A COMPARATIVE STUDY OF COTTON BLOTTER, EVOLON® AND TEK-WIPE AS ABSORBENT SUPPORTS FOR PAPER CONSERVATION TREATMENT


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INTRODUCTION

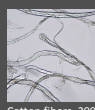
Cotton blotter paper has traditionally been used in paper conservation for a variety of treatment techniques and is ordinarily employed during blotter washing, drying and flattening. In the past five years, however, two major factors have motivated the discipline to explore alternatives to cotton blotter: the pursuit of cost-effective sustainable treatment practices and the unique treatment demands of many modern and contemporary works of art on paper. Oversized artworks necessitate larger substrates for treatment, and the moisture sensitivity of modern and contemporary paper supports and media presents the need for new materials that allow precise control over the introduction and removal of moisture during treatment. Two products—both non-woven fabrics made from man-made fiber blends—have recently emerged as promising alternatives for cotton blotter in paper conservation practice: Evolon® and Tek-Wipe. This poster explores the advantages and disadvantages of both materials as compared to the performance of cotton blotter.

THE MATERIALS

Physical and chemical properties as measured by the authors in the conservation lab. Alternative thicknesses and sizes are available on the market.

COTTON BLOTTER

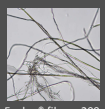
Constituents: Bleached cotton cellulose fibers with approximately 1% softwood pulp. No additives or sizing.
Thickness: 0.033" (0.8 mm)
Absorbency: Absorbs 4.5x its weight in water
pH: 7.0 (TAPPI pH cold extraction)
Planar stability: Distorts when wetted and as it dries
Tensile strength: Weak when wet, pills
Reactivity to solvents: Unreactive with ethanol, acetone, ethyl acetate, MEK, toluene, xylenes, hexanes
Relative drying speed: Slow
Sustainability: Difficult to reuse after wetting, not washable


Cotton fibers, 200x

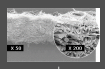
Source: EMI Specialty Papers, Grade 17932
Maximum size: 36 x 44" (also available in custom-sized rolls)
Price: $5.30/sheet ($0.0034/sq. in.)

EVOLON®

Constituents: Non-woven fabric made from 70% polyester and 30% polyamide microfibers, with added titanium dioxide delustrant.
Thickness: 0.020" (0.5 mm)
Absorbency: Absorbs 3.75x its weight in water
pH: 7.1 (TAPPI pH cold extraction)
Planar stability: No planar distortions with wetting or drying
Tensile strength: Durable when wet, does not pill, lint-free
Reactivity to solvents: Unreactive with ethanol, acetone, ethyl acetate, MEK, toluene, xylenes, hexanes, hydrogen peroxide
Relative drying speed: Fast, equalizes moisture
Sustainability: Long-lasting, washable but may retain discoloration


Evolon® fibers, 200x

Source: Talas
Maximum size: 80" wide x 10 yards
Price: $375.00/roll ($0.0130/sq. in.)


www.evolon.com

TEK-WIPE

Constituents: Non-woven fabric made from 45% polyester and 55% cellulose hydrospun fibers, with added optical brighteners.
Thickness: 0.016" (0.4 mm)
Absorbency: Absorbs 4.4x its weight in water
pH: 6.9 (TAPPI pH cold extraction)
Planar stability: Minor planar distortions when wetted, remains flat on drying
Tensile strength: Durable when wet, does not pill, lint-free
Reactivity to solvents: Unreactive with ethanol, acetone, ethyl acetate, MEK, toluene, xylenes, hexanes, hydrogen peroxide
Relative drying speed: Fast
Sustainability : Long-lasting, washable


Tek-Wipe fibers, 200x

Source: Polistini Conservation Material, LLC
Maximum size: 34.5" wide / by the yard
Price: $9.40 per yard ($0.0075/sq. in.)

ACKNOWLEDGEMENTS

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BLOTTER WASHING COMPARISONS

OVERALL PERFORMANCE

Mock-up tests were conducted to compare the performance of the three materials during blotter washing. Two sets of tests were run: the first with a group of non-accessioned prints containing the same tideline, and the second with fragments of a discarded, non-accessioned print. The prints were blotter-washed with deionized water for one hour and then for three additional hours. After visual examination, it was determined that the print fragments washed similarly in treatments performed with the three materials.

DETAIL IMAGES FROM VERSO OF WASHED PRINT FRAGMENTS

UNIFORMITY AND CONTACT

Mock-up samples were tested to compare washing uniformity and contact between the art and the three washing substrates. Sheets of chromatography paper were uniformly colored with sou-sou and let dry. Cotton, the most hydrophilic of all three materials, shows excellent overall contact with the sheet. Evolon®, the most hydrophobic, provides the least homogeneous contact. Poor contact can produce stains and uneven washing. Nevertheless, further testing with these materials proved that if air pockets between the layers are reduced—for instance by compressing them with a brayer—and if the object is very thoroughly humidified—for example in a GORE-TEX® sandwich—the uniformity of the wash can be greatly improved.

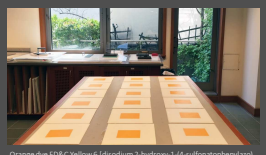

Sou-sou is made by boiling down paper degradation products. It shows strong UV-induced visible fluorescence, which helps assess and document the contact between the sheets of paper and the blotting materials.

UV-INDUCED VISIBLE FLUORESCENCE IMAGES

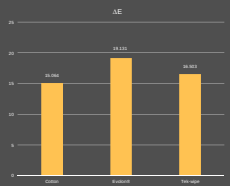
It is not possible to observe products of degradation with UV-induced visible fluorescence on Tek-Wipe due to the high amount of optical brighteners in its composition. In another test conducted in the lab, optical brighteners were leached into deionized water, as visible in the image at the above right. Optical brighteners leached into the water even after the Tek-Wipe was washed multiple times (center beaker in the image).

CLEANING ACTION

To objectively compare the performance of cotton blotter, Evolon® and Tek-Wipe, sheets of chromatography paper were dyed with a soluble orange dye with two goals in mind: 1) to measure the shift in color after blotter washing and 2) to visually follow the movement of solutions absorbed into the structure of the blotting materials. Nine sheets of dyed paper were washed for one hour in deionized water over each type of substrate.


Orange dye FD&C Yellow 6 [disodium 2-hydroxy-1-(4-sulfonatophenylazo) naphthalene-6-sulfonate]

Color measurements with a spectrophotometer were taken before and after washing. The Delta E value represents the distance between CIE L*, a*, b* color values in the two consecutive measurements. A greater Delta E value represents a larger difference in color, that is a lighter orange after washing. Evolon® showed the largest Delta E values, followed by Tek-Wipe and then cotton.

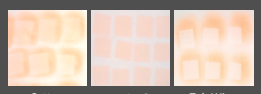


Readings made with X-Rite eXact Spectrophotometer, (D65 standard illuminant/2° standard observer, M0 mode), five averaged readings per site.

OTHER OBSERVATIONS

Small stacks of each type of material were created to allow observation of the movement of discoloration through the layers. Tek-Wipe exhibited the strongest vertical capillary transport of the dye, cotton the weakest. See image at right.

Due to their microfibrous structure, both Evolon® and Tek-Wipe have significantly stronger vertical capillary action than cotton. As a factor contributing to their efficiency in washing, it should also be taken into account when sinking of media might be a concern.



Small squares of dyed chromatography paper were blotter washed and left to dry over several layers of the tested materials. Cotton and Tek-Wipe continue to wash laterally as they dry, allowing air to pull the dye away from the object and outward. Tek-Wipe has a distinct "grain direction." This lateral movement, as well as the different drying rates of the three materials, may be considered when designing a treatment for sensitive media. This lateral effect is not evident with Evolon®, where the dye remains in place under the object, and moves by gravity, downward through the stack.

OTHER APPLICATIONS

Cotton, Evolon® and Tek-Wipe are advantageous:
- To flatten works of art on paper (further comparative study needs to be done)
- As soft interleaving materials (further testing needs to be done on Evolon® and Tek-Wipe for long term contact)
- To dry paper pulp casts

Tek-Wipe and Evolon® are advantageous due to their tensile strength:
- As support for wet treatments on fragile works of art on paper, especially oversize objects

Tek-Wipe and Evolon® are advantageous due to their planar stability:
- As drying substrates for air-drying treatments
- As drying substrates for lining treatments
- As wetting substrates for GORE-TEX® sandwiches

RESULTS & DISCUSSION

Tests show that although apparently similar, the materials investigated here perform differently when used as washing substrates for works of art on paper. Each one possesses its own set of advantages and disadvantages, depending on the specific circumstances of the treatment.

The authors suggest further examination of potential applications of these new materials in the reduction of other varieties of staining. Microfibers as well as nanofibers are currently in use in other fields, as absorbing materials in the reduction of mold, bacteria and oily stains.

Further studies should be conducted to determine the chemical stability of the constituent elements of these new synthetic blends. Oddy testing, as well as accelerated aging tests, are expected to be conducted at the Metropolitan Museum of Art in continuation of this comparative study.