ASK THE EXPERT: COOLNESS IN FIBRES AND FABRICS

Sweat is your friend



Our question-and-answer series on topics of interest to technical textiles and apparel professionals continues, with coolness in fibres and fabrics as the subject this time. On hand to answer our enquiries is **Dr Jan Beringer**, head of research and development in the department of function and care at the Hohenstein Institute for Textile Innovation in southern Germany.

Question: What do technology providers mean when they talk about agents or special fibre constructions giving a cooling effect of (sometimes) a number of degrees Celsius? If the ambient temperature is warm, can special fabrics really make a difference to how comfortable a runner or a golfer or a tennis player or a hiker will feel on a hot day?

Answer: There are tests that show the temperature can come down. We have a heat loss measurement device here called WATson, which is basically a metal plate. We named it after the Dr Watson in Sherlock Holmes, but the WAT in the name comes from 'WärmeAbgabeTester', the German for testing the amount of heat it gives out. It's ideal for testing a piece of fabric measuring 25 by 25 centimetres. You can put cooling fabric onto the metal, which stays at a constant temperature, and

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measure the energy required to maintain the constant temperature. This means the fabric does have an effect and that's something we can measure. What we are not yet able to measure is any link between that drop in temperature and a sportsperson being able to run another five kilometres or play for another ten minutes. We think there must be a link of this kind, but it's not proven. Not yet, anyway. It's simply a guess at this stage that it should work on the skin in the same way as it does on WATson.

Q: What are the advantages and disadvantages of using a chemical agent to achieve this effect compared to fabric construction?

A: Special finishes, whether for wicking or with chemical treatments for freshness, such as menthol or xylitol, will wash out, so they are not long lasting. From the tests we have carried out, I'd say it's best to try to do this with fabric construction, whether with yarns or fibres. This will last. And then you can boost the cooling effect for a limited period of time by using one of the agents.

Q: Let's think about the FIFA World Cup in 2014 in Brazil. It will be winter in the south, but some games will be in tropical climates in cities such as Fortaleza in the north and in Cuiabá and Manaus in the interior. We saw during the Confederations Cup in June 2013 that the conditions can be very hot, humid and uncomfortable for players. If you had *carte blanche* to decide on the best technology to use in a football shirt for those matches, what would you incorporate into it?

A: It all depends on the ambient temperature. If it's above 30°C, the only way is evaporative cooling. Other methods the human body uses to cool itself down, such as radiation heat loss, will no longer work in those conditions; evaporative cooling is the only way, and that's why we start to sweat at higher temperatures. It's not about wicking, necessarily, because it's the evaporation of our sweat that provides the cooling effect rather than moving the sweat away from the skin. We all saw the images of top athletes at the Confederations Cup covered in sweat. What is needed is for the sweat to evaporate as quickly as possible to give the body the cooling effect it needs. The right fabric can be perfect for this because fabric has a high surface area. I'm not allowed to give any details, but I can say that there is research going on at the moment into special ways to prepare fabrics to do this quickly.

Q: A number of finished product and ingredient brands have presented ideas that involve absorbing moisture from the skin to providing a cooling effect. Some of these are very new, but what understanding of this idea have you been able to develop so far and what explanation can you offer of how the cooling effect comes about?



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A: Yes, it's interesting. As just discussed, our built-in air-conditioning needs sweat to evaporate. If that sweat is absorbed, you might feel a little extra comfort for a certain period of time, but the body's air-conditioning will not work as well as it should because the sweat will not be there to evaporate. The fabric needs to absorb sweat, but to stay in contact with the skin while the sweat evaporates. That's what cools you down. In some circumstances, moving sweat away from the skin could even be dangerous. If your in-built air-conditioning is not working, you can be susceptible to heat stroke.

Q: On the question of safety, we have seen in some applications of workwear for emergency services that the ability to keep people, such as firefighters, a few degrees cooler could even be a matter of life or death. What special considerations do you believe are required in these applications?

A: Firefighters present us with a very extreme example of what we are talking about here. They have to wear personal protective equipment to combat fire and heat and you always have to do something to that equipment to enhance comfort. It's difficult to evaporate sweat through lots of layers and a big jacket, that's just the law of textile technology and of physics. But if there are ways of delivering, on demand, five minutes' cooling to keep the core body temperature low enough for firefighters to keep doing their jobs and stay safe, it would be good. Examples exist. You can use special cooling pads and phase-change materials can work for a time, although in great heat the phase-change material becomes molten and will no longer work. There is a need to enhance the overall comfort of this type of clothing. It's a tough challenge for researchers all over the world, including us.

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