

## MOLD AND MILDEW – AN OVERVIEW/MARINE UPHOLSTERY

*Mold and mildew problems in the marine or exterior upholstery, wallcovering, paint, tarpaulin, swimming pool and shower curtain markets, to name a few, have been well documented over the last 25 years. The objective of this overview is to review the causes and cures of these unsightly and odoriferous problems and suggest actions to reduce their impact on the quality of goods as perceived by the consumers.*

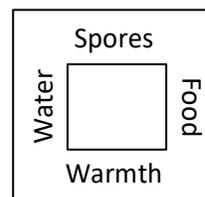
### THE CAUSE – MICROORGANISMS

The two principal causes of offensive odors and unsightly stains and growths are bacteria and fungi, commonly called microorganisms. Bacteria are simple, single-celled organisms. Fungi, referred to as mold and mildew, are significantly more complex. A subset of fungal organisms is a type that produces colored byproducts as part of its digestive process. These byproducts are recognized as stains and are typically pink, yellow, purple or black. All microorganisms require a source of energy; carbon for cell structure, nitrogen for amino acid synthesis, essential minerals and water. Organisms causing problems in the marine, industrial, health care, hospitality, and home environments are frequently very self-sufficient in synthesizing required biochemicals from the most basic molecules. Microorganisms are ubiquitous, they are everywhere, and thus, microbial contamination is the rule. The total absence of microbes, sterility, is the exception.

### CURRENT REALITY

Dr. James Kimbrough and Dr. Virginia Peart of the University of Florida have extensively studied biological problems and their effect on industrial and consumer goods. They have presented a graphical summary of the elements needed for mildew growth and examined these in an attempt to suggest a viable solution. To have a mildew problem, you need four elements which they refer to as the Mildew Square. In order for mildew to proliferate, spores, food, warmth, and moisture are necessary. Elimination of one of these elements would break the square, and the mildew problem would be eliminated. The most

likely element to control is moisture. Keep a surface dry and the ambient air dry, and you can break the link in the Mildew Square. In actuality, this is very difficult. Marine upholstery may be dry when one sits on it, but it is constantly exposed to rain, splashes and wet bathing suits.



### A COMPLEX PROBLEM – AN EXAMPLE

One can observe an unsightly stain, dirt, or mildew growth on the surface of a marine seat and ask the question, "How did it get there?" Dirt carried by the wind or sudden shower will carry the spores or seeds, inoculating the surface. Surface debris can easily be washed off, but what happens to the contamination that gets into a seam or stitch holes? A closer examination reveals that a marine seat is a very complex construction. The vinyl that you look at or sit on is a minute part of the total construction.

The vinyl is usually attached to a fabric to give it dimensional stability and physical strength. Urethane foam of various thicknesses give you the cushion, and the whole seat is usually built on a piece of plywood. If contaminated dirt carried by rainwater gets inside the cushion, the biological growth cycle can begin. It is quite common for soil organisms growing in the foam cushion to produce colored by-products, the most notable of which is a pink compound. This dye is soluble in plasticizer (an ingredient in flexible PVC) and will diffuse and migrate to the vinyl surface. Even though the vinyl compound is adequately protected against mildew growth, pink staining can occur if contact is made with components of a seat which support mildew growth, and this stain cannot be removed by washing.

In any case, the owner's perception of the boat's quality has been seriously affected.

### **THE SOLUTIONS**

As in most complex problems, there are a variety of actions one can take to prevent microbiological problems. These actions must be directed to the components of the product and the total construction. Working in concert, they will assure the highest probability of success in eliminating quality problems associated with mildew contamination. The solution consists of four components: keep seats clean, remove or kill any surface growth, use materials that are treated to inhibit fungal growths, and keep covered, if possible, when not in use.

### **ACTION STEPS**

1. Keep the upholstery clean. Frequent cleaning with a mild detergent will remove any organic matter, dirt or debris which can be readily utilized as a food source for microorganisms.
2. Any observed mildew contamination can be removed by washing with a dilute solution of household bleach in water. Rinse and dry thoroughly after use.
3. Specify and use new materials that have been treated with an effective antimicrobial to inhibit new growth. Here, the boat builders have greatest power for they can specify the performance requirements to assure long-term protection components such as vinyl, urethane, grade foam, and wood.
4. In the design of the seat, consideration should be given to the flow or run off of water so that it is not impeded by seams. Vents should be incorporated to allow water or vapor to escape in the event that leakage into the foam has occurred. A marine grade urethane foam should also be considered along with marine grade threads used to stitch seats.
5. If the exposed part of the boat has a tarpaulin or cover, use it when the boat is not in use. The tarpaulin or cover should only be put on after water is removed and prevented from entering since mold prefers dark, wet environments.

### **ANTIMICROBIAL PRODUCTS**

Antimicrobial is a generic term used in the preservative industry to describe compounds that act as bactericides and fungicides. A broad spectrum antimicrobial will be effective against a wide variety

of bacteria, fungi, and yeasts. There are two general types of applications; those described as giving "in-can" or "dry film" biological protection. The antimicrobial used to give long-term biological resistance to vinyl or other polymer films or foams is classified as a dry film preservative. For over 30 years, antimicrobial compounds have been safely used by the vinyl film and urethane foam industries, and these materials are used in a myriad of different end products. These compounds have proven themselves in both extensive laboratory and field testing.

### **VINYL PRODUCER AND ANTIMICROBIAL SUPPLIER PARTNERSHIP**

Vinyl, as a plastic, is unique in that it can be modified by a wide variety of additives to give it properties that are required by the specific end use. A vinyl film used as part of a marine upholstery could contain a half dozen additives to give the film the desired flexibility, color and processing stability. Suppliers of antimicrobials not only bring their product to the vinyl film producer, they also bring their expertise in biochemistry and microbiology testing.

### **THE FINAL PRODUCT – QUALITY YOU CAN COUNT ON**

Microbiological resistance is one property that is used to build the Total Quality Profile of any product. The Chemical Fabrics & Film Association has included in its "Standard Test Methods" pamphlet protocols for Mildew Resistance (CFFA-120) and Bacterial Resistance (CFFA-300). ASTM G21 or ASTM 1428 may be used to test for mold and bacterial growth. If these test methods are incorporated into a product specification to demonstrate biological resistance, you can be assured that "Quality" has been built in, not just added on.

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