

QUESTION + ANSWER

Q: In terms of consumer research, do you have information that shows in what type of garments consumers are looking for odor control? Is it limited to just activewear or in sportswear, jeans, etc.

JC: Activewear is the top product category consumers are likely to seek out odor control technologies, but opportunities exist across all major categories. About half of consumers say they are likely to seek out odor resistant properties (56%) in their activewear, while about a third (34%) are likely to seek out antimicrobial properties in their activewear. However, less than 1 in 10 activewear items at retail are marketed as being odor resistant (6%) or having antimicrobial (2%) properties. For non-active categories, about 4 in 10 consumers say they are likely to seek odor resistance in their casualwear (48%) and businesswear (39%), while about 1 in 4 are likely to seek out antimicrobials in their casualwear (28%) and businesswear (24%). In these markets, odor control technologies are almost non-existent at retail. As for denim, among those planning to purchase a pair of jeans in the coming year, about 4 in 10 (42%) say they would be likely to purchase jeans with odor resistant properties.

Q: Many consumers now see synthetic fabrics as synonymous with performance. Are there any consumer education initiatives to spread the recognition of Cotton as wicking?

JC: Cotton Incorporated's Fabric Of Our Lives website includes pages dedicated to educating the end consumer on the benefits of cotton, including that cotton can wick moisture. <https://www.thefabricofourlives.com/discover-cotton/the-benefits-of-cotton/breathe-easy>. In addition, some brands who have adopted cotton moisture management technologies, such as Under Armour, have used their websites to educate the consumer on the benefits of moisture wicking cotton. <https://www.underarmour.com/en-us/technology/heatgear?iid=CGW>

Q: Justin mentioned that non-active people purchase double the activewear as active consumers and are less brand loyal. Can he repeat that statement to ensure I have the correct statement?

JC: Non-active consumers, those who do not participate in any athletics or exercise, are a lucrative market opportunity for established activewear brands and new entrants as they own nearly double the amount of active garments as those who exercise 1-3 days per week (42 active garments versus 25 active garments) and are significantly less brand loyal (83% have a favorite active brand compared to 95% of active consumers).

Q: Has odor been tested after TransDRY® or WICKING WINDOWS™ has been applied to the cotton?

WK: This type of evaluation has not been conducted. From experience with these fabrics and wear trials conducted with the TransDRY® technology we do not expect the finishes to have a negative impact on odor. One of the main advantages of cotton is the ability to wet out and wash clean. It is possible for both TransDRY® and WICKING WINDOWS™ fabrics to wet out during laundering.

Q: How many washes does the TransDRY® application last?

WK: Cotton Incorporated has tested the TransDRY® technology out to 50 home launderings and testing shows that 85% of the finish is still present. In addition, visual assessment and moisture management testing confirms the technology is still performing after 50 HLTs.

QUESTION + ANSWER

Q: Does WICKING WINDOWS™ also keep you cooler?

WK: Temperature regulating properties have not been tested for WICKING WINDOWS™, but we predict the wicking properties of the technology will keep wearers cooler. Similar to the TransDRY® technology, WICKING WINDOWS™ moves moisture away from the body and then spreads it over the surface of the fabric. TransDRY® garments have been tested and results show subjects wearing TransDRY® garments were up to 2* cooler than when wearing polyester garments.

Q: Cotton tends to get really heavy as a person works out. Does the use of TransDRY® or WICKING WINDOWS™ help with that?

WK: Yes, TransDRY® and WICKING WINDOWS™ use a special finish that reduces the absorbent capacity of cotton fabrics. TransDRY® achieves this through a special yarn treatment and WICKING WINDOWS™ through a special print application. By reducing the absorbent capacity you reduce the amount of moisture (weight) a fabric can hold.

Q: What are typical up charges associated with the TransDRY® or WICKING WINDOWS™ applications?

WK: The cost of TransDRY® and WICKING WINDOWS™ vary by supplier and manufacturing region. For more specific information on TransDRY® and WICKING WINDOWS™ and for sourcing solutions contact your Cotton Incorporated Account Executive.

Q: Can TransDRY® and WICKING WINDOWS™ fabric be sourced in Asia? Most of our fabric and production is done there.

WK: Yes, there are many qualified TransDRY® and WICKING WINDOWS™ suppliers in Asia. To find a full list of suppliers visit <http://www.cottoninc.com/product/Product-Technology/Moisture-Management/> and for more information on sourcing TransDRY® and WICKING WINDOWS™ products contact your Cotton Incorporated Account Executive.

Q: Can Cotton Incorporated provide help with establishing garment test methods for odor?

WK: Cotton Incorporated can assist by providing information on odor test methods and odor research. Cotton Incorporated does not have odor testing capabilities in-house, but has experience with odor wear trials, sensory and gas chromatography testing.

Q: Does TransDRY® affect the printability of the garment? For example, screen-printing.

WK: Cotton Incorporated recently completed a print evaluation on alternating end single jersey TransDRY® fabrics. The results from the study were positive and the evaluation proved you can achieve good print coverage on TransDRY® fabric. The project evaluated rotary screen printing with pigment and reactive dyes, discharge printing, digital printing and cool transfer printing. Contact your Cotton Incorporated Account Executive if you are interested in receiving printed TransDRY® fabric samples.

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Q: Can you tell us more about what the yarn treatment is for the TransDRY® technique that is able to dry faster and move moisture?

WK: The TransDRY® treatment is a special finish applied to the yarn in a yarn kier. The finish causes the cotton yarn to become hydrophobic. The treated hydrophobic yarns are blended in the fabric with untreated hydrophilic cotton yarns. The interaction between the treated and untreated yarns creates a capillary action which spreads the moisture over a large surface area. TransDRY® fabric dries up to 50% faster than untreated cotton fabrics because they contain the treated hydrophobic cotton yarns.

Q: Will the addition of WICKING WINDOWS™ print increase odor issues on cotton fabrics?

WK: This type of evaluation has not been conducted. From experience with these fabrics and wear trials conducted with the TransDRY® technology we do not expect the finish to have a negative impact on odor. One of the main advantages of cotton is the ability to wet out and wash clean. It is possible for WICKING WINDOWS™ fabric to wet out during laundering.

Q: Are gram negative bacteria odor causing?

RMQ: No. Gram negative bacteria are not responsible for typical underarm odor.

Q: Could the wearers tell which side of the shirt was cotton and which side was polyester?

RMQ: For the participants who wore the t-shirts it was apparent by the fabric feel and look that the two sides of the t-shirt were visibly different. Any participant who was familiar with textiles may be able to recognize that one side was likely to be cotton and the other side polyester. However, they were not labeled as polyester or cotton; nor were participants ever told what the fiber content of the t-shirts were during the study. Odor assessors on the sensory panel were completed blinded to the fabrics.

Q: Has a study been conducted on the differences in odor between cotton and nylon (polyamide)?

RMQ: I have not been able to find any published studies carried out examining odor between cotton and nylon. Nor any studies carried out comparing nylon with polyester.

Q: What test method do you recommend for evaluating odor?

RMQ: At present there isn't a standard test method that I could recommend. However, a sensory method where odor is evaluated using a trained sensory panel is an effective way to assess body odor. The generation of body odor and the transfer of odor to clothing is very complex (e.g., bacteria, sweat & odorous compounds), so collecting body odor on clothing using an in vivo method (wear trial) also is a good way to capture odor as it is realistic. More research into developing a method which can better reflect the complexity of odor generation and transfer to fabrics is required.

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Q: Does *Klebsiella pneumoniae* contribute to odor?

RMG: No. *Klebsiella pneumoniae* is a gram-negative bacteria and is not responsible for odor.

Q: What are the best 3rd party accredited lab tests to prove reduction in odor?

RMQ: Our testing is conducted at the University so I cannot recommend one lab.

Q: How 'odorous' is rayon from bamboo or beechwood compared to cotton and polyester?

RMQ: I have not been able to find any published studies carried out examining odor between cotton and rayon. Nor any studies carried out comparing rayon with polyester.

Q: How did you evaluate bacterial on textiles in case study? How do you test or evaluate carboxylic acids?

RMQ: Bacteria were extracted in saline solution and cultured on bacteriological media. Corynebacteria were cultured on an aerobic corynebacteria selective agar. Carboxylic acids were evaluated using two-dimensional gas chromatography with time of flight mass spectrometry. A full description of the methods (and full study) is available in McQueen et al., 2014. *International Journal of Clothing Science and Technology*, 26(4), 274-290.

Q: How do you measure odor intensity? Any testing method?

RMQ: In the research I reported odor intensity was measured using a sensory panel. Worn fabrics were sampled and cut up into small specimens, placed in glass jars and the jars were placed in a warm water bath to come to body temperature. Individual assessors rated odor intensity on a 150 mm line scale with low and high odor at each end of the scale. The mean odor intensity was taken based on 17 assessors.

Q: How can I decrease the odor in polyester fabrics, with any special finishing?

RMQ: I am not aware of a solution for this issue.

Q: Currently antimicrobial agents are used for odor control, how effective are these in cotton and polyester? Does antimicrobial agents in textiles kill good bacteria as well?

RMQ: Antimicrobials as the only line of defense against odor are not likely to be effective. As odorous compounds may be transferred from the body to the clothing. Antimicrobials would kill "good" bacteria as well. However, as far as textiles are concerned this should not be a concern as ideally no bacteria is needed in the clothing. Furthermore, an antimicrobial which is durable should not transfer to the skin but remain in the fabric and should not alter the microflora on the skin.

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Q: Is Rayon a facilitator of odor as well? Is rayon as much an odor culprit as polyester?

RMQ: I haven't found any research into rayon and odor so cannot answer this question. I would hypothesize that rayon was less odorous than polyester because it is cellulose like cotton. However, it might differ from cotton because it has a less complex fine structure and may be more absorbent.

Q: Sensory test methods, while valid, are difficult to run in a production environment...

RMQ: True, and there is work ongoing to identify and develop standard methods that are easy to implement for odor evaluation.

