TECHNICAL BULLETIN

COTTON INCORPORATED

6399 Weston Parkway, Cary, North Carolina, 27513 • Telephone (919) 678-2220

TRI 5001

BATCH BLEACHING OF NONWOVEN COTTON FABRICS

INTRODUCTION

Nonwoven fabrics can be produced using raw (unbleached) cotton. Certain nonwoven fabrics have enough integrity to allow for bleaching after fabric formation, which eliminates the need for using more costly bleached fiber. Bleaching of nonwoven fabric can be done with batch or continuous systems depending on the integrity of the material.

FIBER PREPARATION

To allow for satisfactory bleaching of the fabric, the raw fiber must be thoroughly cleaned before web formation. This processing should remove as much of the hard to bleach non-lint content (i.e., plant and seed parts) as possible. Most conventional textile cleaning machines do not remove enough of the large foreign matter to provide a high quality bleached product. Without proper fiber cleaning, the fabric will contain objectionable, partially bleached visible matter.

The visible foreign matter (VFM) content of properly cleaned cotton should be less than 0.4% and have a trash count less than 20 particles per gram as measured by the Zellweger Uster AFIS instrument. J.D. Hollingsworth on Wheels, Inc., produces two machines capable of properly cleaning raw cotton (the LINTMASTER™ Opener/Cleaner and the MAC Opener/Cleaner). These machines have cleaning efficiencies of 75 to 80 percent and will remove most of the larger, hard to bleach particles.

The LINTMASTER™ Opener/Cleaner is preferred because it cleans at high production rates (600 lbs/hr and higher) without damaging the fiber or increasing nep content.

FABRIC CONSTRUCTIONS

1. Spunlaced (Hydroentangled) Fabrics

   Hydroentangled cotton fabrics have high strength values and all weights of fabrics produced by this process can be batch bleached. Heavier weight fabrics produced using high water jet pressures are strong enough to be bleached on conventional, continuous textile bleaching equipment (Note: Machine direction fabric strength should be GREATER THAN 30 POUNDS to allow such processing).

2. Stitchbonded Fabric

   The yarn stitching used in making these fabrics can provide sufficient strength for continuous bleaching, but batch bleaching is likely to be the preferred method to preserve the desired fabric surface appearance.

3. Needlepunched Fabrics

   Needlepunched fabrics are more appropriately batch bleached. Light weight (less than 6 oz/yd^2) and lightly needled heavy weight samples produced without scrim need to be supported (i.e. a conveyor) during the wet-out stage to prevent severe fabric distortion due to

stretching. Needlepunched fabrics produced with a supporting scrim should have enough strength to allow for wetting out the fabric without the need of additional support.

EQUIPMENT

1. Experimental trials were conducted on a package dyeing machine equipped with a perforated cylinder that held the fabric in a vertical configuration so that scouring and bleaching liquors could be pumped through the layers from both directions. The package dye chamber closely simulates a commercial kier in design and process functions.

2. A full-size beam dyeing machine at Cotton Incorporated, which operates at atmospheric conditions, was found to be highly suitable for fabric bleaching.

Both machines use separate scour and bleach cycles. The fabric must be pre-wet and batched onto a perforated cylinder prior to being loaded into the appropriate equipment.

In most commercial equipment, 1500-1600 pounds of woven gauze fabric can be loaded on a cylinder. Circulating pump size and fabric permeability will affect the amount of fabric that can be wrapped on a cylinder for bleaching. Therefore, the amount of fabric that can be processed in an individual case must be predetermined by trial and error experiment.

PROCEDURE

A. Kier Bleaching

1. Wet out fabric in a surfactant solution (0.5% Basophen M, BASF) with a pad and dip system and tightly wind it on a perforated cylinder.

2. Securely wrap a gauze or open scrim tightly around the outside of the fabric roll.

3. Place the cylinder and fabric into the package machine.

4. Close the machine and fill it with the scour solution by pumping it through the fabric from inside the perforated cylinder. Increase the temperature to 200°F (94°C) and continuously pump the scour solution through the fabric for 30 minutes.

Scour Formula:	a. Sodium Hydroxide (50%)	40.0g/l
	b. Lufibrol KB (chelate) BASF	1.0g/l
	c. Kierlon TX-199 (surfactant) BASF	2.0g/l

5. Drain the scour solution and rinse by pumping hot water, 200°F (94°C), through the fabric until clear.

6. Fill the machine with bleaching solution. Increase the temperature to 200°F (94°C) and continuously pump the bleaching solution through the fabric for 45 minutes.

Bleach Formula:	a. Kierlon TX-199 (surfactant) BASF	1.0g/l
	b. Prestogen K (stabilizer) BASF	0.4g/l
	c. Sodium Hydroxide (50%)	4.0g/l
	d. Hydrogen Peroxide (35%)	5.0g/l

7. Rinse with hot water, 200°F (94°C), until neutral pH or neutralize with acetic acid.

8. Remove cylinder from kier.

9. Remove excess water by nip roll, centrifuge or other extraction means.

10. Dry the fabric.

B. Beam Bleaching

1. Wet-out fabric in surfactant solution (0.5% Basophen M, BASF) with a pad and dip system and wrap the fabric tightly on a perforated cylinder.

2. Securely wrap a gauze or open mesh scrim tightly around the outside of the fabric.

3. Place the cylinder and fabric in the beam bleaching unit.

4. Fill the machine by pumping ambient temperature water through the perforated drum and fabric.

5. Add the scouring chemicals to bath.

Scour Formula:	a. Sodium Hydroxide (50%)	40.0g/l
	b. Lufibrol KB (chelate) BASF	1.0g/l
	c. Kierlon TX-199 (surfactant) BASF	2.0g/l

6. While circulating, increase the bath temperature to 190°F (88°C).

7. Circulate the scour solution through the perforated cylinder and fabric for 30 minutes at 190°F (88°C).

8. Drop the scour bath.

9. Fill with hot water, 160°F (71°C), and rinse for 10 minutes.

10. Drop the rinse bath.

11. Refill the machine with ambient temperature water.

12. Add the bleaching chemicals to the bath.

Bleach Formula:	a. Prestogen K (stabilizer) BASF	0.4g/l
	b. Caustic (50%)	4.0g/l
	c. Hydrogen Peroxide (35%)	5.0g/l

13. While circulating, increase the bath temperature to 200°F (94°C).

14. Circulate the bleach solution through the perforated cylinder and fabric for 60 minutes at 200°F (94°C).

15. Cool to 160°F (71°C) and drop the bleach bath.

16. Refill with 160°F (71°C) water and overflow rinse for 20 minutes.

17. Continue overflow rinse with cold water to 100°F (38°C).

18. Close drain and stop rinse water flow. Add 0.4 g/l of acetic acid (56%) to the bath.

19. Circulate 10 minutes.

20. Drop the acetic acid bath.

21. Overflow rinse with cold water for 10 minutes.

22. Remove excess water by nip roll, centrifuge, or other extraction means.

23. Dry the fabric.

NOTE: The above conditions worked well in the batch bleaching processes at Cotton Incorporated facilities. Every process is different in terms of equipment, fabric construction, etc. Therefore, the above procedures provide a starting point and the conditions and chemical concentrations may need adjusting to provide optimum bleaching performance. The BASF chemicals may be substituted with other chemical manufacturers recommended surfactants, chelating agents and stabilizers.

RESEARCH AND TECHNICAL SERVICES

Cotton Incorporated is a research and promotion company representing cotton worldwide. Through research and technical services, our company has the capability to develop, evaluate, and then commercialize the latest technology to benefit cotton.

- Agricultural research leads to improved agronomic practices, pest control, and fiber variants with properties required by the most modern textile processes and consumer preferences. Ginning development provides efficient and effective machines for preservation of fiber characteristics. Cottonseed value is enhanced with biotechnology research to improve nutritional qualities and expand the animal food market.

- Research in fiber quality leads to improved fiber testing methodology and seasonal fiber analyses to bring better value both to growers and then mill customers.

- Computerized fiber management techniques result from in-depth fiber processing research.

- Product Development and Implementation operates programs leading to the commercialization of new finishes and improved energy and water conserving dyeing and finishing systems. New cotton fabrics are engineered -- wovens, circular knits, warp knits, and nonwovens -- that meet today's standards for performance.

- Technology Implementation provides comprehensive and customized professional assistance to the cotton industry and its customers -- textile mills and manufacturers.

- A fiber-to-yarn pilot spinning center allows full exploration of alternative methods of producing yarn for various products from cotton with specific fiber profiles.

- The Company operates its own dyeing and finishing laboratory, knitting laboratory, and a laboratory for physical testing of yarn, fabric, and fiber properties including High Volume Instrument testing capable of measuring micronaire, staple length, strength, uniformity, color, and trash content.

For further information contact:

COTTON INCORPORATED
WORLD HEADQUARTERS
6399 WESTON PARKWAY
CARY, NC 27513
PHONE: 919-678-2220
FAX: 919-678-2230

COTTON INCORPORATED
CONSUMER MARKETING HEADQUARTERS
488 MADISON AVENUE
NEW YORK, NY 10022-5702
PHONE: 212-413-8300
FAX: 212-413-8377

Other Locations
• Los Angeles • Mexico City • Osaka • Shanghai • Singapore •

Visit our website at: www.cottoninc.com

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