TPC WIRE & CABLE CORP.
EXPECT HIGH PERFORMANCE®

ANTIMICROBIAL TECHNOLOGY APPLIED TO ELECTRICAL CABLES

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INTRODUCTION

This paper discusses various antimicrobial technologies and their increasing use in many consumer and manufacturing applications. Of primary interest is the unique application of this technology to electrical cables in the food and beverage industry.

ANTIMICROBIALS

Antimicrobials are chemical agents capable of destroying or inhibiting the growth of micro-organisms. These additives are used widely in consumer products such as hand soaps, toothpaste, deodorants, swimming pool chemicals, preservatives in cosmetics and anti-dandruff shampoo additives. Some of these act very rapidly to destroy bacteria, but disappear quickly and leave no residue (e.g. alcohols, chlorine, peroxides, and aldehydes). A second group of compounds leave long-acting residues on the surface and have prolonged effect (e.g. triclosan, triclocarban, and benzalkonium chloride). A third method has application in polymer products, where silane-based or silver-based ions are dispersed in the compound.

Antimicrobial agents are typically targeted against bacteria, fungi (mold and mildew) and algae. There are many ways by which microbes are affected by antimicrobial agents. First, the antimicrobial agent must come in contact with the organism for it to be effective. Second, the antimicrobial needs to attack the cellular functions of the microbes so they can't take in food, can't excrete waste, and can't reproduce. Since microbes are living organisms, they must continually convert nutrients into energy to grow and replicate. Thus, the primary role of antimicrobials is to inhibit the conversion of nutrients into energy, with the desired effect of destroying the microbe.

REGULATION

Antibacterial agents are regulated depending upon their intended use. The United States Food and Drug Administration (FDA) regulates antibacterial soaps and substances that will either be used on the body or in processed food. If a substance is not intended for use on or in the body, it is regulated by the United States Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide and Rodenticide Act. Electrical cables used in food processing facilities fall under the EPA regulations.

APPLICATION

The conditions for growth of fungus and bacteria are naturally occurring in the Food and Beverage Industry. Moisture, heat, organic material (meat, fish) combine to produce an environment where concern is high. Concern over microbes and their effect on article surfaces has generated increased interest in antimicrobial additives. Unprotected polymer materials can be attacked by microbes, leading to unsightly discoloration, unpleasant odors, and polymer degradation issues.

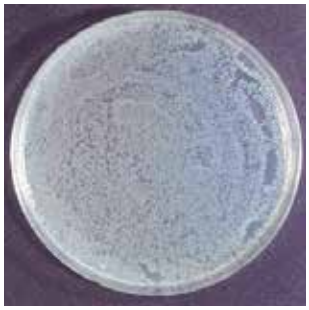
PRODUCT

TPC Wire & Cable Corp. has developed the ***DEFENDER®*** line of electrical cables that address the issue with an extruded polymer jacket that eliminates greater than 99% of bacteria and fungi. The jacket material remains effective for the life of the cable, as the antimicrobial agent is evenly dispersed throughout the material and does not transfer to materials or human hands that come in contact with the cable.

TESTING METHOD

Independent test lab results confirm the effectiveness of antimicrobial cables. The process involves the applica-

tion of a gram-negative bacteria (E. Coli) to an actual extruded cable jacket sample, and a gram-positive bacteria (Staph) to another jacket sample for a duration of 24 hours. The live bacteria are then removed from the jacket and placed in a petri dish with the nutrients that promote growth of the bacteria. The samples are then placed in a humid dark environment to further promote the growth of bacteria. After 14 days (E. Coli and Staph) and 30 days (Fungus) the samples are inspected for any signs of bacteria growth. Any bacteria found are counted and compared to the control sample. The actual lab test photographs below show the absence of bacteria in the samples that had been exposed to the cable jacket for 24 hours. The samples that had not been exposed to the antimicrobial cable show significant growth.



E. COLI GROWTH
No Antimicrobial Additive

E. COLI NO GROWTH
With Antimicrobial Additive

STAPH GROWTH
No Antimicrobial Additive

STAPH NO GROWTH
With Antimicrobial Additive

A similar test was performed to prove the effectiveness of antimicrobial material against fungus (mold and mildew). The result was identical, proving that the antimicrobial cable is **an effective broad-spectrum antimicrobial and antifungal product, capable of eliminating >99% of gram-negative and gram-positive bacteria and fungus in a 24-hour period.**

Examples of the types of Microbes that are eliminated by antimicrobial cable include:

- **Gram-Negative Bacteria** *(E. Coli, Salmonella, Pink Mold—Serratia Marcescens, Shigella, Enterobacteriaceae, Pseudomonas, Moraxella, Helicobacter, Stenotrophomonas, Bdellovibrio, Acetic Acid Bacterial, Legionella, Cyanobacteria, Spirochaetes, Green Sulfur Bacteria and Green Non-Sulfur Bacteria)*

- **Gram-Positive Bacteria** *(Staph Aureus, Listeria, S. Epidermidis, S. Saphrophyticus, S. Haemolyticus, S. Hominis, S. Capitis, S. Schleiferi, S. Warneri, S. Lugdenenis, Strep Pyrogenes, S. Agalactiae, E. Faecalis and E. Faecium)*

- **Fungus** *(Zygomycota, Ascomycota, Basidiomycota and Deuteromycota)*

- **Mold** *(Black Mold—Aspergillus, Cladosporium, Fusarium, Mucor, Penicillium, Rhizopus, Stachybotrys, Trichoderma and Alternaria)*

CONCLUSION

The application of antimicrobial technology in electrical cables has been proven to be effective in eliminating >99% of bacteria, mold and fungus within 24 hrs. The TPC cable that employs this technology remains effective for the life of the cable. Clean, bacteria and fungus free cable will last longer and reduce the frequency of replacement due to visual inspection. However, this does not replace nor should it affect the established cleaning methods in a food processing facility. As with the adoption of most new technologies, small but certain steps will lead to food facilities that are cleaner and benefit from an overall reduction in maintenance costs.

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