A Pleasing

The spring over there takes you by the throat, the flowers blooming by the thousands over white walls. If you strolled around for an hour in the hills surrounding my town, you would return with the odor of honey in your clothes.

—Albert Camus (Algerian-French author and philosopher)
Once, when bathing was a luxury reserved for the wealthy, people masked unpleasant odors in fabrics with perfume—applied on their persons, carried around in little fragrant sachets, or placed in open containers throughout a room. They boiled fabrics with harsh chemicals such as lye, to drive away unpleasant smells. Today, odor controlling products keep fabrics smelling fresh, and scent modification products bring distinctive fragrances to the fabrics themselves. These accomplishments are achieved in a variety of ways, from sophisticated nanotechnology-based finishing to micro-encapsulation to substances incorporated directly into the fiber or yarn. Today, any fabric can have a pleasing scent.

WHEW! Stink vs. Fragrance

I counted two and seventy stenches; All well defined and several stinks!

—Samuel Taylor Coleridge (English poet)

There seems to be a trend in society that bad or even strong odors are no longer acceptable," says Barrie Clemo, sales manager from Thomson Research Associates, makers of the Ultra-Fresh antimicrobial products. Today, many people bathe daily and use deodorants and antiperspirants on a regular basis to reduce body odors; they wash their clothing, towels, and bed linens with scented detergents and fabric softeners. "Treating textiles to help control odors fits well into this framework," says Clemo.

Don Alexander, president of textile technology innovation and commercialization specialists, Anovotek LLC, notes that when discussing scent modification on textiles, it's important to differentiate between a pleasant fragrance and an unpleasant stink. "Smell is a general term," he says. "Odor has come to indicate an unpleasant smell. And most people use [the words] fragrance, scent, and aroma to indicate a pleasant smell."
Curt White, CEO of Aegis Environments, an antimicrobial manufacturer, says there are a variety of sources for unpleasant odors on fabrics. There are human sources of odor, such as sweat and urine. Microbes can be responsible for rotten, musty (from fungus/mold/mildew), yeasty (from yeast), and putrid (from bacteria) odors. Industrial odor sources include gasoline and chemicals. Environmental odors can come from food, tobacco, and plants.

Which smells are considered pleasant or unpleasant depends greatly on personal preference and, to a large extent, on what is socially acceptable, says Wayne Swofford, vice-president of research and development for antimicrobial manufacturer Microban. “Everyone’s sense of smell is different and everyone’s comfort level [with scents] is different,” says Dennis Schneider, director of marketing and sales at NanoHorizons, manufacturer of nanotechnology-based antimicrobials. “Unpleasant smells like body odor are body chemistry related and, therefore, individual, but the amount of body odor that is considered acceptable is very socially-dependent.”

Just as with unpleasant odors, the use of fragrances on fabric also depends both on what is socially acceptable as a “pleasant scent” and the individual emotive response to fragrance that makes a consumer feel good about the product,” says White.

A BREATHE OF FRESH AIR—Odor Control Makes a Difference

THAT SMELL WILL WEAR OFF…EVENTUALLY—Apparel

So what’s the big stink? “Odor control is becoming a consumer standard in activewear,” says Schneider. Clothing that is regularly worn for athletic activity and is heavily perspired in is bound to smell a little ripe without laundering, unless countermeasures are built in to the garment’s fabric. “Athletic gear is where most people are concerned about odor,” agrees Jonathan Erb, principal and chief marketing officer of TrapTek LLC, developer and marketer of Cocona fabrics and yarns. “Shirts and footwear need faster drying and odor management properties,” he says. For sports team uniforms, notes Schneider, some odor control technology is almost mandatory. Another “mandatory” application, according to many experts, is hunting apparel, where neutralizing human scent is useful for a hunters’ success, or hiking gear, where campers don’t wish to attract animals to their campsite.

In areas other than these niche markets, odor control may be more for comfort. “When you’re traveling, for example, it’s difficult to find the time or place to do laundry, and it’s a definite benefit not to have to wash your clothes because they still smell fresh,” says Schneider. “I think that lasting freshness is a consumer value.”

Some apparel items aren’t easily laundered, or can’t be laundered at all, says Swofford. Items like shoe linings are “particularly difficult because you can’t throw them in the laundry. Yet it’s important to control odor there,” he says. Marketing Director Victoria Cabot of X-Static, manufacturers of silver-based yarns, says that it’s often unwise to launder textiles with a technical finish.

Some medical conditions make odor control for apparel more difficult, yet imperative. Jeff Williams, chief technical officer and senior vice-president of HaloSource, which manufactures a fabric treatment that chemically binds chlorine to a variety of fibers, says “There are a significant number of people, approximately six to seven million people in the US, that have a problem with excessive sweating. They have an acute need for effective odor control in garments.” And conditions like extreme foot odor are often the brunt of jokes, but are no laughing matter, says Cabot.

THAT AWFUL HOSPITAL SMELL—Medical Applications

Schneider points out that medical textiles, such as fabric liners for prosthetics and casts, also require odor control. The conditions are damp and inclined to bacterial growth, which causes odor. Odor
control based on antimicrobials is often needed to control odors in bandages. "Chronic wounds smell [bad]," says Williams. "An antimicrobial needs power, speed, and durability to deal with those odors."

Incontinence also is a growing problem in healthcare because of an ageing population, Williams points out. "The control of odor from leaking urine will grow in importance as this demographic grows," he predicts. The growing market for incontinence products is relatively neglected, notes Williams. "So far, [their] needs are mostly unmet."

The increasing need for incontinence odor control is not just confined to garments, but also is required for bed pads, linens, and upholstery.

SMELLS LIKE HOME—Other Textile Applications

Towels, bed linens, upholstery, and carpeting can all benefit from odor control technology. Odor control is important for any fabrics in damp or moist conditions where odor-causing microbes thrive, according to Peter Cowey, textiles business director of antimicrobial producer Arch Chemicals. It's especially important for transportation fabrics in areas of high heat and humidity, "where people covered in perspiration sit on them all day," Cowey says.

"It's important to prevent odors from occurring at the onset," adds Cabot, especially in baby and baby-related products like cribs and nursing bras. "A nursing mom who is also a working professional doesn't appreciate going around smelling like milk," she explains.

There are many other areas of our lives that need odor control, too. Pet beds, an item in millions of homes, are both a source of odor and are difficult to launder effectively, says Cabot. White notes that there is also a market for odor control in non-woven air filters.

"Typically, air filters use various substances, such as activated charcoal or zeolite, to trap odors," he says. Odor-trapping air filters are found in industrial, office, and commercial settings, as well as homes and personal automobiles.

THE SWEET SMELL OF SUCCESS—Strategies for Controlling Odor

According to the experts, there are five common odor-controlling tactics:

- Killing odor-causing organisms
- Trapping or capturing odors
- Covering up or masking odors
- Neutralizing odors
- Dulling individuals' olfactory senses

DON'T LET THEM SMELL YOU COMING—Killing the Cause of Odors

The most common approach for controlling unwanted scents in fabric is with an antimicrobial treatment. Clemo explains, "Perspiration odors are caused by the bacteria that are on our skin, which migrate into the clothing during perspiration. The gases that they give off are the perspiration odors. By inhibiting the growth of bacteria, we can control the odors."

"Pure silver fibers in the yarns neutralize odors and give their antimicrobial properties to the fabric. Photo courtesy of X-Static. Used with permission."
As skin bacteria or other microbes and sweat-related human waste products collect in a fabric, the fabric becomes the "home" for the odor causing microorganisms, says White. Cowey notes that it is not necessary for antimicrobials to kill all the bacteria, they just need to "keep numbers of bacteria below the level at which odor can be sensed by the human nose."

Modern home laundering practices have increased the need for antimicrobials to combat odor. In earlier decades, laundering meant boiling the clothes, or at least washing them in very hot water. In modern times, with energy conservation concerns, the typical temperature of wash water is much cooler. Unfortunately, these cooler washing temperatures don't kill all the bacteria that generate odor. "These bacteria grow to form a biofilm on the fibers," says Cowey. "As soon as warmth and moisture are added, bacterial growth starts again and its byproduct is odor. A biofilm is difficult to remove—you must use high washing temperatures and aggressive chemicals, like chlorine bleach, which are damaging to textile fabrics."

Current washing detergents are primarily formulated to remove dirt and stains. According to Cowey, introducing an antimicrobial will at best only sanitize the wash water, as most cannot fix to textiles in the washing machine. Antimicrobials bound to the fabric in textile finishing processes, however, have been used to combat odor in sportswear and hosiery for more than 30 years, notes Cowey. "If antimicrobials were used more widely in all apparel, then consumers would get the benefits of fresher smelling clothes with fewer washings," he says. "It would increase consumer comfort, and save them time and money from doing less laundry, since often the only reason the consumer is laundering the clothing is to freshen it. The environmental benefit of fewer loads is also a significant consideration." Alexander points out that "if you consider the total environmental impact of a textile product using Life Cycle Assessment, typically the largest impact is from laundering. Extending the clean [usable life of a garment] using antimicrobials has a substantial environmental benefit."

While antimicrobials tackle the odors caused by bacteria, they have no effect on odors that may contaminate fabrics from other sources, such as smoke, gasoline and other chemical odors, and food aromas. For those smells, we turn to odor trappers.

**CATCHING A WHIFF OF SCENT—Trapping Odors**

*O smell a rat.*—Ben Jonson
(English dramatist, poet, and actor)

Trapping or capturing odors is generally performed by products with activated charcoal or cyclodextrins, which trap the odor molecules and then release them when the article is laundered.

Activated charcoal is most often used in nonwoven products like air filters, but TrapTek LLC has found a way to incorporate the particles of activated charcoal from recycled coconut shells into fibers used in apparel so that they "trap airborne odors like smoke, and also bacteria from perspiration," says Erb. "The particles act like a sponge or air filter."

Cyclodextrin molecules, says Oliver-Daniel Bogatu, director of business development and global marketing for specialty chemical supplier Cognis GmbH, are sugar-based and sourced from corn. The cyclodextrin molecule's mechanism of odor control is triggered by perspiration moisture, says Bogatu. After the odors are absorbed, normal laundering "empties" the molecule of the odor it's collected. "The big issue," says Alexander, "is when odor trappers become saturated and need regeneration. One of the great benefits of cyclodextrin is that it is regenerated with each washing." When odor absorbers get "filled" they stop working until they are refreshed in the laundry.

**THAT SWEET PERFUME—Masking Odors**

*Virtue is the fragrance of the flowers which the tree of life puts forth.*
—Sri Sathya Sai Baba
(Hindu teacher and author)

Odor masking technologies—those that cover up odors—generally use fragrances. We're all familiar with the "rain forest fresh" scents in laundry detergents, fabric softeners, and dryer sheets. Often, consumers choose these products with regard to the fragrance they will impart to the fabrics in the laundry. Further, fragrances imparted to the fabrics by laundry products typically aren't long-lasting.

Long-lasting scent can be applied as a finish. However, this leaves manufacturers with another challenge in using fragrance...
to cover odors—and that is which scent to use. "In general the best approach is to eliminate odors that are commonly found to be unpleasant rather than to introduce a specific scent, unless the scent that is being introduced has a specific purpose, such as in the use of aromatherapy," says Alexander. The reason is that "if you add scent to a textile, you will have lovers or haters of the scent," says Bogatu.

One way to avoid having the fabric smell of something the consumer finds unpleasant or inappropriate (corporate executives rarely wish to smell of baby powder) is to give the consumer a way to choose what scent the fabric will have. According to Bogatu, a cyclodextrin-based fabric finish can store fragrance particles from the scents of the consumers' own laundry products and release the fragrance all day.

Commonly used in aromatherapy, micro-encapsulation provides an alternative way to add long-lasting fragrance to a fabric. "Aromatherapy scents are supposed to leave the user feeling activated or calmed and relaxed depending on the effects you want and on the scent you use," says Bogatu. He cautions that such products need to have a "high dermatological safety level."

Micro-encapsulation goes beyond masking unpleasant odors, to providing a pleasant consumer experience. "Retailers are finding that there are categories of products where having a scent can increase initial purchases and add value," says White. "The emotive response that fragrance evokes makes the consumer feel good about the product."

"Because you are dealing with a diversity of people, they will have a diversity of likes and dislikes," says White. He also points out that the perfume and cosmetics industries have already developed scent "notes," like flavors, or colorways. "Those industries have a well-understood human response to those scents," says White.

Micro-encapsulation offers the possibility of using scents as a marketing strategy. "It's now possible to design garments with a 'brand' scent," notes Bogatu. "The scents chosen can be adjusted to match the marketing of the brand." White calls the idea of branding a scent—making a unique "signature" scent as part of the brand—"an intriguing opportunity." He says, "The textile industry is at a real nexus where consumers are responding to these new fragrances."

**GONE LIKE A PUFF OF SMOKE—Neutralizing Odors**

Neutralizing odors is achieved through a variety of means. Some systems use permanganate, chlorine, or other chemicals. The usual mechanism is to oxidize the odor-causing substance. Some of these odor-neutralizing chemicals may not be kind to fabrics.

Karen Deniz, managing director-marketing of textile research, development, and marketing company Optimer Performance Fibers, notes that the company's FreshGuard odor neutralizer, inherent in all Dri-release yarn, "inhibits the formation of oily odor bodies by sterilizing the environment inside the fabric without the use of noxious chemicals," she says. "It makes the environment unfriendly to bacteria—slowing their growth and respiration enough to limit odor development, without actually killing the bacteria."

Another yarn-based solution, X-Static yarn, uses pure silver fibers wound into the yarn to bind with ammonia and neutralize odors, according to Cabot. "The silver also acts as an antimicrobial," she says.

Karen Deniz, managing director-marketing of textile research, development, and marketing company Optimer Performance Fibers, notes that the company's FreshGuard odor neutralizer, inherent in all Dri-release yarn, "inhibits the formation of oily odor bodies by sterilizing the environment inside the fabric without the use of noxious chemicals," she says. "It makes the environment unfriendly to bacteria—slowing their growth and respiration enough to limit odor development, without actually killing the bacteria."

Another yarn-based solution, X-Static yarn, uses pure silver fibers wound into the yarn to bind with ammonia and neutralize odors, according to Cabot. "The silver also acts as an antimicrobial," she says.

**Small Company Customer Service with Big Company Products**

- Flame Retardants – Melt extrudable, Exhaustible, Saturants, Coatings
- UV Stabilizers – Custom Dispersions for SPF and Light Fastness
- Water and Oil Repellants – Durable and Non-durable Products for Preparation, Dyeing and Finishing

**APEXICAL**

**Small Company Customer Service with Big Company Products**

- Flame Retardants – Melt extrudable, Exhaustible, Saturants, Coatings
- UV Stabilizers – Custom Dispersions for SPF and Light Fastness
- Water and Oil Repellants – Durable and Non-durable Products for Preparation, Dyeing and Finishing

**APEXICAL**

**Small Company Customer Service with Big Company Products**

- Flame Retardants – Melt extrudable, Exhaustible, Saturants, Coatings
- UV Stabilizers – Custom Dispersions for SPF and Light Fastness
- Water and Oil Repellants – Durable and Non-durable Products for Preparation, Dyeing and Finishing

**APEXICAL**

**Small Company Customer Service with Big Company Products**

- Flame Retardants – Melt extrudable, Exhaustible, Saturants, Coatings
- UV Stabilizers – Custom Dispersions for SPF and Light Fastness
- Water and Oil Repellants – Durable and Non-durable Products for Preparation, Dyeing and Finishing

**APEXICAL**

**Small Company Customer Service with Big Company Products**

- Flame Retardants – Melt extrudable, Exhaustible, Saturants, Coatings
- UV Stabilizers – Custom Dispersions for SPF and Light Fastness
- Water and Oil Repellants – Durable and Non-durable Products for Preparation, Dyeing and Finishing

**APEXICAL**

**Small Company Customer Service with Big Company Products**

- Flame Retardants – Melt extrudable, Exhaustible, Saturants, Coatings
- UV Stabilizers – Custom Dispersions for SPF and Light Fastness
- Water and Oil Repellants – Durable and Non-durable Products for Preparation, Dyeing and Finishing

**APEXICAL**

**Small Company Customer Service with Big Company Products**

- Flame Retardants – Melt extrudable, Exhaustible, Saturants, Coatings
- UV Stabilizers – Custom Dispersions for SPF and Light Fastness
- Water and Oil Repellants – Durable and Non-durable Products for Preparation, Dyeing and Finishing

**APEXICAL**

**Small Company Customer Service with Big Company Products**

- Flame Retardants – Melt extrudable, Exhaustible, Saturants, Coatings
- UV Stabilizers – Custom Dispersions for SPF and Light Fastness
- Water and Oil Repellants – Durable and Non-durable Products for Preparation, Dyeing and Finishing

**APEXICAL**

**Small Company Customer Service with Big Company Products**

- Flame Retardants – Melt extrudable, Exhaustible, Saturants, Coatings
- UV Stabilizers – Custom Dispersions for SPF and Light Fastness
- Water and Oil Repellants – Durable and Non-durable Products for Preparation, Dyeing and Finishing

**APEXICAL**

**Small Company Customer Service with Big Company Products**

- Flame Retardants – Melt extrudable, Exhaustible, Saturants, Coatings
- UV Stabilizers – Custom Dispersions for SPF and Light Fastness
- Water and Oil Repellants – Durable and Non-durable Products for Preparation, Dyeing and Finishing

**APEXICAL**

**Small Company Customer Service with Big Company Products**

- Flame Retardants – Melt extrudable, Exhaustible, Saturants, Coatings
- UV Stabilizers – Custom Dispersions for SPF and Light Fastness
- Water and Oil Repellants – Durable and Non-durable Products for Preparation, Dyeing and Finishing
THE NOSE KNOWS—Other Strategies

Trouble. I can smell it.
—John Michael Hayes
(American screenwriter)

Other approaches to controlling or modifying smells on fabrics are used less often. Chemically dulling the olfactory senses of individuals in the area so that they don’t notice odors is rarely used to control odor in fabrics, but is sometimes used in commercially available air fresheners. White feels that shutting down their sense of smell can put people at risk, since smells often warn us of chemical or smoke hazards.

A key to the success of any fabric odor control strategy is durability—consumers want the odor-controlling performance to last for the life of the fabric. Some technologies achieve durability by integrating their solution into the fiber. Other products use nanotechnology to molecularly bind odor-controlling finishes to the fabric.

S & J Laboratories, Inc.
4669 Executive Drive, Portage, Michigan 49002

AATCC Test Method <30>
Antifungal Activity, Assessment on Textile Materials: Mildew and Rot Resistance of Textile Materials

AATCC Test Method <100>
AATCC Test Method <147>

Antibacterial Activity Assessment of Textile Materials

Call 269-324-7383 ext. 23 for testing information
Visit our website www.sandjlab.com

IT SMELLS LIKE A WET DOG—The Role of Fibers, Fabric, and Garment Construction

Hit a tripwire of smell and memories explode all at once. A complex vision leaps out of the undergrowth.
—Diane Ackerman
(American author, poet, and naturalist)

Fiber, yarn, and garment construction all play a role in allowing bad odors to develop and remain on fabric. "Depending on the fiber, the molecules that you smell may be absorbed by the fiber itself and won’t go away, even with washing," says Swofford. Some synthetic fabrics, like polyester, seem to trap odors that won’t wash out. The odor-control solutions for these fabrics are commonly applied in the fiber itself, while finish-based solutions are used more often for natural fibers. "The biggest problem with using fibers with built-in technologies is the impact on the overall supply chain if you want the products in a variety of styles and patterns quickly to respond to market trends," says Alexander.

Some natural fibers have inherent odor issues. "Wool releases sulfur when it gets wet, which gives it an unpleasant odor," says Schneider. He suggests a silver-based solution for that "wet-wool" smell. "The silver ions break the amine-sulfur bonds," he says.

Other natural fibers, like bamboo and chitosan, are claimed to have natural antimicrobial (and therefore, anti-odor) properties. "Chitosan has antibacterial and antifungal properties," notes Williams. "Pure chitosan fibers are used in fabrics to control odors, and are especially popular in Asia." In addition, says Williams, "The kind of fiber enhances the potential for contact with bacteria, and makes a tremendous difference to the efficacy of the antimicrobial. The surface conditions of the fabric are really important."
According to Erb, garment construction affects breathability, therefore affecting odor-production. Consequently, the ability of the fabric to wick away moisture from the body will have an effect on fabric odors. "Odor in fabric is a function of body moisture being held over time and becoming rancid. If the fabric evaporates moisture away, it will dry faster and there will be less bacteria to cause odor," he says.

Additionally, some garments are likelier to become smelly than others. "[The worst offenders are] fabrics that are next to the skin, like sportswear, underwear, and socks," says Clemo. "These are the fabrics that get the most perspiration."

WHAT'S IN A NAME—Marketing Odor Control

What's in a name? That which we call a rose, by any other name would smell as sweet.
—William Shakespeare
(English poet and playwright)

According to researchers Jan Beringer, director of the textile services and innovations department, and Dirk Hoefer, director of the Institute for Hygiene and Biotechnology, of the Hohenstein Institutes, "The textile industry says there are no bad odors on textiles." In other words, marketing odor-control products for fabrics can be a tricky business. You don't want to tell a company that their garment or other textile product literally stinks.

Consumers don't like being told that they stink, either. "Don't use fear-factor marketing," says Cowey. "The marketing message is important—instead of saying anti-odor or anti-bacterial, say freshness enhanced instead, it is a more positive message."

"Odor control implies that there is a problem, so marketing from a standpoint of freshness is more important," Swofford adds. The idea is that the fabric's naturally pleasant freshness is being maintained rather than nasty odors being suppressed.

"The consumer expectation is that a treated garment will stay fresh during a longer period of time than an untreated garment," says Cowey. "But we can't underdeliver or underdeliver on performance claims. Behind the pleasant marketing message, we need data and performance standards."

"It is important that odor management claims are supported and factual," agrees Erb. "We help control odor; we don't eliminate it. Over-promising and under-delivering erodes consumer confidence in performance fabrics—and that is not good for anyone." In other words, nobody can promise that life—or fabric—will always smell sweet.

OMEGA SOFTENERS

The last word in softening with the most complete line of softeners produced in the USA

OMEGA CHEMICALS, INC.
Manufacturer of Chemical Specialties SINCE 1973

PLANT: U.S. 29
COPPENS, S.C. 29330
FAX: (864) 463-4330
PHONE: (864) 582-5346/7
E-mail: mail@omegachelicalsinc.com

JULY 2007
AATCC Review 25