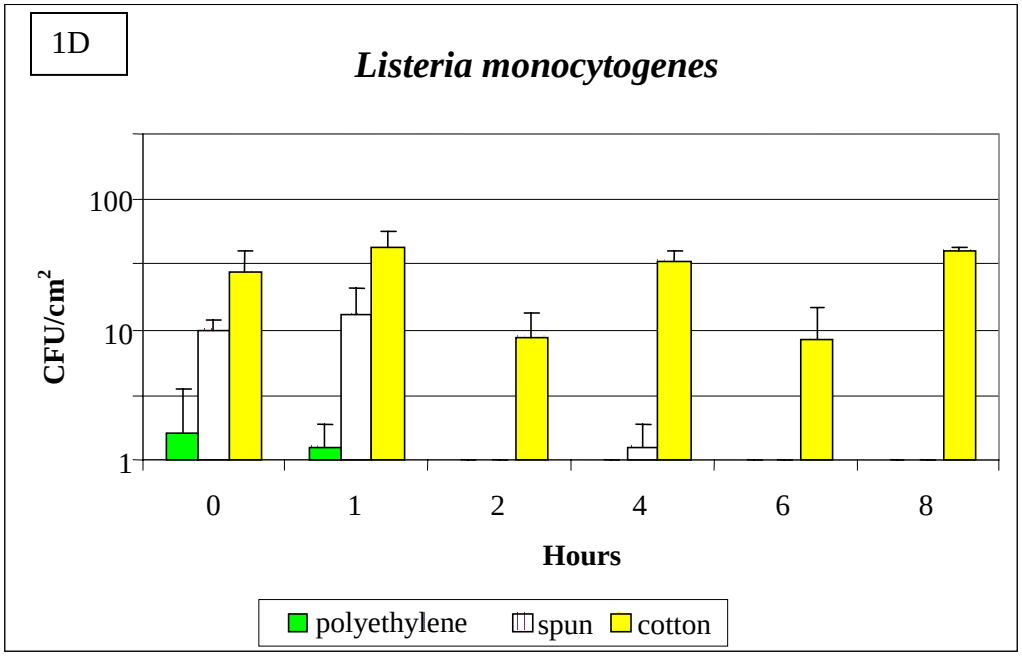

Figures 1A-D. Numbers of Target Organisms Recovered after Inoculation and Extended Storage of Different Frock Materials Worn during Meat Manufacturing.