



Wipes: The Oldest Cleaning Tool Adds New Hi-Tech Capabilities

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by Michael Jones

Wipes are everywhere, used every day. They come in a nearly infinite variety of materials, sizes and packaging, and they are used in every industry from repairing the family truckster to prepping the space shuttle. "Wipes are just another tool, just like a screwdriver," grumbles an exasperated Lynn Engler, Territory Manager with John R. Lyman Co. of Chicopee, MA. "But the best technician in the world can't do good work if he doesn't have the right tool for the job." Like Rodney Dangerfield, it seems that wipes "just don't get no respect."

In general, there are three broad categories of wiping products: woven flat wipes, nonwoven flat wipes, and swabs. In all cases, the cleaning surfaces are made of paper, cloth or synthetic materials. But it can be difficult to select the optimal product for the job. Here's a quick review of the choices and a few key attributes to leverage when selecting the best product for each specific task.

Background: Cleaning Criteria

With hundreds of choices and grades, selecting the most cost-effective cleaning tool can be tricky. John Corley, Division Manager at Lymtech Scientific, says smart customers look first for absorbency. "Engineers need to target the wipe to the cleaning solution being used," Corley says. "Some wipes will not absorb water; others are better with solvents, paints and lacquers." For example, polyester is petroleum-based, so polyester wipes easily absorb gasoline, fuel oils and alcohols. "The contamination defines the wipe to choose," Corley concludes.

Lyman's Engler agrees, but notes that the cleanliness of the wipe is crucial, too. "Cleanliness is inversely related to absorbency, and it can be a tough balancing act," Engler observes. "The cleanest wipes may be less porous and don't absorb as much. More absorbent materials may leave fibers or residues."

While absorbency is critical when selecting a swab, a unique issue is materials compatibility. The construction of the swab must be compatible with the cleaning application. For example, if acetone is used on a foam swab, the foam tip will swell and weaken. In applications where acetone must be used, a polyester swab is a better choice.

Engineers also must consider the special needs of their application. Clean rooms are an oft-cited packaging problem, and medical applications may require sterile wipes. The fluid power industry uses lint-free wipes to avoid fibers which might clog hydraulic oil filters while nuclear power plants require chlorine-free wipes that have never been bleached. Schools, hospitals and the wood-working industry use wipes impregnated with a "tackafier" that attracts and retains dust.

Packaging is a special factor with wipes and swabs. Most clean rooms require special "double-packaging." Even the packaging itself deserves scrutiny: it must be contaminate-free with no fibers, no plasticizers, silicones or ionics. Another feature some engineers appreciate is static-dissipative wrapping which will not attract dust in transit. And the wipes and swabs themselves must be assembled and packaged in a clean room, or the process is merely "double-packaging the dirt" according to Paul Blair, Business Manager for the Coventry division of ITW/Chemtronics, an Atlanta-based maker of specialty cleaners.

Lastly, durability and cost have to be evaluated. In general, woven wipes usually are more durable than paper wipes. Fabric wipes tend to be more absorptive, stronger and durable; they may be more expensive to buy but generally are less expensive to use. Paper wipes often are found in applications where re-contamination cannot be allowed, such as electronics and medical applications.

One conclusion is certain: if the market is large enough, the wipe manufacturers will have an answer. Listed below are representative specifications of paper and cloth wipes.

Typical Specifications for Various Flat Wipes

Material	Unique Features	Weight Per Square Yard	Pre-Washed	Texture	Edges	Number of Particulates Larger than 0.5 μ Per Square Meter	Absorbency of Water, in Milliliters Per Square Meter	Clean Room Packaged
Synthetic Regenerated Cellulose	For general precision cleaning. Max. absorption, convenient size, very lint-free, very low extractables	1.87 oz.	No	Smooth, soft	Cut	13.6	391	No
Polyester Cellulose blend	Our best seller. Economical. For general precision cleaning. Medium absorption, convenient size	2.1 oz.	No	Smooth	Cut	15.4	320	No
Composite (cellulose layer between two layers polypropylene)	Great cleaning at low cost. Extra strong quilted for extra absorption	4.0 oz.	No	Quilted, shiny	Cut	120.0	490	Class 100
Polyester	Ultra-clean, no extractables, slightly coarser for better scrubbing, and thicker for more absorbency	4.2 oz.	Yes	Smooth, thick	Cut	2.6	321	Class 10
Polyester	Ultra-clean, heavier material for greatest absorption, no extractables, light weave, sealed edges	4.2 oz.	Yes	Smooth, thick	Sealed	2.4	478	Class 10
Cotton Twill	Pharmaceutical-grade cotton, high absorbency, low extractables, static-free, natural & biodegradable, bias-cut to minimize fraying	4.0 oz.	No	Linen-like	Cut	129.5	219	Class 1000
Reticulated Foam 100ppi	High purity, electronics-grade foam wipe. Average thickness: 1/4 in. (<1 cm). 100 ppi. Sized for single-use cleaning	1.2 oz.	No	Foam	Cut	170.0	890	No

Non-Woven (Paper) Wipes

Flat wipes are generally made of either paper or fabric. Paper (more precisely termed "nonwoven") products are single-use disposables, like paper towels in a kitchen. Fabric wipes are woven or knitted materials using a wide variety of fibers.

It's hard to imagine how a simple paper wipe could be strong enough and clean enough to be useful in industrial situations. But paper manufacturers have learned some new tricks and developed with a new, hybrid paper called a "nonwoven fabric." This material has the strength, softness, and quality of a woven textile, but is produced at the volumes, speeds and cost of a paper. DuPont's "Sontara" nonwoven is the market leader, but Alhstrom/Dexter, PGI and others also have nonwoven offerings.

Cheaper nonwovens, like facial tissues, use glues (also called "binders") to hold the fibers in place. Binders can amount to 30% by weight of some nonwoven products. The most common binder is a water-based latex such as polyacrylate. Most binders will dissolve when exposed to

solvents, introducing unwanted contaminants, so wipes made with binders are undesirable in critical applications.

At the bottom of the wiping food chain are cheap cellulose wipes. Made with binders, one industry wag described cellulose wipes as "clouds of dust flying in tight formation." They leave adhesives, lint and fibers on the surfaces being cleaned, especially when wet. Most cellulose wipes simply are insufficiently strong, clean and absorptive to handle anything but the simplest cleaning tasks. Their only positive attribute is their deliciously inexpensive price.

In the middle price range are nonwovens made from synthetic fibers. Polyester, polypropylene and rayon are popular choices, according to Mike Myers, Product Manager for OEM Automotive Products for Contec, Inc. of Spartanburg, SC. "Polyester nonwovens are ideal for pharmaceutical companies because they minimize the 'bioburden' trapped in the wipe," he said. "But for cleaning grease and heavy oils from car parts and even under your fingernails, nothing beats textured

polypropylene wipes presaturated with a d-limonene solvent."

An extreme is a new nonwoven innovation from DuPont's Sontara® division. This material is an ultra-clean, ultra-strong paper that closely resembles a fabric wipe. Engineered originally as a stencil wipe for electronics assembly, it is roughly 20% stronger, 50% more absorptive and ten times cleaner than the current best-selling polyester/cellulose nonwoven wipe on the market today. Marketed under the brand of "Sontara® FP" it probably will supplant many traditional wipes.

Paper wipes generally are priced at a cost-per-piece. Cheap cellulose wipes will be less than a dollar for a box. Typical nonwoven 6-inch square wipes will retail for about \$6 for 50 wipes, and the high-performance Sontara® FP will carry a 30% premium.

Fabric Wipes

Woven wipes come in a range of materials, qualities and prices. The least expensive material is simply "reclaimed fabric." Priced at around 50 cents/pound, these wipes are cut from cotton shirts, jeans, old uniforms, pajamas and other materials. Often these wipes still will have buttonholes, embroidery and seams which can make cleaning a challenge. To reduce costs, some vendors mix high-quality reclaimed fabric with pounds of junk. This usually is noticed when employees are found sorting through the box of wipes looking "for the good ones." In the end, many of these wipes are discarded without being used. Caveat emptor.

A better choice is a "mill end." This is fabric designed for clothing but that never made it to the sewing desk. These wipes will not have the seams or decoration of reclaimed fabric. But they can be loaded with permanent press chemicals, stain-resisters and dyes. The best grade is "new white washed." This fabric will have had all of the chemicals and dyes rinsed from it with solvents. Expect to pay about \$1.20/pound, but the entire box will be usable.

The next level is washed cheesecloth. Coming from the mill, cheesecloth (also called crynolin) is very hard and stiff, completely unsuited for wiping. However, after a thorough washing with the special surfactants and detergents the material becomes very smooth and soft. The best grades of washed cheesecloth are the first choice for painters, auto shops and the makers of fine furniture. Expect to pay \$1.20-1.80/lb.

Nearing the top of the quality pyramid is "washed diaper fabric." This material is soft, strong and highly absorbent. With proper processing, diaper fabric may qualify for use in Class 1000 clean rooms. Quality cleaning comes at a premium price, however, usually in the range \$1.80-2.50/lb for non-clean room packaging. Among the natural fibers, the very finest quality wipes made from cotton twill. This fabric that can be processed to medical grades and even clean room qualified. Because of its

strength, twill is often re-used, with each application progressively less critical. Expect to pay \$80-100 per bag of 300 sheets.

Synthetic fibers can enhance performance even more. A treated polyester/polymide micro-fiber from Asia is sweeping the auto detailing industry. Washed diaper fabric was the wiper of choice for years, but the new fabric is a substantial upgrade. "Under a microscope, you can see grooves and ridges on each fiber which scrape the contamination away," reports Contec's Myers. "It delivers swirl-free results in half the time."

If clean room performance is essential, opt for knitted synthetic fabrics of polyester or rayon. These polyester materials can be extremely soft, clean and absorbent, so polyester is the leading choice for cleaning optical systems, for example. Using a knitted product reduces linting. "Contamination mostly comes from the edges and ends [of fibers]," Contec's Myers explained, "and the interlocking weave of the knitting process minimizes loose ends and locks stray fibers into the fabric." Contec uses a laser to slice the edges of the wipes, which melts the fiber ends and further minimizes linting. Then special double-sided clean room washing machines remove any remaining lint and fibers, making these products suitable for the most demanding environments. Myer adds "Semiconductor companies are most concerned about fibers and particulates, so they always use washed knitted polyester wipes." Expect to pay \$80-100 for a bag of 100 sheets.

Swabs

"Swabs are basically just a wipe on a stick," reports Chemtronics' Blair. "But the stick allows a swab to tackle jobs an ordinary flat wipe would never handle."

The main advantage of swabs is the variety of shapes and materials in which they are available. This makes them ideal for cleaning in very small, very precise areas. "People use swabs when they want to control the cleaning process," Blair summarized. "They allow techs to scrub, absorb and rinse all in one convenient disposable package."

The real key to selecting a swab is the design of the swab. The size and shape of the swab's head, plus the configuration of the handle, are the first criteria. "There are round swabs, flat swabs, hard-pointed swabs, and they were all designed to fit the shapes people need to clean," says Blair. Selecting a swab shape is easy, usually from catalogs or getting samples from sales persons.

But the manufacturing of the swab makes a difference. Blair notes "We don't use any adhesives to hold our swabs together.... so the solvents don't dissolve the adhesives and leave residues." He noted that many adhesive polymers, which are quickly dissolved by solvents, may cause problems downstream in a manufacturing process.

Wrap-Up

Whatever special requirements there may be, engineers can be comfortable that today's wipe manufacturers will have the answer they need at a price that's right.

About the Author

Mike Jones is Vice President at MicroCare Corp., a leader in critical cleaning for electronics, aerospace, the

medical world and other industries. MicroCare provides environmentally improved cleaning alternatives to the electronics industry. Mr. Jones spends an average of 110 days each year on the road, helping electronics plants in every part of the world migrate from CFCs to more acceptable and cost-effective cleaners.

