Backing Up Marketing Buzzwords

Fiber Computing Coming Soon to a Fabric Near You

Ozone in Textile Bleaching: Roadblocks and Path Forward
You know cotton as comfortable, durable and incredibly versatile—a natural fiber you can use in products as wide-ranging as shirts, sheets, wet wipes and 3D printed buttons. Cotton can also be completely circular—it can be reused, recycled* or returned* to the earth. When you choose cotton, you choose a material that does not have to go to the landfill. Whatever product you make, there’s a circular path ahead when you make it with cotton.

Learn more at cottonworks.com/sustainability.

* Cotton products are recyclable only in a few communities that have appropriate recycling facilities. 1H composting tests, cotton fabric samples underwent a weight loss of approximately 50-77% after 90 days in a composting facility. J. I. Land, Frey, Margaret, Browning, Kristie (2020), Journal of Engineered Fibers and Fabrics, 5 (4): https://www.jsjournals.org/papers/Volume5/5-4-dFovu.pdf

AMERICA'S COTTON PRODUCERS AND IMPORTERS, Service Marks/Trademarks of Cotton Incorporated, © 2020 Cotton Incorporated.
Features

16 Backing Up Marketing Buzzwords
By Kilara Le

The one thing that can sink a brand most quickly: making false claims about what the product will do for your consumer. Not only will this lose a brand customers, but government agencies can levy fines and lawsuits on behalf of consumers who have filed complaints, and the brand will also face the wrath of bad press and vocal consumer advocacy groups. So, what can a brand do to support their claims?

24 Textile Industry 5.0? Fiber Computing Coming Soon to a Fabric Near You
By Cary Sherburne

As an industry, we’ve barely gotten our feet wet with Textile Industry 4.0, and now Textile Industry 5.0 is on the horizon! According to experts at Advanced Functional Fabrics of America (AFFOA), the development of functional fiber computing solutions will likely be the basis for moving us into Textile Industry 5.0. AFFOA has proven that a variety of non-polymeric functional materials can be integrated into fibers, enabling us to think about the functionality of fibers and fabrics in ways we couldn’t before.

Technology

34 Ozone in Textile Bleaching: Roadblocks and Path Forward
By Roshan S. Pai, Uttam R. Doraswami, Nuno Belino, and Roshan Paul

The search for greener and more efficient textile chemicals has resulted in extensive research on the use of ozone for textile bleaching. The use of ozone for bleaching of cellulose is well known and is being carried out in commercial scale in the pulp and paper industry. But, for textile fabric bleaching, research work is continuing on the laboratory scale to replace hydrogen peroxide with ozone or to use ozone in combination with hydrogen peroxide.
Dear Members,

As you receive this magazine, AATCC staff and officers are making final arrangements for the upcoming committee meetings. I challenge you to join at least one meeting on November 10 or 11.

**Minimal Investment**

You can join AATCC committee meetings online or by phone, even when there’s an in-person option. Just register at [www.aatcc.org/events/committees](http://www.aatcc.org/events/committees) to get the link or meeting ID.

There is no cost to attend meetings. You don’t need to be a member of the committee or of AATCC (though I encourage you to join both.)

You don’t have to speak during the meetings. And you certainly don’t have to remain quiet! You can even use the chat feature, if that’s most comfortable for you. However you choose to participate, be present.

**Maximum Return**

Think of the committee meetings as professional development, research, market analysis, and networking, all rolled into one. It’s a truly valuable use of your time.

If you have never attended an AATCC committee meeting, now is the perfect time to see what they’re all about. Committee work is the heart of AATCC. The members—YOU—determine the direction of everything from AATCC standards to member benefits.

Committees plan webinars and events, write books, develop test methods, and more. There is a place for everyone. Whether you’re drawn to technical discussions or Association operations, there’s a committee of industry colleagues who share your interest!

Find a committee that interests you and register to attend the meeting today!

[www.aatcc.org/events/committees](http://www.aatcc.org/events/committees)

Best regards,

Diana A. Wyman  
AATCC Executive Vice-President
New Members

Central Atlantic Region
Delaware Valley Section
Senior members: Julia Ableson, Heidi Lunasin, Duane Morris

Hudson Mohawk Section
Senior member: Heidi Lunasin

NY Metro Section
Senior member: Sarah Hoit, Facebook

Midsouth Region
Piedmont Section
Senior members: Chris Baglin, Benjamin Galphin, founder, Outsider Innovation
Reggie Pryor, president, Pryor Global LLC
Sudhakar Puvvada, Dream Catcher Innovation Labs
Miranda Tidwell, VF Corp.
Phyllis Yezek, QC lab manager, Precision Fabrics Group Inc.

New England Region
New England Section
Senior member: Gary Goldberg, CEO, CleanBrands LLC

Southeast Asia Region
Senior members: Wenfa Chen, technical director, Qiaodan (Xiamen) Enterprise Co. Ltd., China
Samuel Kumar, COO, Global Nonwovens, India
Anfei Luo, Gayou Lace Industrial Co. Ltd., China
Kenji Ng, project manager, Woolmark Technical Services & PIEE, Australian Wool Innovation, Hong Kong
Zuojie Qin, inspector, Fujian Suntion Textile Technology Co. Ltd., China
Chuanliang Wang, Suzhou Saint Tone Textiles Co., China
Yuanying Yao, Fujian Suntion Textile Technology Co. Ltd., China
Wanqi Zeng, Qiaodan (Xiamen) Enterprise Co. Ltd., China

Southern Region
Texas Section
Senior members: Hector Cruz, manufacturing services manager, SNC Technical Services
Valerie Markham, Ascend Performance Materials

Victor Vothang, SND Manufacturing Ltd.

Western Region
California Section
Senior members: Jenine Hillaire, Diana Rosenberg, product sustainability manager, Gap Inc.

Northwest Section
Senior member: Hang Liu, assistant professor, Washington State University
Student member: Clay Saa, Portland State University

Student Chapters
Central Michigan University: Lillian Gendron and Mollie Wiltzius
Fashion Institute of Technology: Miranda Annunziata, Clyde Carpenter, Jennifer Dominguez, Alisa Feliz, Aliyah Freeman, Maria Gutierrez, Mina Jung, Olivia Martin, Jing Huang-Oliver, William Meyer, Mary Sherman, Clarissa Steed, and Egle Tvirbutaitė
North Carolina State University: Faisal Abesin, Josephine Cranfill, Ian DeBois, Javian Evans,
Sophie Frain, Sruthi Koppol, Karuna Nambi Gowri, Sarah Palmer, Balaji Soundararajan, Marian Talip, Kedea Thompson, Parris Tysinger, and Lian Zeng

Independent Members—Worldwide
Senior members: Gözde Ercan, TYH Uluslararası Tekstil Pazarlama Sanayi ve Ticaret Aş., Turkey
Tara Hackett, teaching faculty, Florida State University, USA
Sara Lundin, product safety specialist, H&M Hennes & Mauritz GBC AB, Sweden
Ralph Basile, VP of marketing and regulatory affairs, Healthmark Industries Co. Inc., USA
Robyn Feldkamp, technical designer, Champion Teamwear, USA
Kaumudi Kulkarni, senior manager of research & development, Healthmark Industries Co. Inc., USA
Student members: Josephine Bolaji, Laura Munevar, and Ikra Shuvo, University of Alberta, Canada

New Corporate Members

V Technical Textiles Inc.

V Technical Textiles Inc. (VTT) is a woman-owned small business and a USA manufacturing company of products made from conductive textiles. VTT is the leading manufacturer of RF/EMI/EMC portable shielded enclosures, RF shielded curtains, RF pouches, and RF shielding/antimicrobial garments. The company is also a supplier of the world’s largest selection of conductive textiles, yarns, and fasteners. With a broad range of products, and 20+ years of development and application experience, the quality line of Shieldex conductive fabrics are supplied by Statex.

Since 1969, Healthmark Industries Company Inc. has developed and marketed innovative solutions to aid healthcare facilities in their delivery of surgical instruments and other lifesaving medical devices to patients. These solutions include: products for the effective cleaning, validation, and verification of the cleaning process; packaging and other accessories for the proper sterilization, storage, and delivery of surgical instruments; and tools to identify and secure emergency and other lifesaving supplies and equipment. Healthmark will continue to innovate, continue to support, and continue to serve the healthcare provider and the support services that make it possible to deliver quality healthcare.

Corporate Member News

Elevate Textiles announced that its American & Efird (A&E) division has agreed to purchase Charles Craft Inc. The combination of these legacy brands brings together leading technical yarn expertise and expands A&E’s product offering related to thermal protection, cut-resistant, and flame-retardant yarns. The purchase includes the assets of the Charles Craft manufacturing operation in Hamer, SC, USA, which will operate as part of the American & Efird US manufacturing platform.

SDL Atlas introduced the Impact Penetration Tester, designed to satisfy AATCC Test Method 42: Water Resistance: Impact Penetration. Originally developed to predict rain penetration, AATCC TM 42 has been adopted by the medical industry as a measure of liquid barrier performance for personal protective equipment (PPE). The Type II Design Impact Penetration Tester is specifically designed to meet AATCC TM42. The instrument is comprised of a sturdy frame, and made of high-grade stainless steel, which allows for precise and repeatable test results.
The SDL Atlas Vortex M6 was developed to meet the requirements outlined for washing by AATCC. While this has met a large segment of the industry's needs, numerous requests have been made to SDL Atlas to adjust the instrument to meet supplier specific requirements, especially in the sportswear markets. This is where the custom programming ability of the Vortex M6 truly allows it to outshine the competition with capabilities for method specific settings in all areas of washing.

As part of its active engagement in the fight against Covid-19, Archroma announced a collaboration with Soorty for the development of the Pakistan-based denim manufacturer's new collection, combining eco-advanced colors with hygiene and protection technologies. The collection will include some of the most advanced Archroma technologies, innovations, and systems for coloration, hygiene, and protection. The denim collection will be introduced by Soorty under the brand Smart-Care+ and will include denim fabric, garments, and, coming soon, masks.

Huntsman Textile Effects has extended its industry-leading High IQ brand-assurance program with the launch of High IQ Lasting Black eco. Based on Huntsman’s award-winning Avitera SE Black reactive dye, the new color-retention program will help mills, brands, and retailers meet global demand for eco-friendly black shades that retain their intense color even after repeated washing.

People

Stutts Joins Color Solutions International


He is a graduate of North Carolina State University, with a degree in textile chemistry, and has an MBA from Montreat University. Stutts has held various positions in technical support, product management, and sales. Since 2003, his focus has been consulting with retailers on best practices for color evaluation, implementing digital color workflows, and shifting their supply chain to self-approving lab and production color. Stutts brings over 30 years of providing color management solutions to the apparel and footwear industry with the goal of reducing time and cost in color development cycles.

Obituary

Edwin Benson Armstrong Jr., 90, passed away July 2020. A native of Gastonia, NC, USA, he was the devoted husband of Marilee Meares Armstrong for 56 years, who predeceased him in 2008. In 1951, Armstrong graduated from North Carolina State University, with a degree in textile chemistry and dyeing. He served with the US Army Medical Research Laboratories at Fort Knox, working on many sensitive projects during the Korean War. He reached the rank of First Lieutenant.

Well-known globally as an innovator in the textile industry, he held numerous patents in dyeing, dye formulas, finishing, and heat transfer printing. Armstrong was the owner and president of Alamance Knit Fabrics until his retirement. He was the first to create an efficient carbon capturing system which delivered significant fuel savings, eliminated pollution, and met strict US pollution regulations by reburning smokestack exhaust. His carbon capturing inventions have been widely used globally for decades. He served as Chair of the Piedmont Section of AATCC.
As a founding director of The Concerts of Alamance, Armstrong and his partners had lofty goals. They brought top-billing classical music performers to Burlington, NC, USA. After retirement, at age 53, he was an Associate of the International Executive Corps, serving as a hands-on consultant around the world. Traveling and entertaining with wife, Marilee, and sailing with his son, Morgan, were his passions. He treasured and gave his all to his family and friends. His interests ranged from landscaping, anthropology, poetry, and all things scientific. A friend’s toast to him at his 85th birthday party declared, “Edwin stays connected with the world!” Survivors include his daughter, Lee Armstrong, his son, Morgan Armstrong (wife, Shawn), and three grandchildren, Branford Armstrong, Rachel Lewis, and Anne Woodham, as well as five great-grandchildren.


**AATCC Honors 50-Year Members**

Join us in honoring AATCC members who joined the Association in 1970, and have served the Association faithfully for the past 50+ years. We are pleased to introduce these members and congratulate them for their outstanding service to AATCC!

**Archie Wendell Coleman**, of North Augusta, SC, USA, received an associate’s degree from the University of South Carolina, Aiken, in 1975. He served in the National Guard from 1963 to 1972. Coleman is currently a consultant at Graniteville Specialty Fabrics, in Graniteville, SC, USA, where he began his career in 1959. He held the position of director of technical quality assurance for more than 40 years. In 2008, he took on a new role with the company as purchasing and supply manager, which he held until his retirement in 2013. In his free time, Coleman enjoys sailing and gardening. He and his wife Wanda Jean Fuller Coleman have three children and five grandchildren.

**George J. Ganiaris**, of Lords Valley, PA, USA, holds a master’s degree from the Institute of Textile Technology, in Charlottesville, VA, USA. He earned his bachelor’s degree in chemistry from Randolph-Macon College in 1965. In 1972, he worked for Milliken Inc. in their LaGrange, GA, USA manufacturing facilities as shift supervisor and eventually department manager. He became manager of The Velour Operation in 1975. From 1980-1981 he was project supervisor with the Institute of Textile Technology for various research assignments. He also taught in the Master’s Program (dyeing and finishing sections) and research. In 1981, Ganiaris was employed by Liberty Fabrics of New York in their Gordonsville Industries facility in VA, USA. As technical director, he was responsible for quality control, research and development, in-plant standard operating procedures, and liaising with the New York Marketing and Development Group. Ganiaris held teaching positions at the Fashion Institute of Technology (FIT) beginning in 1985. From 1997 to 2004, he was Chair of the Textile Development and Marketing Department at FIT. Ganiaris enjoys playing guitar in his free time. He is married to Linda A. Gellar. They have an extended family with six children.

**Cesar H. Guerrero**, of Miami, FL, USA, graduated from Pontifical Catholic University of São Paulo, Brazil, in 1964. He worked part time with Ciba-Geigy in São Paulo, Brazil, as a lab technician from 1961 to 1965. He relocated to Mt. Vernon, NY, USA to work as a dyes manager at Empire Synthetics Corp. until 1970. He then joined Phoenix Dye Works in Cleveland, OH, USA as a dyer in 1971. Guerrero later became production manager at Paternayan Yarn, a subsidiary of Johnson Creative Arts. He was dyehouse manager at Spinnerin Yarn Co. Inc. shortly afterwards. Guerrero also worked for American Garment Finishers Corp. as technical director through 2001 and then worked for Gap Inc. as wet process manager from 2001 to present. Guerrero has served on AATCC Committees: RA41 Enzyme Activity, RA104 Garment Wet Processing, RA56 Stain Resistance, and RA63 Water Resistance, Absorbency & Wetting Agent Evaluation. He enjoys golf and going to the movies. He and his wife Laura V. Dominguez-Guerrero have two children and two grandchildren.
John Callow Lark, of Kansas City, MO, USA, earned his BA in 1960 from Park College and his PhD in 1965 from the University of Arizona. His career in textiles spans over 45 years, and he continues to work for himself today. Lark was employed with Amoco Chemical Co. in 1973 and joined Pioneer Chemical Co. in 1980, doing chemistry and marketing for both companies. In 1986, he relocated from South Carolina to Marietta, GA, USA, for a chemistry and marketing position with North Chem/Rhône-Poulenc. Nine years later he joined Callaway Chemical Co. in Columbus, GA, USA until 2004. After retirement, Lark has worked on product development of nanosize particles in enhancing woven fabric formation. Lark served as AATCC Committee Chair of RA73 Warp Size Technology. He is married to Mildred Byrd Lark; they have three children, three grandchildren, and four great grandchildren.

Gary Norman Mock, of Raleigh, NC, USA, attended many meetings of the AATCC Palmetto Section while employed with Milliken & Co. from 1968 to 1972. He resigned from Milliken in 1972 to go back to school and earn a PhD so he could teach. He recalls that everyone was supportive and many of the mentors he met while at Milliken & Co. continued to be friends and colleagues over the following years. Mock salutes Gilman Hooper, VP of Deering Milliken Research Corp., for recruiting him. While studying for his PhD in Chemical Engineering under the direction of Richard Harshman at Clemson University, he regularly looked through the Textile Chemist & Colorist magazine. There, he found an ad from North Carolina State University (NCSU). He started in his new position as an assistant professor at NCSU’s College of Textiles. He worked with Perry Grady to co-author a book: Microcomputers and Minicomputers in the Textile Industry. Late in his career, he became interested in the history of technology and the college and wrote A Century of Progress: The Textile Program, North Carolina State University. It was published in 2001 by the NCSU Textile Foundation. He also served as Chair for AATCC’s History and Archives Committee. In his free time, Mock enjoys reading, traveling, and exercising. Mock acknowledges his wife Ruth as the greatest support any husband could ask for. They have three sons and seven grandchildren.

Arvind Patel, of Ontario, Canada, holds a master's of science degree in textiles. He managed laboratories for Sears, in Toronto, Canada, for over 30 years until his retirement in 2001. He has since been involved in test methods and care labelling with the Canadian General Standards Board. He also served on the Board of Directors for the Institute of Textile Science, Canada. Patel enjoys traveling, gardening, reading, and hiking. He has three children and four grandchildren.

Heath L. Strawn Jr., of Duncan, SC, USA, first earned a bachelor's degree in chemistry from Belmont Abbey College, and later, a master's degree in business administration from Furman University in 1977. Strawn served with the National Guard for 22 years with special forces and field artillery. He began his career in 1962 as a production worker for American Cyanamid Co. in Charlotte, NC, USA, where he later worked as a research and development chemist. He continued in R&D with Polymer Industries in Greenville, SC, USA in 1972. Strawn furthered his career several years later with Apex Chemical Co. in Elizabeth, NJ, USA, as a sales representative until he joined Quaker Chemical Co. in Conshohocken, PA, USA. In 1999, Strawn began a new position as sales manager for ABCO Industries before working as a consultant in 2002. He retired in 2013. In his free time, Strawn enjoys exercise, visiting family, hanging out on Orange Beach, AL, USA, and parachute jumping with other veterans. Strawn has honored our D-Day veterans by parachuting into Normandy from 3 C-A7’s, which were used during the June 1944 invasion. He is married to Peggy Brazille Strawn, and they have two children and two grandchildren.

Howard Zins, of Ballwin, MO, USA, graduated from Lowell Technological Institute in 1957. He worked as a textile engineer at that time and later as a development engineer until 1964. In 1965, Zins became manager of development for Milliken in Spartanburg, SC, USA. After five years with the company, he moved to Missouri to work as director of research and development for Angelica Uniform Group. Zins stayed at this position until his retirement in 2001. He continued to stay active as legislative director for the American Reusable Textile Association (ARTA) from 1990 through 2019. From 1992 through 2009, Zins also served as speaker and co-chair for the Clemson Medical Textile Conference. He authored a chapter in the Handbook of Medical Textiles and gave presentations at numerous textile conferences. Zins authored articles in the AATCC Review magazine, the TRSA journal, and the Industrial Launderer. He holds seven patents in textile technologies. He enjoys reading and spending time with his family. Zins and his late wife Jeanne, have a daughter, Jennifer. They have two grandchildren.
**Extent and Nature of Circulation**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of copies</td>
<td>2218</td>
<td>2075</td>
</tr>
<tr>
<td>Mailed Outside-County Paid Subscriptions on PS Form 3541</td>
<td>1549</td>
<td>1472</td>
</tr>
<tr>
<td>Mailed In-County Paid Subscriptions Stated on PS Form 3541</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Paid Distribution Outside the Mails Including Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Paid Distribution Outside USPS®</td>
<td>445</td>
<td>441</td>
</tr>
<tr>
<td>Paid Distribution by Other Classes of Mail Through the USPS</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Total Paid Distribution</td>
<td>2010</td>
<td>1928</td>
</tr>
<tr>
<td>Free or Nominal Rate Outside-County Copies included on PS Form 3541</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Free or Nominal Rate In-County Copies Included on PS Form 3541</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Free or Nominal Rate Copies Mailed at Other Classes Through the USPS</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Free or Nominal Rate Distribution Outside the Mail</td>
<td>88</td>
<td>62</td>
</tr>
<tr>
<td>Total Free or Nominal Rate Distribution</td>
<td>102</td>
<td>75</td>
</tr>
<tr>
<td>Total Distribution</td>
<td>2112</td>
<td>2003</td>
</tr>
<tr>
<td>Copies not distributed</td>
<td>106</td>
<td>72</td>
</tr>
<tr>
<td>Total</td>
<td>2218</td>
<td>2075</td>
</tr>
<tr>
<td>Percent Paid</td>
<td>95.17%</td>
<td>96.25%</td>
</tr>
<tr>
<td>Paid electronic copies</td>
<td>2457</td>
<td>2391</td>
</tr>
<tr>
<td>Total paid print copies + paid electronic copies</td>
<td>4467</td>
<td>4319</td>
</tr>
<tr>
<td>Total paid distribution + paid electronic copies</td>
<td>4569</td>
<td>4394</td>
</tr>
<tr>
<td>Percent paid (both print &amp; electronic)</td>
<td>97.76%</td>
<td>98.29%</td>
</tr>
</tbody>
</table>
New Online Education
Sustainability in Textiles
November 5, 19, and December 3, 2020

Don't miss *Sustainability in Textiles*, a new digital series running November-December 2020. Reserve your spot to learn about key topics in sustainability through the lens of textiles, exploring claim substantiation, recycled products, microplastics, and more!

**www.aatcc.org/aatcc-events/sustainability**

Luminosity: LED Lighting & Color

If you didn't have a chance to see Luminosity: LED Lighting & Color, recordings are still available to view on AATCC's website. Hear top experts speak about the science, practical applications, and new opportunities for efficiencies and control within the textile supply chain.

**www.aatcc.org/aatcc-events/led**

Learn More Online:
AATCC Textile Education!

Take advantage of virtual learning to enhance your skills and grow your knowledge remotely! Visit AATCC's website to learn more about educational resources and training:

- Personal Protective Equipment (PPE) Series
- Impact of Penetration Testing for Textiles
- Hydrostatic Pressure Testing for Textiles
- Overview of Surgical Mask and Respirator Requirements
- Low-Cost Measurement of Facemask Efficacy for Filtering Expelled Droplets During Speech

**https://members.aatcc.org/store/webinars/3080**

Professional Development

- **Training Your Visual Apparel Color Team**
- **How to Reduce Risk in Major R&D Projects… With Confidence**
- **Drive Organic Growth… with B2B-optimized Customer Interviews**

Don't forget to check current job listings on AATCC's website [www.aatcc.org/members/jobsite](http://www.aatcc.org/members/jobsite)
[www.aatcc.org/events/online/webinars](http://www.aatcc.org/events/online/webinars)

2021 Speaking Opportunities!

AATCC is soliciting content for 2021 online education! If you have an idea for a topic or speaker, please submit it to Angela Jabara at jabaraa@aatcc.org.

Online Test Method Training:
Register Your Team Today!

Registration is officially open for Online Test Method Training! The AATCC technical team has developed a new set of online training modules for participants to learn:

- How key test methods are performed
- Best practices for each test method discussed
- Identification of testing equipment and its association with respective test methods
- How test results are assessed and scored
- How to avoid common issues associated with methods, results, equipment, and protocol

Modules include:
- Color Vision and Evaluation
- Colorfastness
- Laundering
- Repellency and Resistance

Don't wait—register today! AATCC members receive discounted rates!

**www.aatcc.org/events/online/testing**
Digital Textile Printing 2020
December 9-10, 2020

Don’t miss it! AATCC and PRINTING United Alliance (formerly SGIA) are hosting Digital Textile Printing 2020 this December 9-10, 2020. Attendees will have the opportunity to tune-in to a variety of presentations and discussions lead by industry experts. Visit www.sgia.org to check out the topic sessions, sponsorships, speakers, and more! Registration opens early November—sign-up early to ensure your seat!

www.sgia.org/events

Textile Fundamentals
Grow your textile knowledge with AATCC and North Carolina State University! If you’re looking for affordable education to expand your textile expertise, learn about the Textile Fundamental Series. Courses provide a comprehensive, in-depth study of textile processing, from fiber to finishing. AATCC members receive discounted rates. Topics are listed below:

- Fundamentals of Fibers
- Texturing Fundamentals
- Spun Yarn Manufacturing
- Fundamentals of Warp Preparation
- Fundamentals of Warp Knitting
- Fundamentals of Weft Knitting
- Weaving Fundamentals
- Fundamentals of Nonwovens
- Fundamentals of Fabric Preparation
- Color and Color Properties
- Dyestuffs and Applications
- Printing Fundamentals
- Chemical Finishing
- Mechanical Finishing

Register now and start learning from anywhere!

www.aatcc.org/events/online/textile-fund

Mark Your Calendar
Make plans now for upcoming events and opportunities. For details, visit www.aatcc.org/events/.

2021
2021 AATCC International Conference
www.aatcc.org/events/ic2021

ONGOING
AATCC Webinar Series
www.aatcc.org/events/online/webinars/

UV Calibration Reference Fabric Program
www.aatcc.org/testing/uv/

Global Test Method Training
www.aatcc.org/testing/training/global/

Proficiency Testing Programs
www.aatcc.org/testing/proficiency/

Onsite Test Method Training
www.aatcc.org/testing/training/onsite/

Textile Fundamentals Online Training
www.aatcc.org/events/online/textile-fund/
The 2021 AATCC Concept 2 Consumer® Student Design Competition is a poster competition that allows students the opportunity to showcase their creative design and problem-solving skills in textile/apparel design.

This year’s theme, Fashion Evolution, showcases AATCC’s Centennial—the Association’s 100th Birthday! The theme for AATCC’s Centennial celebrations is “Celebrating a Century—Focused on the Future!”

Fashion Evolution will mirror that theme. From the 1920s, when AATCC was founded, to the present day, students will be asked to choose a decade from the last 100 years and reinvent the fashions for the 2020 decade focusing on one or more of the following:

- fit/sizing for various body types
- sustainable fashion
- personal protection
- new materials/technology

Students will be asked to research the chosen decade, related apparel products from that decade, and the chosen focus area(s), then reinvent the fashion for the 2020 decade. Entries will be judged based on content, creativity, completeness, thoroughness, and presentation of poster.

Educational Component
AATCC will provide online resources regarding various AATCC Test Methods related to the theme. Each entry must highlight at least one AATCC Test Method and describe why it is important to the product line and why it was chosen.

Entry Requirements
The competition is open to undergraduate or graduate students (US and international), either individuals or teams of up to four. All individual and team members must be AATCC student members to enter.

- Join online; US$35
- Memberships must be purchased by March 25, 2021.
- Only one entry per student (either individual or team member—not both) per AATCC competition per year is permitted.
- All portions of the entry must be received on or before 11am EST April 1, 2021.

Awards
Team entries will divide the prize among all members.


Winners will be announced by May 31, 2021.

Sponsors

For additional information, including a competition checklist, or to enter, visit www.aatcc.org/students/competitions/c2cdesign

Questions? Contact Manisha Patel, patelm@aatcc.org
The Herman and Myrtle Goldstein Undergraduate Student Competition is intended to highlight projects conducted by students from all areas of the textile/apparel supply chain. Projects submitted may include academic research, technology and/or process investigations, and literature reviews. This competition is designed to enhance the textile education experience for student members of AATCC. The intent is to encourage independent student projects both within the US and internationally.

**Entry Requirements**
This competition is for undergraduate students only. December graduates may compete as long as ALL work is completed during the undergraduate’s final semester. Student must be an AATCC student member to enter the competition. Students may compete as individuals only (no groups).

- Join online (US$35/year)
- Memberships must be purchased by January 22, 2021. Allow one business day to process.

**Timeline**
Phase I Entries: Due by 12:00 pm US EST January 26, 2021
Finalists will be notified by February 26, 2021
Phase II Finalist Entries: Due by 12:00 pm US EST April 19, 2021

**Awards**
- 1st place: US$1,000
- 2nd place: US$600
- 3rd place: US$400

Winners will be announced by June 1, 2021.

**Phase I: Teaser/Elevator Pitch Video Submission**
The purpose of Phase I of the competition is to explain your project in less than three minutes in a video format. The goal is to present your project clearly, concisely, and enthusiastically so the judges will invite you to be a finalist in the competition to learn more!

**Phase II: Finalist Written Submission**
The purpose of this portion of the competition is to further detail the student’s project findings in a written format. The final date for acceptance of papers is 12:00 pm US EST April 19, 2021. Papers arriving after this deadline are not eligible for consideration in the competition.

For competition guidelines and submission forms, visit www.aatcc.org/students/competitions/pitchit Questions? Contact Manisha Patel at patelm@aatcc.org
FASHION EVOLUTION
AATCC’s 100th Anniversary: Celebrating a Century—Focused on the Future

2021 AATCC C2C Student Merchandising Competition

The 2021 AATCC Concept 2 Consumer® Student Merchandising Competition is a poster competition that will allow students the opportunity to demonstrate their skills in business, marketing, and merchandising.

This year’s theme, Fashion Evolution, showcases AATCC’s Centennial—the Association’s 100th Birthday! The theme for AATCC’s Centennial celebrations is “Celebrating a Century—Focused on the Future!”

Fashion Evolution will mirror that theme. From the 1920s, when AATCC was founded, to the present day, students will be asked to choose a decade from the last 100 years and market the reinvented fashions for the 2020 decade focusing on one or more of the following:

• fit/sizing for various body types
• sustainable fashion
• personal protection
• new materials/technology

Students will be asked to:

• Develop and describe the marketing plan and merchandising plan and products for an integrated apparel line.
• Research one chosen decade and related apparel products from that time period.
• Reinvent the fashion for the 2020 decade and incorporate a focus area to create a modern approach.
• Consider how the selected focus area makes the apparel line more relevant or marketable today.
• Explain how the product line is unique.
• Describe what aspects from the selected decade were chosen and what in your product line makes them reinvented for the future.

Students do not need to design the product but do need to describe the product line at least verbally. They will explain how the product line is unique and competitive. After reviewing the educational component, they must describe what they learned and specify which AATCC test methods would be used to verify product claims.

Educational Component
AATCC will provide online resources regarding various AATCC Test Methods related to the theme. Students must explore these resources and show that they understand them in their posters.

Entry Requirements
This competition is open to undergraduate or graduate students (US and international), either individual students or teams of up to four. All individual and team members must be AATCC student members to enter.

• Join online; US$35
• Memberships must be purchased by April 20, 2021.
• Only one entry per student (either individual or team member—not both) per AATCC competition per year is permitted. All portions of the entry must be received on or before 11am EST April 22, 2021.

Awards
Entries will be judged based on content, creativity, completeness, thoroughness, and presentation of poster. Team entries will divide the prize among all members.

• 1st place: US$1000 from AATCC and US$300 from Farhan Patel
• 2nd place: US$750 from AATCC
• 3rd place: US$250 from AATCC

Winners will be announced by May 31, 2021.

For additional information, including competition checklist, or to enter, visit www.aatcc.org/students/competitions/c2cmmerch

Questions? Contact Manisha Patel, patelm@aatcc.org
AATCC Foundation Graduate Fellowship Recipients

Connelly/Perkins Graduate Fellowship

Griffin Donley is conducting research with the Kornev group in the Materials Science and Engineering Department at Clemson University. "My research project is focused on the development of a ballistic, textile-based material," says Donley. "We are modeling the fibers that will be used after insect antennae that exhibit super damping properties. From there, we hope to recreate fibers that mimic this property to construct this ballistic material for protection purposes."

Grady, Hauser, Houser, Daniels Graduate Fellowship

Chandler Probert completed his bachelor's degree studying polymer and color chemistry at North Carolina State University (NCSU). During his undergraduate career he was a mentor to a class of freshmen in the Exploratory Studies Village, served as Vice President of Phi Sigma Pi National Honor Fraternity, and was an active member of the Wolfpack community.

After his four years of undergraduate studies, Probert transitioned from student to researcher and continued his education pursuing a master's of textile engineering at NCSU. His research was focused on characterizing and understanding firefighter's exposure to chemical hazards and developing test methods to evaluate firefighter decontamination practices. Probert's work has resulted in a partnership with the Raleigh and Cary, NC, USA, fire departments to conduct field trials to assess firefighter turnout gear and skin contamination during training exercises.

After finishing his master's degree during the summer of 2020, Probert is pursuing a PhD in Fiber and Polymer Science at NCSU. He hopes to continue his work helping firefighters, but to also address the needs and concerns of arson investigators, a frequently neglected group who have similar risks of chemical exposure and fewer requirements for personal protective equipment.

Donate to AATCC Foundation today at www.aatcc.org/foundation!
This year's Foundation scholars shared their stories of thanks and appreciation—of gratefulness for less financial worry and hope for their own futures in textiles. When you give to AATCC Foundation, your donation supports students like these building a future in textiles.

Thank You for Giving!

This year has been a difficult one for college students. Some university campuses are closed, many courses are online rather than in-person, and student extracurricular activities are at a stand-still. For some students, Covid-19 has created a shift in the family dynamic, requiring that the student becomes the caregiver and breadwinner. The pandemic makes AATCC Foundation scholarships, fellowships, and grants even more important to students in textile programs around the country.

Earlier this year, AATCC Foundation presented two graduate fellowships and 18 undergraduate scholarships to 28 students taking textile-related programs at universities across the country. This is the highest number of scholarships AATCC Foundation has ever offered!

This fall, AATCC Foundation begins accepting a new cycle of applications for next year’s scholarships and fellowships. Your financial support is needed more than ever! Contribute to a specific scholarship that is close to your heart (or career) or make a general donation to AATCC Foundation.

Thank you for giving; your contributions DO make a difference!

“I am thankful for your investment in AATCC Foundation and students like me.”
—C. Carpenter, FIT

Support AATCC Foundation today!
www.aatcc.org/foundation
Backing Up Marketing Buzzwords

By Kilara Le

DOI: 10.14504/ar.20.6.1
Brands are built on the concept of recognition and differentiation in the marketplace. Today’s branding is made to evoke a ‘je ne sais quoi,” sometimes aspirational, sometimes comforting, sometimes outright outlandish, but nonetheless recognizable and relatable. Product categories and trends come and go just like brands. However, some endure for decades with very simple common products or corner the market with complex signature ones. Others quickly become a distant memory in the minds eye of the consumer.

Disclaimer: Responsibility for opinions expressed in this article is that of the author and quoted persons, not of AATCC. Mention of any trade name or proprietary product in AATCC Review does not constitute a guarantee or warranty of the product by AATCC and does not imply its approval to the exclusion of other products that may also be suitable.
While there are many, many aspects surrounding a brands’ longevity and customer base, including good marketing, supply chains, and partnerships, there is one thing that can more easily sink a brand than almost any other aspect: making false claims about what your product will do for your consumer. Not only will this lose a brand customers, but government agencies, such as the US Federal Trade Commission (FTC), can levy fines and lawsuits on behalf of consumers who have filed complaints, not to mention dealing with the wrath of bad press and vocal consumer advocacy groups. So, what can a brand do to support their claims? Enter the test method!

**What Is a Test Method Really?**

Test methods like those developed by AATCC and ASTM enable brands to test products and materials in a repeatable manner. They are not a magic bullet, or an instant way to claim that a product does a particular thing or fulfills a specific claim. Test methods establish a baseline of conditions, equipment, and the series of repeatable steps to conducting them, no matter which lab, or individual, is doing the testing. Due to the repeatability of testing methods and the range of results from them, brands can determine what levels of test results meet their product performance needs. This also allows them to compare their results to other products in the marketplace to see how they stack up.

It’s important to remember that test methods are just that, methods to test. These tests give a range of results, and then it’s up to brands to decide which level of result is acceptable to make their claim.

“It is not the laboratory’s duty to say whether a fabric is good or bad,” remarks John Crocker, business development manager at SDL Atlas Textile Testing Solutions. He adds that labs, “simply perform the testing as described by the standard and present the results to those who requested it. This is why it is so important that standards be so detailed.”

By using test methods and standards, in making a claim about a product a brand can point to the test results and say that, for example, over X amount
of time in these specific conditions it did Y and therefore we warrant it to do Z. Although it’s highly recommended to have these actual results to back up these claims, the average consumer is unlikely to note that their new rain jacket resisted water for 150 minutes under a force of water equal to 5 gallons/per minute in an environment of 60% relative humidity and a temperature of 86 degrees F.

To a consumer that is way too much information. So, instead, if a brand’s jacket “passes” this type of test or tests, to the degree which the brand finds it acceptable to do so, they claim that their jacket is “waterproof.” At the end of the day, to back up the buzzword, “the performance specification that these materials must meet or exceed is either determined by the supplier, or brand,” says Crocker.

“Ultimately the brands are responsible for the claims being made,” states Ellen Roaldi of commercial testing lab, Bureau Veritas Consumer Products Services.

“We can provide data to support a claim, but the client should review the data to assure the claim is appropriate for the product based on the data.” Roaldi adds that, “generally, with claims testing, the marketing is critical to the interpretation of a claim.” Since there are often many components and multiple manufacturers in every product’s supply chain, Roaldi notes that commercial testing labs “will work closely with the client and also often recommend that the manufacturer or importer review the claim with their internal staff to assure the marketing claim is appropriate.”

Testing In-House Versus a Certified Lab

The repeatable and structured nature of a test method, or series of them, means that with specific equipment, certain tests can be conducted on location, at a factory or a brand’s office. Crocker

James Heal
Extraordinary Testing Solutions

WickView:
The Future of Moisture Management Testing

Find out more...
www.james-heal.co.uk/wickview
sales@james-heal.co.uk
notes that, “labs, both internal and third party, test to determine a fabric’s properties, such as: strength, abrasion resistance, colorfastness, waterproofness, etc.” However, there are tests that have more complex steps or that require more expensive equipment or specialized preparation.

Roaldi explains that, “for specialty markets such as personal protective equipment, and also for thermal mannequin testing,” working with an external lab may be necessary due to the conditions required to perform the tests as well as specific equipment and expertise needed, adding that “toxicology testing is also an outsource project that a client may request.” If a brand is looking for a lab to test a specialty claim, “there are labs that offer special services in these areas and focus the majority of their business in these areas,” notes Roaldi.

Some claims may need to be backed up using multiple tests; however, “a manufacturer or brand may just use one as a spot check in the manufacturing facility during production,” notes Stacy Cain Chadwell, lab services manager for Shawmut Corp. This provides a real-time gauge that can then be verified with all of the required tests in the lab at a later date.

Most Common Claims Made By Brands?

There are product claims everywhere, in commercials, marketing materials, product stickers and hangtags, op-eds, and online descriptions. This is key to differentiation in the marketplace and creating a “value-add” for the item. Some of those most routinely visible on hangtags for consumer products are, “moisture management or wicking, breathable, waterproof, color safe, abrasion or tear resistant, and fabric feel,” says Crocker, “all of these buzzwords fall into the category of ‘performance materials.’”

From a previous role at a large hosiery company that did both private label and their own branded product, Chadwell notes that, “moisture management and wicking is really important in socks and tights.” Customers on a basic level, “want to be comfortable and keep their feet dry,” however, says Chadwell, today more brands, “are trying to find that edge in technology to differentiate their product,” in that market they are looking at adding features such as, “blister prevention and anti-microbial to control odor.”

Across the broader industry, “breathability, moisture wicking, quick dry, water proof, water resistant, wind proof, fade resistant, stain resistant, and
more-recently with the current pandemic situation, antimicrobial are the most common tests that brands want to verify, “ says Roaldi.

**To Test or Not to Test?**

The testing that should be done depends on the end use of the product. Some products, regardless of performance claims, have standards that are required legally, such as “children’s sleepwear, which requires extensive flammability testing mandated by the Consumer Product Safety Commission (CPSC), for instance,” states Crocker.

Though some results can be obtained with a single test, Roaldi notes that some claims, “may include one or more tests,” for example testing for moisture management may encompass, “identifying one way moisture transport, drying rate, wickability, absorption, and moisture vapor transmission.” These tests each individually look at a specific aspect of moisture management.

For example, when looking at moisture management in a sock, “you first want to see how well it wicks or dissipates moisture,” through the structure of the fiber and yarn construction, says Chadwell. Then the dry rate of the sock needs to be tested, “to see how fast it evaporates,” she continues, and then if it does meet test desired results, a brand can say that the product, “makes you feel cooler faster by mimicking the body’s evaporation.”

In addition to the tests that are determined to be necessary to back up a claim, “in my personal opinion, you should always test in ‘as received,’ ‘after one wash,’ and ‘after extended washings,’ or some other ‘aging’ process, when talking about materials for apparel,” remarks Crocker. This mimics the lifecycle of the product and typical post sale experiences in the hands of the consumer as it is worn and washed repeatedly.

**Harder to Prove Via Testing?**

Not all claims can be fit into the buzzword category, and lack of quantifiable test results or borderline medical performance claims may require a brand to assign a more generic claim.

At a previous company, Chadwell worked with “a specific fiber for recovery” designed “to reabsorb body heat and speed healing.” This, combined with a specialized fabric construction, was tested in a wear trial, with great feedback from participants. A wear trial is when brands get a group of people to try out their products for a period of time and give their feedback or fill out a questionnaire to see if
they report the observation of the feature or performance measure they’d like to make a product claim on. In this case, they decided that the recovery claim they wanted to make would potentially fall into the realm of a medical product claim, which requires much more rigorous testing and a different process for substantiating it through the U.S. Food and Drug Administration (FDA), and so the company decided to use a more generic claim, such as, “it makes you feel good,” says Chadwell. This is a more legally safe way to attach a differentiation to a product—but it may also miss out on reaching customers who may benefit from its specific performance characteristics.

Crocker echos this concept, “buzzword marketing may or may not have testing data to back it up, which can get a supplier in trouble.” For example says Crocker, “The term ‘sustainable’ has been thrown around for many years,” to describe fiber made from bamboo. However, Crocker adds, “the problem here was that in order to turn it into a usable fiber, a large amount of dangerous chemicals are necessary,” which actually ends up being, “ultimately worse for the environment.” In addition, this process, according to the FTC, actually results in a rayon fiber and cannot be just labeled “bamboo fiber” as the processing strips the actual bamboo bast fibers down to cellulose fibers, essentially rendering them equal to other sources of rayon, such as rayon fiber made from wood pulp.

When it comes to products that must perform, “medical claims, extreme thermal claims, and PPE [personal protective equipment] claims” are some of the most difficult to prove, “states Roaldi. Due to the life and death nature of some critical products, Chadwell notes that, “anything healing-wise will have to tow the line with the FDA for a medical device claim,” which is required for consumer safety as well as ensuring the product performs to the claim being made.

Crocker remarks that, “from my personal experience, automotive interiors and medical” claims are more complex and, “require a high level of testing.” One of the reasons for the complexity he says is
that, “materials such as these are not limited to an ‘as received’ state. You also have to test them after a number of accelerated aging situations, such as heat, cold, light, washings, etc.”

Since different countries have different requirements for backing up product claims, “if they are marketing to multiple countries they might have slightly different packaging,” says Chadwell, with a claim consistent with the regulatory requirements of the country in which it’s being sold.

How does a brand know where their product fits in with regards to buzzwords and claims? Some labs, such as Bureau Veritas, says Roaldi, “have the most current capability to validate client claims.”

“In the case when a requirement for a product does not exist, similar products from the market may be compared to each other to evaluate the same properties and determine the performance of a product to validate the claim and product appearance,” advises Roaldi. The global industry has many experts who can help brands to substantiate product claims and navigate the waters surrounding them.

What Should Brands Consider when Making a Claim?

“‘Buzzword’ marketing is a great way of capturing your customer’s interest,” says Crocker, “In the modern world of internet search engines and online purchases, consumers have more information at their fingertips than ever before.” He cautions, however, that “making claims without performance and potentially field testing can result in a poor product that can be detrimental to a supplier.” No matter what the claim is, says Roaldi, “Brands should review claims with legal staff to avoid misinterpretation. Marketing, legal, design, and quality all should be aligned internally.”

Roaldi advises that, “brands should consider the risk of the claim, and how to phrase the claims to not be misleading.” In addition, she says that brands should, “also consider if the claim is objective when no method is available to support the product claim, and the interpretation may be questionable, or subjective,” which may make a claim more susceptible to legal questioning. Chadwell, “strongly encourages,” brands, “to do their due diligence and put on their skeptical hat from the point of view of the average consumer that knows nothing about the testing process, and don’t make a claim that you can’t substantiate.”

Crocker adds that “within the worldwide supply chain, it is extremely important that textile suppliers be involved in the various standards organizations, such as AATCC, ASTM, and ISO, to let it be known what is needed when it comes to international methods so that testing standards can be edited or developed to be adequate and understandable to the masses.”

If you are reading this article, chances are you agree, or are planning to learn more about backing up buzzwords to strengthen your brand’s position in the marketplace.

Kilara Le is a Raleigh, NC, USA-based writer and consultant, specializing in the apparel industry. www.linkedin.com/in/kilaralittle
Low-power LEDs embedded in fabric. Image compliments of AFFOA.
Textile Industry 5.0?
Fiber Computing Coming Soon to a Fabric Near You

By Cary Sherburne
DOI: 10.14504/ar.20.6.2

As an industry, we’ve barely gotten our feet wet with Textile Industry 4.0, and now Textile Industry 5.0 is on the horizon! According to experts at Advanced Functional Fabrics of America (AFFOA), the development of functional fiber computing solutions will likely be the basis for moving us into Textile Industry 5.0.

Disclaimer: Responsibility for opinions expressed in this article is that of the author and quoted persons, not of AATCC. Mention of any trade name or proprietary product in AATCC Review does not constitute a guarantee or warranty of the product by AATCC and does not imply its approval to the exclusion of other products that may also be suitable.
The (Not) Good Old Days

Eric Spackey, chief marketing officer at Advanced Functional Fabrics of America (AFFOA), likes to hearken back to his days in the telecom industry to draw parallels between how the smartphone became ubiquitous and what needs to happen for fiber computing solutions to do the same. Spackey has been around long enough to have owned a “bag phone”—an early mobile phone that was really a brick weighing several pounds that you could take with you in the car.

His point is that carrying that heavy thing around was not that comfortable, and it had a limited feature set, as did cell phones over the next couple decades. It wasn’t until 3G networks with digital data capability began to be available, and then Apple integrated the iPod with a phone, calendar, and other capabilities in 2007, that the adoption chart went vertical.

Challenges & Opportunities

Fiber computing faces some of the same barriers. AFFOA has proven that a variety of non-polymeric functional materials can be integrated into fibers, enabling us to think about the functionality of fibers and fabrics in ways we couldn’t before. AFFOA CEO Alexander (Sasha) Stolyarov reports that possible functionality can include things like physiological monitoring of body temperature, heart rate, blood oxygen level, respiratory rate and more, as well as monitoring things like contaminants in the environment that might be harmful.

We’ve already seen many developments in the class of products commonly called wearables that can do some of these things—the Apple Watch, the Levi’s smart Commuter Trucker jacket, products from companies like Garmin and Fitbit. These require some sort of external device—even the Commuter Trucker jacket requires Bluetooth connectivity with a smartphone using a cuff dongle. However, it does have capacitive fibers woven into the jacket, allowing you to trigger certain actions using customized gestures—play music, provide directions, read notifications, etc.

However, AFFOA has set its sights much higher. Eric Spackey comments, “What I think we will see in the next five to seven years are significant breakthroughs where there will be applications processed off the fabric as opposed to having a watch or device connected to the garment—such as a puck that carries the radio information or a battery pack as a power source. No one wants a puck or battery pack attached to an undergarment. When we look back, we will laugh at the early wearables attempts, and even the need to use a watch or phone, in much the same way we look back now and laugh at those bag phones. We’ve been able to show in the lab that we can process information at the fiber level, but how to make it robust enough to actually have consumers make use of it still remains to be determined.”

Right now, e-textile products are still a niche market. What is required to bring them into the mainstream? “Need is…an inhibiting factor, as is comfort level,” says AFFOA Senior Director of Business Development Natasha Spackey. “Many solutions are still relatively big and bulky. We need to address size, weight, comfort, ease of use, and power consumption barriers to see an exponential growth curve. But the real challenge in the near term is finding that compelling use case that is important enough that people will put a bit of that comfort aside to use it.”
Sophisticated Functionality
“One of biggest advances we have made is the integration of semiconductor materials into fibers,” says Stolyarov. “We can now start thinking about way more sophisticated functionality. Because of the revolution in materials processing at the fiber level, what we see moving forward is the ability to not only sense things but perform computation and algorithms that give you local actionable data. We now know how to process semiconductor chip materials into fibers—the same ingredients that go into a cell phone—and so you can think about being able to achieve functionality in fabric at that same level.”

However, if important electrical components are to be housed inside of a fiber, it needs to be viable and reliable under the rigors of textile use cases. Not only do these technical fabrics need to perform a function, but they also must survive things like washing, or a soldier jumping into the mud or dirt or bumping against a rock. Incorporating sensitive components inside a sheath of fiber helps with that reliability, according to the team.

Ubiquitous
One important quality of textile fabrics that make them appealing as a computer platform is that they’re everywhere. Because textiles are something most people are in contact with from the day they are born until the day they die, they become attractive and valuable real estate for local computing.

“The smartphone laid down the blueprint of the fusion of powerful sensing with local computation. When you start combining that capability with the four or five different sensors that are present in most smartphones, you have a set of interesting services,” notes AAFOA Chief Technology Officer, Jason Cox. “But now think about the fact that..."
people are often wearing as much as 10 square meters of fabric. It’s a ubiquitous interface on your body and can connect your body with the outside world. We envision a not-so-distant future where the phone in your pocket starts to disappear into the fabric you are wearing.”

The vision goes beyond apparel as well, into added functionality in architectural and structural materials. “For example,” Stolyarov comments, “you can use fiber and fabrics to detect strain in a bridge in a more intelligent manner. And self-monitoring composites can be used in body armor, ship hulls, and undersea systems that rely on various sensors, as well as the integration of detectors into ropes and other maritime systems that can be used to do things like measure temperature as a function of depth and capture data about climate change models. There are also applications in aerospace and medical. All of a sudden, the space of applications expands. Textiles are ubiquitous.”

**Interfaces**

Most people are used to interfacing with computing devices via screens. This may seem a drawback when considering a textile fabric as a computing platform. However, even some level of display characteristics can be incorporated into e-textiles. “We have been working on developing thermochromic fibers and fabrics that can change color with low power consumption as well as working with LED technologies,” says Cox.

“Computer screens use LEDs, and we envision being able to incorporate LEDs into fabrics to create displays.”

“There is also work being done to incorporate touch interfaces in fabrics,” adds Cox. “While others have made touch sensing fabrics, the difference with some of the work being done at the Pennsylvania Fabric Discovery Center at Drexel University, for example, is that they only require two connection points as opposed to the multiple connection points in other solutions. That’s important because every connection you have to make takes time and labor.”

**In Our Lifetime**

In addition to the obvious benefits of fiber computing at a basic level, there are economic benefits as well. “Our mission is to reignite
Standard detergent is the only way to ensure consistent testing.

If test results matter—detergent matters.

Use AATCC standard detergent for consistent results.

Order Today!

www.aatcc.org/testing/laundering/#detergent

phone: +1.919.549.3526 | fax: +1.919.549.8933 | ordering@aatcc.org
domestic manufacturing in the textile industry. The textile industry left the United States for lower cost labor abroad,” says Stolyarov. “But the current pandemic crisis has exposed the fragility of those supply chains and highlights the fragmentation of the industry. We want to revitalize it in new ways, but to do that we need to make it a high-tech industry. This includes the development of technical fabrics—and not just the fabrics of the past—as well as advanced manufacturing approaches and robotic assembly. We believe it will take both advancements in technology and assembly knowledge to make this happen.”

“At AFFOA, we are more focused on capabilities roadmap than a technology roadmap,” Cox explains. “This involves several verticals. One vertical is sensing capabilities for fabrics that will be able to communicate with the environment. Another part is processing capabilities, or fabric computing. We are just starting down the road of integrating a more complex device like a microprocessor into fabric. Also, there is communication. If you are getting data from the world and processing it on the fabric, it has to go somewhere—to a mobile device, the cloud, etc. That can be done with NFC, or Bluetooth, or optical communications.”

“The last piece is that you, as a user, need to be able to interact with your fabric,” Cox adds. “You need to have an indication from the fabric about what is happening, and you also need to be able to interact back with the fabric, and that’s where touch comes in. We are working all these verticals in parallel. We want to build a toolkit that gives developers a set of modular tools that will enable them to build applications that can solve customer problems.”

Today, there is a tremendous amount of work being done around the process associated with fiber computing, but no one has yet put it all together as a complete system, nor have adequate automated manufacturing technologies been implemented. Eric Spakey concludes, “Fiber computing and the revitalization of the American textiles manufacturing industry requires a complete system, not just creating a button that can be a switch, but also where the information goes, who gets it, what is done with it, and how products are efficiently manufactured. When you buy an iPhone, you don’t just buy the camera; you pay for the network that has required investments of hundreds of billions of dollars, the advances in touch screens, the increased efficiencies that have been developed for manufacturing them, and all of the other capabilities that go into the device. These are things you never see; they are in the background. You just want to turn it on and have it work. The same will happen with fiber or fabric computing. It’s evolving rapidly and you will see it come to fruition in our lifetime!”

Cary Sherburne is an author, journalist, and marketing consultant, supporting the print, packaging, and textile industries. To contact her, visit www.sherburneassociates.com; Twitter: @csherburne; or www.linkedin.com/in/carysherburne
**AATCC Review Research Bulletins**

This feature of *AATCC Review* covers recent important developments in academic and industrial research of interest to our readers. Send your breaking research news to Mike Quante, AATCC science editor, quantem@aatcc.org.

**How Effective Are Face Masks?**

Researchers with Duke University’s physics department demonstrated the use of a simple method that uses a laser beam and cell phone to evaluate the efficiency of masks by studying the transmission of respiratory droplets during regular speech.

A visual aid showing how the laser beam and sheet of light work to capture respiratory droplets. “We use a black box, a laser, and a camera,” Martin Fischer, one of the authors of the study, told CNN. “The laser beam is expanded vertically to form a thin sheet of light, which we shine through slits on the left and right of the box.” In the front of the box is a hole where a speaker can talk into it. A cell phone camera is placed on the back of the box to record light that is scattered in all directions by the respiratory droplets that cut through the laser beam when they talk. A simple computer algorithm then counts the droplets seen in the video. From *Duke News*.

https://olv.duke.edu/news/researchers-created-a-test-to-determine-which-masks-are-the-least-effective/

**Micro- and Nanoplastics Detectable in Human Tissues**

In a study at Arizona State University, samples were taken from lungs, liver, adipose tissue, spleen and kidneys—organs likely to be exposed to, filter, or collect plastic monomers and microplastics. To develop a method and test it, the team spiked nano/microplastic beads into this sample set. Then, they analyzed the sample with flow cytometry. With this procedure, the researchers showed that they could detect the beads that they introduced into these samples.

Next, the researchers used another method called mass spectrometry to analyze 47 human liver and fat tissue samples. No materials were spiked into these samples. The team found plastic contamination in the form of monomers, or plastic building blocks, in every sample. Bisphenol A (BPA), still used in many food containers despite health concerns, was found in all 47 human samples. From *ACS News Releases*.


**New Closed Loop Recyclable Plastic Developed**

A team of researchers from Colorado State University, Beijing National Laboratory for Molecular Sciences, and King Abdullah University of Science and Technology has developed a new kind of plastic that is able to maintain its original qualities when recycled. Their paper was published in the journal *Science Advances*.

The researchers made the new plastic by preparing a bridged bicyclic thiolactone monomer from a bio-based olefin carboxylic acid. The result was a plastic (they called PBTL) that had all the qualities of traditional plastics. They next tested their plastic by conducting bulk depolymerization at 100 °C using a catalyst. Testing of the result showed the PBTL had been broken down into its original monomer. They followed that up by breaking down samples of PBTL (using a catalyst) at room temperature. And once again, close examination showed the sample had been broken down to the original monomer. The team then used the monomers from both processes to make new batches of PBTL, proving that the new plastic could be created, broken down, and created again—over and over. From *phys.org*.


**Stanford University Researcher Makes Stretchable Electronics for Artificial Skin**

Zhenan Bao, a chemical engineer at Stanford University, received an award from the American Chemical Society (ACS) for her “extensive and disruptive research in the field of conducting polymer molecular designs and their applications, as well as her outstanding advances in the development of artificial electronic skin and other bioelectronic devices.” Bao’s work in this area includes the development of stretchable circuits, flexible batteries, and a material that connects medical implants to biological tissue. These stretchable electronics allow Bao to build devices that can interface with living tissue. Such electronic skin could also be used for both human prostheses and robots. From *Chemical & Engineering News*.

The History of Textile Technology: ADR & AATCC

By Jack Daniels

Wow! One hundred years old! Few textile associations can claim the same. AATCC is celebrating our Centennial in 2021. The theme for AATCC’s celebration is “Celebrating a Century—Focused on the Future!”

Starting with this issue of AATCC Review, and continuing throughout 2021, AATCC is celebrating a century of our technical and publishing heritage by introducing a series of selected articles published in American Dyestuff Reporter (ADR), the first magazine to publish AATCC activities, reports, and presentations. We also look at the AATCC publications that followed ADR: Textile Chemist & Colorist (TC&Cs), and AATCC Review, where history is still being made.

A.P. Howes purchased and became publisher of the fledgling ADR in July of 1918. He immediately encouraged Louis A. Olney, then professor of chemistry and dyeing at the Lowell Textile School, to establish an American society for textile chemistry. The American Association of Textile Chemists and Colorists was officially founded in Boston, MA, USA, on November 3, 1921. ADR served as the official publisher for the new Association for nearly 50 years, until AATCC launched Textile Chemist & Colorist in 1969. AATCC subsequently purchased the assets of ADR in 1999.

Maria Thiry, AATCC Communications Director, recently challenged a task force consisting of Keith Beck, Martin Bide, Brian Francois, Harold Freeman, Ian Hardin, Peter Hauser, Gary Mock, and Jack Daniels (as convener), to select historical articles, published in ADR and early issues of TC&Cs, to introduce in AATCC Review to celebrate this centennial year.

This group of prior Olney Medalists, AATCC Presidents, Executive Vice Presidents, and college professors held numerous online conferences with the primary focus of selecting articles that would provide insight into key historical chemistry- and color-related developments that would benefit our younger members or late-comers to our association and industry. We hope these selected articles will rejuvenate your creative juices and encourage you to gain a better understanding of the science and history behind some of the early technological developments that have so dramatically affected our industry.

Articles reviewed and selected included the developments of hydrogen peroxide bleaching, polyester fiber, disperse dyes, fiber reactive dyes, color measurement, wrinkle-free cotton, and rotary screen printing. Each of these developments were revolutionary for our industry in their time, all continue to be refined, and continue to be in use today.

We hope these selected articles, along with the introductions to each offered by members of the task force, encourage you to explore the wealth of resources available to members on the AATCC website.

We look forward to hearing your thoughts and comments!
Celebrating a Century: Continuous Bleaching with Hydrogen Peroxide

Introduction by Brian C. Francois

“The key to good dyeing is preparation.” This was a statement heard early and often in my career. The statement itself is quite vague, but the meaning is clear. “Preparation,” in this context, referred to the bleaching and scouring of the fabrics before they were ready—or “prepared”—for dyeing.

As we celebrate the 100th anniversary of AATCC and we look back to significant milestones in textile chemistry and applications that have helped shape our industry, it is only appropriate to start with the introduction of continuous bleaching and scouring of cotton and cotton-rich fabrics. The chemistry of peroxide bleaching of cotton has been used commercially now for more than one hundred years.

The first patents relating to the continuous peroxide bleaching of textiles were filed in 1932 by Clark and Smolens while working for Buffalo Electro-Chemical Co. and in 1939 by Campbell and Fennell while working for E.I. du Pont de Nemours & Co. World War II and its demands on the textile industry seems to have slowed the introduction of the new technology; but in early 1944, Campbell presented his work during a Rhode Island AATCC sectional meeting.

His presentation, along with the subsequent question and answer period, are captured in the July 3, 1944 edition of American Dyestuff Reporter (ADR). The article is an excellent example of the practical application of textile chemistry—and the fundamentals shown are still applicable to even the most modern equipment we find in our factories today.

Procedure and Equipment for Bleaching Cotton Goods with Peroxide by the Continuous Method
(D.J. Campbell, ADR July 3, 1944)

Available to members at www.aatcc.org/pubs/adr/
Ozone in Textile Bleaching: Roadblocks and Path Forward

By Roshan S. Pai and Uttam R. Doraswami, Elxion Private Limited, Bangalore, India; and Nuno Belino and Roshan Paul, University of Beira Interior, Covilhã, Portugal

DOI: 10.14504/ar.20.6.3

Introduction

The textile industry contributes significantly to the growth of the global economy, but it is also one of the most polluting industries. Bleaching of cotton is an integral part of the textile wet processing industry. It is carried out to remove naturally occurring coloring matters from cotton to prepare the fabric for further processing. The fabric achieves the required whiteness index and improved wettability with minimal strength loss after bleaching.

The conventional method of bleaching is carried out using hydrogen peroxide along with sodium hydroxide at a temperature of nearly 100 °C. The use of hydrogen peroxide is the result of the extensive research and development that was carried out both in academia and industry to replace harsh chemicals like sodium hypochlorite. With this effort and optimized process, the industry has moved completely to the chlorine free bleach process and it is a well-known fact that almost all textile processors now use hydrogen peroxide as a bleaching agent.

As industrialization progresses, processes with lower chemical consumption, high energy efficiency, and lower effluent load are inevitable for sustainable growth. The search for greener and more efficient textile chemicals has resulted in extensive research on the use of ozone for textile bleaching. The use of ozone for bleaching of cellulose is well known and is being carried out in commercial scale in the pulp and paper industry. But, for textile fabric bleaching, research work is continuing on the laboratory scale to replace hydrogen peroxide with ozone or to use ozone in combination with hydrogen peroxide.

Ozone

Ozone is the triatomic state of oxygen and is a powerful oxidizing agent. It can be synthesized using oxygen or air as feed gas. The common methods to generate ozone are corona discharge, photochemical (UV based), electrolytic process, and so forth. Depending on the method used for generation and the feed gas, the output ozone concentration will vary from 1 wt% to 12 wt%. The use of oxygen as feed gas will yield the highest ozone concentration in the gas phase. One of the major limitations of ozone gas is that it has to be generated on-site as it cannot be stored or transported like other gases. Ozone is used in different industries including pulp and paper, pharmaceuticals, wastewater treatment, and drinking water disinfection.

Existing Application in Textile Industry

The existing use of ozone gas in the textile industry is limited to denim and denim-based garments in the washing process and for color removal of the dye effluent. In denim washing, the garment is bleached with ozone dissolved in water in a washing machine. However, this technique can also be carried out in a closed chamber by using ozone gas.

Ozone Bleaching of Cotton and Other Fibers

Extensive laboratory level research was conducted on the use of ozone for bleaching of cotton-based fabrics, yarns, other cellulosic and protein-based fibers, and fabrics in a batch process. Here is the summary of some research carried out in the recent past on the use of ozone for bleaching of cellulose-based yarn and fabric. Ozone gas was used for bleaching knit fabrics in the gas phase by applying ozone gas to desized, wet cotton fabric with moisture contents varying from 10–100% at different pHs and temperatures. It was found that the maximum bleaching efficiency was achieved at room temperature (25–30 °C) and nearly neutral pH. Attempts were also made to treat cotton yarns with ozone to produce nano-crystalline cellulose. Some studies suggested desizing and scouring prior to ozone bleaching for efficient bleaching results with terry towels.

The combination of conventional bleaching with ozone and the use of ultrasound and ozone for bleaching were also investigated. It was observed that the...
effluent load was lower in the case of ozone bleaching of nettle fibers, and the results were at par or superior in comparison with hydrogen peroxide bleaching. Some of the major advantages of ozone bleaching over hydrogen peroxide as reported by researchers are shorter process time, improved whiteness index, and lower weight loss. These results suggest that the bleaching efficiency of ozone is comparable or superior to a conventional hydrogen peroxide process. However, it seems that the industry has a long way to go to scale up the process to a commercial scale. Here are the concerns that need to be addressed for a smooth path forward.

**Method of Ozone Application**
Researchers have not concluded whether to apply ozone in gaseous form directly on the fabric/fiber or dissolve the same in water and then apply. Ozone gas is more stable in its gaseous form than when dissolved in water. Application of gaseous phase ozone on a commercial scale will be difficult in the textile industry, as wet processing is based on chemicals used in the aqueous phase and the batch process machines are designed for the same. In the aqueous phase, the concentration of dissolved ozone increases at decreased temperatures and by lowering the pH, resulting in improved bleaching efficiency. This was well corroborated by researchers with respect to ozone bleaching. Hence, the application of ozone in the aqueous phase should not be a concern in a batch process.

**Temperature of Process House and Water**
In a process house, the bleaching/dyeing machines are not thermally insulated. Hence, the heat is dissipated to the atmosphere, which keeps the atmosphere inside the process house warmer than normal. Effluent water is treated for reuse and is mixed with water from condensed steam, which makes the inlet process water hotter than normal—ideal for a conventional process. However, a temperature higher than 35 °C is detrimental for application of ozone in the aqueous phase, as the half-life of ozone decreases with the rise in temperature in the aqueous phase. The process water used for ozone bleaching should have a temperature of around 25 °C for efficient bleaching, and it is an energy efficient process.

When hydrogen peroxide is used as a bleaching agent, the use of peroxide stabilizers during bleaching and peroxide killers/removers after bleaching is necessary. Ozone bleaching can also replace the use of these two chemicals. The stability of ozone in water is dependent on the temperature and pH of water. The residual ozone in water after bleaching can thus be removed by increasing the water temperature before the fabric is subjected to the next process.

**Quality of Ozone Bleached Fabric**
The efficiency of ozone bleaching will depend on the type, condition, and cleanliness of the greige fabric. Any inefficient bleaching with ozone is to be combined with conventional hydrogen peroxide bleaching in a proper sequence as in the case of nettle fiber bleaching to obtain the desired bleaching efficiency. The substantial reduction in the usage of conventional chemicals can justify the use of ozone bleaching in combination. The resulting chemical load of the effluent is also lower.

**Industrial Scenario: Capital and Operating Costs**
An ozone generator is a capital investment. There are different proven methods for solubilization of ozone in water like ventury diffusers, spargers, and so forth. The selection of an appropriate method for dissolution and the introduction of water with dissolved ozone at the right place/places in the machine and replenishing the ozone in the circulation line to the process machine are very critical. The use of vented ozone from the bleaching process into the dye effluent stream for color removal will justify the capital investment to an extent.

If the feed gas is oxygen, it is a recurring cost. The alternative to this is the well-designed Vacuum Pressure Swing Adsorption system for continuous oxygen supply, however, this also will be a capital investment. The ozone system can be retrofitted to the existing process machine with a modification to the existing circulating water line. The original equipment manufacturer of the process machine should be expected to provide all the usual services, irrespective of this modification. This is worthwhile for the process houses that have already invested in ozone generators for dye effluent water treatment to try ozone bleaching on a commercial scale in one of their process machines.

When ozone is applied in an industry scale machine, even though replacement of hydrogen peroxide and allied chemicals is possible, replacing all the bleaching chemical auxiliaries may not be possible. Concerns about the compatibility of ozone with...
other textile chemicals like wetting agents, lubricating agents, and so forth, should also be addressed during these trials.

Safety Concerns of Ozone

There are concerns regarding ozone leaks into the process house and the subsequent hazards. Ozone is widely and safely used in various industries, including pulp and paper and pharma. A properly designed system with leak detectors and safety controls must be in place while using ozone. Depending on the concentration of ozone leakage, different personal protection equipment need to be used. For routine work with ozone, where the concentration of ozone leakage is not known, escape respirators are to be used. If the personnel are working on an ozone system with the possibility of an ozone leak, a full-face respirator is the best option. If a leak occurs and the personnel have to enter the site for addressing the leakage, various types of personal protection equipment that can be used include half-face respirators (with organic vapor cartridges with goggles), full-face respirators (with organic vapor canister or cartridges), supplied air respirators, and self-contained breathing apparatuses. The selection of these will depend on the concentrations of ozone leaked.19–21

Employee training on safety of ozone and troubleshooting of the equipment is also a must. The material used in the construction of the existing process machine and the associated circulating line should be chemical resistant, to use the same for ozone bleaching. It is important to bring together the academicians, ozone generator manufacturers, and the process machine manufacturers in the same platform. This will help to optimize the process on an industrial scale, commercialize the same, and achieve the benefits.

Conclusion

Standalone ozone bleaching or ozone bleaching in combination with conventional hydrogen peroxide bleaching can lead to reduction of chemical usage, lower effluent load, and enhanced energy efficiency in the textile process industry. Several ozone chemistry experts and quality ozone generator manufacturers are already serving in various industries. Integration of knowledge, extrapolation of the well-established processes in other industries to the textile industry, machine manufacturers, and the application site are keys to the success of this novel process. It is evident that the development of commercially-viable ozone bleaching will eventually contribute towards the sustainability of the textile industry.

References


Author

Roshan S. Pai, Consultancy Division, Elxion Private Limited, No. 24, 23rd A Main, JP Nagar 2nd Phase, Bangalore 560078, India; roshan.pai@elxion.in.
Abstracts from the AATCC Journal of Research

The AATCC Journal of Research is available to AATCC members and AATCC Journal of Research subscribers. The Journal's scope includes papers from advanced materials, fiber and polymer sciences, textile and polymer chemistry, color science, textile and apparel design, nanotechnology, sustainable materials and processes, and biomedical materials.

Below are the Abstracts, Authors, and Key Terms for the November/December 2020 AATCC Journal of Research (Vol. 20, No. 6).

To access the AATCC Journal of Research, log in on the AATCC website (www.aatcc.org), go to Publications → AJOR → Member Access to AJOR. You will need to log in to the Members portion of the website to read AJOR. This AATCC Members page contains a link to the journal, where members and subscribers may view or download the full pdf of all published papers.

Authors Can Use Free ORCID IDs with AATCC Journal of Research Submissions

An ORCID ID is a nonproprietary code that uniquely identifies an academic author. Publishers use it to unambiguously attribute any published work to the correct authors. Authors and researchers can use it to track all of an author’s published works. ORCID IDs (orcid.org) are free for all authors and can be used in submissions to the AATCC Journal of Research through Peer Track! Send journal article submissions to www.editorialmanager.com/aatcc.

Indexed in Science Citation Index!

AATCC Journal of Research is indexed in Science Citation Index Extended (SCIE) and is discoverable in the Clarivate Analytics Web of Science Core Collection. The journal’s impact factor is available in Journal Citation Reports.

Design of Powernet Knitted Fabrics from PET/BaTiO\textsubscript{3} as Pressure Garments for Rehabilitation of Cerebral Palsy

By Nilüfer Yıldız Varan, Pamukkale University

Abstract

In this study, powernet warp-knit fabrics were designed using polyethylene terephthalate (PET) yarns melt-spun with three different amounts (20, 25, and 30 wt.%) of barium titanate (BaTiO\textsubscript{3}) and 30 wt.% elastane yarns. The resulting fabrics were characterized by antimicrobial activity, cytotoxicity, electromagnetic shielding properties, differential scanning calorimetry (DSC) analyses, stiffness tests at MD and CD (machine and cross directions), and pressure measurements using wireless pressure sensors. According to the results, the newly-designed pressure garments would help in the rehabilitation of cerebral palsy patients to improve motor skills and to prevent complications by training muscles with the needed tight structure and electric stimulus onto limbs. They would also provide a hygienic environment during long physical therapy.

Key Terms

Antibacterial, Barium Titanate, Cerebral Palsy, Electromagnetic Shielding, PET, Pressure Garments

DOI: 10.14504/ajr.7.6.1
Quantifying Water Repellency by Modifying Spray Test Method AATCC TM22 to Extend Test Duration Allowing Discrimination between Similarly Graded Fabrics
By Philippa J. Hill, David Kirton, Mark Taylor, and Richard S. Blackburn, University of Leeds

Abstract
The AATCC TM22-2014 spray test (similarly BS EN ISO 4920:2012) is widely used to determine the water repellency of textiles. Given the ongoing move towards non-fluorinated chemistries to provide water repellent finishes on textiles, modifications to the spray test are suggested to discriminate between those which initially demonstrate similar repellency and aid in assessment of performance within laboratory textile testing. An extended shower duration of 60 minutes or 120 minutes is recommended, with additional calculations to objectively quantify surface wetting. This increased test period demonstrated differences in performance between repellent finishes with a 1.37 g mass difference between fluorinated and non-fluorinated chemistries after 120 minutes. Further quantification of repellent performance, as set out in this study, would determine the performance of non-fluorinated durable water repellent (DWR) chemistries and suitability for end use.

Key Terms
AATCC TM22-2014, Durable Water Repellent (DWR), Spray Test, Surface Wetting, Water Repellency

Comparison of Wool Fabric Dyeing with Natural and Synthetic Dyes in View of Ecology and Treatability
By Riza Atav, Elçin Güneş, Deniz İzlen Çifçi, and Yalçın Güneş, Namik Kemal University

Abstract
The aim of this study was to compare the fastness properties and wastewater quality in obtaining the same color on 100% woven wool fabric with natural (madder) and synthetic (1:1 metal complex) dyes. The same color, with similar wet fastness properties, was obtained on the wool fabric when dyed with either dye. However, conductivity, chemical oxygen demand (COD), and the ammonia nitrogen (NH₃-N) content of dyeings carried out with the synthetic dye mixture were considerably higher than dyeing with madder root extract, and its pH was more acidic. On the other hand, the amount of volatile suspended solids and color obtained in natural dyeing was higher than the amount in the synthetic dyeing wastewater.

Key Terms
1:1 Metal Complex Dyes, Chemical Oxygen Demand, Dyeing, Madder, Wool

Ecotoxicological Impact Assessment of the Production of Cotton Fabric
By Jiahong Qian, Zhejiang Sci-Tech University; Yuying Qiu, Jiaxing University; Xiang Ji and Yiduo Yang, Zhejiang Sci-Tech University; and Laili Wang, Zhejiang Sci-Tech University and Zhejiang Ecological Civilization Research Center

Abstract
Textiles and garments are increasingly being included in life cycle assessment (LCA) studies because the use of chemicals in industrial production of these items has potential environmental impacts. The USEtox model, characterized by ecotoxicity characterization factors based on abundant data, is a useful tool for assessing the toxicity of chemical pollutants. The objectives of this study were to estimate characterization factors of cotton fabric-related chemicals based on data from a quantitative structure–activity relationship (QSAR)
model and assess the ecotoxicological impact of cotton woven fabric. The research boundary ranged from fabric production to wet treatment. Wet treatment was found to contribute more to ecotoxicity than fabric production did, with primary alcohol ethoxylate and sodium hydroxide being the main pollutants.

**Key Terms**
Characterization Factor, Cotton, Ecotoxicity, Quantitative Structure–Activity Relationship, USEtox

**DOI:** 10.14504/ajr.7.6.4

### Green Reduction of Graphene Oxide Coated Polyamide Fabric Using Carob Extract

**By Nergis Gültekin, İsmail Usta, and Bahattin Yalçın, Marmara University**

**Abstract**
A green reduction processes for graphene oxide using carob extract is reported in this work. In this study, graphene oxide (GO) nanosheets were synthesized using the improved Hummer’s method and applied to polyamide fabric through the simple dip coating method. Then, the graphene oxide was reduced with a chemical reduction process using carob extract as a green reducing agent to give the reduced graphene oxide (RGO) material. The reduction time was studied. The structure, morphology, and thermal behavior of the material was characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), and thermogravimetric analysis (TGA), respectively. The electrical resistivity results clearly revealed that the GO coated polyamide fabric was successfully converted to the RGO coated polyamide fabric with the effective elimination of oxygen containing functional groups.

**Key Terms**
Carob Extract, Coating, Graphene Oxide, Green Reduction, Polyamide

**DOI:** 10.14504/ajr.7.6.5

### The Effect of Enzymatic Modification on the Dyeability of Polyester Fabric with Reactive Dye

**By Tuba Toprak and Pervin Anis, Bursa Uludag University**

**Abstract**
The inert chemical structure of poly(ethylene) terephthalate (PET) prevents its dyeability with reactive dyes. In this study, the reactive dyeability of polyester fabrics after enzymatic surface modification with different lipases and cutinase was investigated. The reason for the hydrophilicity of the fiber after enzymatic treatment was thought to be functional groups produced after this process, but their peak intensities in Fourier transform infrared spectroscopy (FTIR) were low and shaded by other functional groups. Scanning electron microscopy (SEM) showed that the enzymatic treatment did not cause any surface damage. A slight staining ($K/S = 0.30$) of the PET fabrics with the reactive dye occurred after enzymatic treatments. Moreover, the fastness to washing and rubbing of the reactive dye stained fabrics were good to excellent.

**Key Terms**
Cutinase, Enzymes, Lipase, PET, Reactive Dyeing, Surface Modification

**DOI:** 10.14504/ajr.7.6.6

---

### New! Free Sustainability Special Issue Available

Volume 7, 2020 Special Issue One of the AATCC Journal of Research, covering sustainability issues in textile science is now available as a free access issue on IngentaConnect at

[www.ingentaconnect.com/content/aatcc/jor/2020/00000007/a00101s1](http://www.ingentaconnect.com/content/aatcc/jor/2020/00000007/a00101s1)
Thanks to Our Advertisers for their Support in 2020!

The following companies providing products and services to the textile industry advertised with AATCC in 2020, allowing AATCC to publish *AATCC Review*, *AATCC News*, and host our website.

We gratefully thank them for their support:

- **Cotton Incorporated**
- **DyStar**
- **GTI Graphic Tech**
- **James Heal**
- **Omega Chemicals Inc.**
- **SDL Atlas**
- **The Chemours Company**
- **Verivide**
Be Part of AATCC Review!

If you have expertise on an upcoming feature topic, we’d love to hear from you. Please contact us as soon as possible to arrange an interview.

See a topic that matters to your customers? They’re reading AATCC Review. Make sure they see your ad when they do.

www.aatcc.org/pubs/advertise

Maria Thiry
thirym@aatcc.org
+1.919.549.3458

Chris Shaw
chris.shaw@chrisshawmedia.co.uk
+44.1270.522130

Genevieve Bot
botg@aatcc.org
+1.919.549.3539

<table>
<thead>
<tr>
<th>2021</th>
<th>Feature Topics: Focused on the Future!</th>
<th>Interview Deadline</th>
<th>Ad Order Deadline</th>
</tr>
</thead>
</table>
| January/February | • Informed Decisions: Using labels to communicate a brand’s sustainability efforts to consumers.  
• Race to the Future: How functional sportswear goes the extra mile to help runners break world records. | 10/1/20            | 11/23/20          |
| March/April  | • Textiles & Big Data: The capabilities of predictive analytics using big data and how it will impact product development, manufacturing, and retail.  
• A Competitive Edge: How can newer sewing machines help with efficiency and what types of machines can automate the process? | 1/4/21             | 1/29/21           |
| May/June     | • Increasing Transparency: How will brands authenticate products and provide consumers with sustainability details?  
• Smart Production: How digital transformations in production and supply chain management will enable earlier and better decisions about textile designs and permit consumer purchases to drive production. | 2/1/21             | 3/26/21           |
| July/August  | • Near-shoring: A look at the impact that on-demand apparel manufacturing and micro-factories will have on sourcing.  
• Connecting to Nature: What are some experimental and organic textile construction methods being used for practical applications? | 4/1/21             | 5/28/21           |
| September/October | • Improving Factory Conditions: Young entrepreneurs have arrived on the scene, with ideas on how fabric and fashion can be designed while respecting the basic rights of workers with a living wage and safe conditions.  
• Artificial Intelligence for Textiles: How will AI technology influence the textile industry? | 6/1/21             | 7/29/21           |
| November/December | • Novel Materials Versus Recycled Materials: Are textiles from novel virgin materials more sustainable than those made using recycled yarns or other recycled materials such as PET bottles?  
• Smart AND Sustainable: Carbon zero textiles and the new requirements for hybrid fabrics and biodiversity. | 8/2/21             | 9/24/21           |

Ad Index

AATCC ......................................................... 29, Cover 4
Cotton Incorporated* ........................................ Cover 2
James Heal* ...................................................... 19
SDL Atlas* ....................................................... 27

*AATCC Corporate Member

Find us on...
Check Your Test Results with AATCC Proficiency Testing Programs.

Register Now!

www.aatcc.org/testing/proficiency