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# Appendix I

## Microfiber Technology

The following series of articles appeared in the February 2003 issue of *Executive Housekeeping Today*. David Carmichael introduces us to a synthetic fiber, microfiber, that will change how we clean. A companion piece shows us how to maintain this wonderful new product. A third article by Robert Kravitz introduces us to microfiber and flat mops and gives us a look at a remarkable study

conducted at the University of California Davis Medical Center. I wish to, once again, thank Beth Risinger, CEO/Executive Director, and Andi Vance, EHT Editor/Ad Sales, at the International Executive Housekeepers Association (IEHA) for allowing me to reprint these articles from *Executive Housekeeping Today*.

## Microfiber Cleaning . . . If Not Now, WHEN?

*By David Carmichael*

You've read about it. You have seen products displayed at trade shows and on Internet sites. So what is it? Does it work? Is it practical? Will it work in a commercial application?

Only a century ago, rayon, the first manufactured fiber, was developed. Prior to that, the use of fiber was limited to those fibers available in the natural world. However, cotton and linen wrinkled from wear and washings; silk required delicate handling; wool shrank and was irritating to the touch. Since rayon and other synthetics, manufactured fibers are now found in modern apparel, home furnishings, medicine, aeronautics, and yes, cleaning products.

Microfiber, introduced in 1986, is a revolutionary synthetic that can be processed, woven and finished in a variety of different ways to achieve a specific result. As a synthetic, it provides mankind with control over its supply and can be manufactured to extremely fine tolerances, many times thinner than other synthetics and hundreds of times thinner than a human hair.

Rated in denier, the unit for measuring fineness of a fabric, a strand of cotton has a rating of 200. A human hair has a denier of 20 and a strand of silk has a denier of 8.

Microfiber has a denier of 0.01 to 0.02. Hundreds of times finer than a human hair, yet strong and tough, split microfiber attracts dust, grime, microorganisms and residues like a magnet.

Microfiber, by itself, would wear and shed its fiber with use. But when it is expertly combined with nylon, a synthetic thermoplastic material, the result is a cloth that exhibits the advantages of both synthetics—cleaning and absorbency of microfiber and the strength and lint-free nature of nylon.

Microfibers are tiny fibers that have been slit into millions of finer fibers that are no thicker than 1/100th of a human hair. The special slitting process produces an ultra-fine fiber with wedge shape filaments and a core of nylon. The wedge shape, the nylon core and the smaller-sized fiber are the key to their effectiveness.

When these tiny fibers are woven together into a cloth through a unique weaving method, the result is a powerful cleaning tool.

Each cloth consists of tens of thousands of tiny storage compartments that lift the dirt up, trap the waste and leave a clean, streak-free surface.

The nylon core within the microfiber form tiny cutting edges that break up surface dirt and easily absorb and remove oils and other grimy substances. The only solvent needed is water!

The conjoining of the two synthetics in just the right combination is crucial. Too much nylon will result in a cloth that will scratch fine or delicate surfaces. Too little nylon and the cloth will not last or clean rough surfaces with-

out rapid deterioration. It is only the perfect combination of polyester and nylon, extruded and woven into microfiber cloth that makes the cloth effective and durable.

Quality manufactured microfiber offers a unique surface structure that contains millions of micro-hooks that grab, lift and hold dust, dirt and grime. These micro-hooks can clean into the pores of surfaces and when used dry, create a positive charge within the fibers that literally "vacuum" dust and dirt from the surface and into the cloth—all without chemicals. High-grade microfiber cloth can hold as much as seven or eight times its weight in dust, dirt and moisture.

### **Not All Microfiber is Created Equal**

From fine fashion to biotechnology, the demand for microfiber is growing exponentially. Factories in Korea, China and other countries are flooding the American market with poor quality, low-grade "microfiber" products. So buyer beware! There are significant differences between cheap, poor quality cloths and high-grade, durable cloths. High-quality extruded microfiber is expensive to produce; with machining costs that can exceed several million dollars. Low-grade microfiber can be produced for under \$100,000.

Blending ratios are an important factor in microfiber cloth quality and cleaning ability. While a blend of 80% polyester and 20% polyamide (nylon by-product) is typical, a 70/30 blend that contains more polyamide fibers can be more expensive and will clean more aggressively. Research conducted by the University Hospital, Lund, Sweden, indicated that microfiber cleaning resulted in dust, microorganism and bacterial reductions from a low of 96.9% to a high of 99.4%.

The density of the fibers per square inch can affect pricing and cleaning ability. A cloth with 50,000 fibers per square inch can cost much less than one with 220,000 fibers per square inch. Greater density translates into greater cleaning power and durability.

Finally, the quality of construction and the finish of the cloth affect cleaning ability. Cloths can be woven, hooked, knitted, and feathered, each good for specific cleaning functions. Ultra-suede, a high fashion material is a finely polished microfiber blend that works well on fine optical glass.

*Executive Housekeeping Today* asked Chris Schran, president of Reliable Maintenance Services of Fountain Valley, CA, to explain microfiber cleaning and the experience RMS and their nearly 300 janitors have had using microfiber cleaning for the last two years.

"We are a 54-year old, family-owned company," said Schran, "and as any building service contractor can tell you, labor and supplies are the two costliest drains on revenues. We are constantly looking for innovative ways

to increase our cleaners' productivity and decrease our consumption of chemicals and other consumables. Simply stated, transitioning to microfiber cleaning has saved our company. We have decreased our chemical consumption by over 70%, increased our worker productivity by 31% and have decreased consumable expenses by over 40%—all the while raising our customer satisfaction approval rating to nearly 99%. It has allowed us to compete nationally, and, perhaps most importantly, to differentiate ourselves from all competitors by making us a low-chemical, low moisture cleaning company.

“We experimented with several microfiber products during the test phase and found that cloths and floor tools designed to perform specific cleaning functions work best for us. One cloth is for aggressive heavy-duty cleaning; another is designed specifically for wet environments, and the third is engineered for dusting and delicate cleaning.

“Each cloth is color-coded, and that helps the cleaners easily recognize each cloth for its specific cleaning function. We added the microfiber tools to our team cleaning training and the results have been astounding. After about two weeks of using the cloths, our cleaners asked us why we hadn't given them these tools before now.

“Microfiber floor tools and mops have had the greatest impact on our productivity. We clean several million square feet of commercial and retail space daily and eliminating the wet mops, buckets, wringers and trips to the janitor closet to change dirty water has saved us over an hour per shift per cleaner.

“We have some of the most stringent environmental regulations here in California, and converting to microfiber cleaning has brought us some welcome attention. Several floor manufacturers are using the microfiber mop as their suggested maintenance tools because of the low-moisture nature of the cleaning process. Medical facilities are converting over to microfiber cleaning because of the lower incidence of cross-contamination. The EPA estimates that the typical janitorial worker uses over 240 pounds of chemicals during the course of a year. By cutting that amount 70%, we're not only saving money, we're safeguarding our workers, clients and their guests and tenants. I call that a win-win situation for everyone.”

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## Caring for Microfiber Cloths and Mop Heads

The many benefits of microfiber cloths and mop heads are finally reaching more and more end users. Microfiber, constructed from polyester and polyamide nylon fibers, is approximately 1/16th the size of a human hair. There are approximately 90,000 microfibers in one square inch of a microfiber towel. It is the resulting density of the material that allows microfiber cleaning cloths and mop heads to lift and trap grime, making them more thorough cleaning agents than traditional cleaning cloths and mops.

However, less is known about the proper care and cleaning of microfiber products. For them to work their very best, microfiber cloths and mops do need to be cleaned on a regular basis. Usually, all that is needed after one or more uses is a thorough soaking in a disinfectant, rinsing, and then wringing out until all visible signs of soil are gone. They do not need to be machine washed after every use.

Eventually (and definitely after heavy use) microfiber cloths and mop heads will require a more thorough scrubbing and should be machine-washed using household laundry detergent and hot water. “Washing in warm water is necessary because it causes the fibers to swell, releasing the dirt and soil trapped within,” says Aileen Cleary, assistant global marketing manager for Unger Enterprises, a supplier of microfiber products.

Cleary suggests washing microfiber products with nothing else in the load. She explains that other fabrics can “shed” lint during the wash. The lint can become embedded in the microfiber, reducing its usefulness.

### Using Bleach and Fabric Softener

Though microfiber is a very hearty material and can withstand from 500 to as many as 1000 washings, certain cleaning products are harmful to microfiber, affecting its longevity and usefulness. Bleach should not be used.

Many studies report that fabric softener should never be used to clean microfiber. According to these studies, the microfiber will treat the fabric softener as if it were soil. It will attempt to store the tiny particles of the softener in its fibers. When this happens, the microfiber becomes stiff and hard and cannot be used effectively.

### Drying Microfiber

Microfiber can be dried in a commercial dryer using a low heat setting or simply hang microfiber cloths and mop heads out, allowing them to air dry. “Never expose microfiber to extreme heat,” says Cleary, “Treat them as you would any other polyester fabric.”

Microfiber offers another benefit of which many end users are unaware. They are positively charged. That means they attract dust, which has a negative charge. “This is another reason to keep microfiber products clean,” adds Cleary. “There are so many pluses to microfiber, just a little cleaning care is well worth the effort.”

*Unger Enterprises, Inc., an international company with offices in the United States, Germany, the United Kingdom, and Brazil, has been manufacturing economically designed cleaning tools for more than 35 years. Unger takes pride in developing innovative and unique products and cleaning systems that allow professionals to achieve consistent quality results while saving time and energy.*

## Alternative Floor Maintenance Systems

*By Robert Kravitz*

The University of California Davis Medical Center (UCDMC) decided to reevaluate its floor mopping procedures. It was looking for a floor maintenance system that reduced chemical costs, trimmed cleaning times, and minimized custodial staff injuries and workers' compensation claims.

The hospital also was seeking a more environmentally friendly way to maintain floors. Many floor-cleaning products used in hospitals contain chemicals. Some chemicals can be harmful to human health as well as to the environment, and UCDMC wanted to reduce the amount of chemicals necessary for cleaning.

Additionally, UCDMC was seeking ways to make floor maintenance tasks less burdensome on the custodial staff. For instance, they wanted to reduce the number of times the cleaning solution and rinse water had to be changed. Traditionally, to reduce the risk of cross-contamination for patients and staff, the cleaning solution and rinse water had to be changed every two or three rooms. Because each solution-filled bucket could weigh as much as 40 pounds, establishing a floor cleaning system requiring fewer cleaning solution changes would be less strenuous for the cleaner and provide direct cost savings for the hospital.

### Going Flat

Just a few years ago, the hospital would have found few alternatives to the conventional mopping methods that have been used for decades. However, they discovered that some medical facilities had recently begun using microfiber flat mops with considerable success.

Microfibers are nylon fibers that are approximately 1/16th the size of a human hair. The resulting density of a mop made with microfiber allows it to absorb up to six times its weight in liquid, making it considerably more absorbent than a traditional mop. In addition, the microfiber mop heads are lighter, making them easier to maneuver than conventional mops.

Because microfibers are so small, they can easily penetrate grout areas and uneven surfaces in floors. This allows the cleaning professional to remove soil and grime deep within the pores of the floor.

UCDMC was so impressed with the potential of microfiber technology that they decided to test the product for one year. They also instituted a floor mopping system to help achieve their goals of reducing costs, injuries, and cleaning times and finding more environmentally safe ways to maintain the hospital's floors.

This system included the use of two buckets or dual buckets—buckets with two separate compartments—one for cleaning solution and one for rinse water. With this system, the cleaning solution was not contaminated

by dirty rinse water, preventing cross-contamination, reducing chemical costs, and making the process less taxing on the custodian.

Floor mopping procedures using flat mops usually included “cutting” the floor by mopping all edge areas first. The custodian then mopped using a “figure 8” or “S” movement, which allowed the flat mop to partially overlap areas just cleaned, assuring the floor was thoroughly mopped. The system assured a consistency in cleaning, allowing for easier benchmarking and cleaning standards.

### Resistance and Reasons for Change

Though the hospital believed there were compelling reasons to consider microfiber flat mops and to introduce a new floor mopping system, convincing the custodial staff, hospital personnel, and even hospital patients of the merits of microfiber was not an easy task. The hospital's cleaners were averse to change and initially found using the flat mop and the new floor mopping system awkward. Doctors and nurses were unconvinced that microfiber could be as effective as claimed. Even patients expressed their concerns when they first saw custodians using the flat mop.

Though change is rarely easy, the hospital patiently worked with custodians, communicating the benefits they believed would be derived by using the new microfiber mops and floor mopping system. Eventually, two primary selling points materialized that eased the way for the transition:

- 1) The microfiber mops weighed five pounds less than the conventional mops.
- 2) The microfiber mop head could be easily changed after every room was mopped, if necessary.

This second reason benefited custodians because it reduced the time and effort required to wring a mop and, with the floor mopping system in place, there would be less need to change the cleaning solution. According to hospital studies, the solutions needed to be changed an average of seven times a day per cleaner before implementing the new restroom cleaning system.

Still, there were concerns about the effectiveness of the microfiber mops. To allay these concerns, UCDMC staff ran tests using conventional mops in specific areas and then re-cleaning the same area with a microfiber mop. In each case, the microfiber mop captured more dust and dirt. To further bolster their support of the microfiber mops, they performed the same test in reverse order, mopping first with the microfiber mop and then with the conventional mop proved ineffective.

**Program Results**

*Benefits*

UCDMC began tests with the microfiber flat mop in 1999. Within one year, the hospital had completely replaced loop mops with microfiber and had implemented the dual bucket floor mopping system.

There were initial costs to put the program into action. Microfiber mops can cost three times more than conventional mops, plus the new dual buckets had to be purchased. However, most manufacturers guarantee that conventional mops will withstand 55 washings; microfiber mops are guaranteed to last after 500 washings. This gave the microfiber mop a comparatively low life-time cost.

Additionally, the purchase of additional buckets or dual buckets resulted in considerable cost savings when the floor mopping system was implemented. Floor cleaning chemicals purchased by the hospital were reduced by 46 percent, from 513 gallons in 1999 to 283 gallons in 2000. With the use of the microfiber flat mop, the dual bucket, and the floor mopping system, UCDMC saved 638 hours per year for each worker, or approximately \$7,665 in wages multiplied by the number of workers.

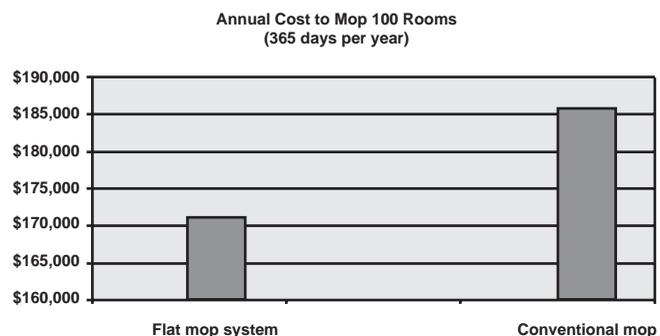
UCDMC cut its water use by a whopping 95 percent because of the floor mopping system. Another benefit was cost savings from reduced workers' compensation claims. Because the microfiber flat mops were five pounds lighter and there was less need to change the cleaning solution, custodians suffered fewer job-related injuries. In fact, floor mopping was reclassified as "light duty" by the hospital with the switch to flat mops.

*Limitations*

UCDMC decided not to use microfiber mops in areas "contaminated with an extraordinary amount of blood or other body fluid" such as emergency and operating rooms, though no reason was cited. Additionally, they did not use the mops in greasy areas such as high-traffic kitchens where the hospital decided to continue using mechanical floor cleaning machines.

The microfiber mop heads could not be washed in the hospital's industrial washers and dryers because the high heat setting damaged the material. However, washing the mop heads in conventional washers with lowered heat settings and using standard laundry detergent easily solved this problem.

<b>Cost Savings Using A Microfiber Flat-Mop System vs. A Conventional Mop</b>			
	Microfiber Mop	Conventional Loop Map	
<b>Mop Cost</b>			
Initial Cost:	\$17.40 each	\$5.00 each	
Washing Lifetime:	500 to 1000*	55 to 200*	
Rooms Cleaned:	1	22	
Total Mop Costs	\$1.75 to \$3.48	\$0.11 to \$0.41	
	Per 100 rooms	Per 100 rooms	
<b>Labor Costs</b>			
Rooms Cleaned/Day	22 in 8-hour shift	20 in 8-hour shift	
Hourly Rate Paid	\$12 per hour	\$12 per hour	
Total Labor Costs	\$436	\$480	
	Per 100 rooms	Per 100 rooms	
<b>Chemical Use</b>			
Quantity	1 gallon/day	21 gallons/day	
Cost of Chemicals	\$0.22/gallon	\$0.22/gallon	
Rooms Cleaned/Day	22	20	
Total Chemical Costs	\$1.00	\$23.10	
	Per 100 rooms	Per 100 rooms	
<b>Water Use</b>			
Quantity	1 gallon	21 gallons	
Rooms Cleaned	22	20	
Total Water Usage	5 gallons	105 gallons	
	Per 100 rooms	Per 100 rooms	
<b>Electricity Usage in Wash Mops</b>			
Cost	\$0.30 per mop	\$1.00 per mop	
Cleaning Frequency	Once per room	Once per day	
Total Electric Costs	\$30	\$5	
	Per 100 rooms	Per 100 rooms	
Total of all Costs	\$468 to \$470	\$508	
	Per 100 rooms	Per 100 rooms	
Total Savings for One Custodian Per Day: \$38 to \$40 per day			
Total Savings for One Custodian Per Year: \$13,870 to \$14,600 per year*			



Source: Environmental Protection Agency; University of California Davis Medical Center.

**Summary**

The limitations that resulted from using microfiber mop heads were minor when compared to the benefits derived. Overall, the hospital found that microfiber flat mops were:

- Light and ergonomic
- More absorbent

- Dense and durable
- More effective for cleaning floor surfaces
- Cost-effective

They found that the floor mopping system was less work-intensive than conventional mopping, virtually eliminated cross-contamination, and drastically reduced chemical and water use while cleaning more effectively.

They also found that microfiber manufacturers underestimated the longevity of the mop heads. Use at UCDCM proved that the mop heads could withstand up

to 1,000 washings, double the manufacturer's guarantees—all the more reason to change from conventional mops to microfiber flat mops and the new floor mopping system.

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