Everybody wants synthetic baselayers and sports shoes that don't smell, but usually prefer not to hear about the microbes that produce smells or the biocides used to reduce them. Many anti-odour products are based on silver, which inevitably brings to mind nano, a term no brand wants to be associated with. Many seek solutions that do not involve biocides. Legislation is complicated and ever-changing. This is the tricky context that antibacterial textile additives face.

Odour under control



With Take Care, first launched in apparel in 2014 and extended to footwear in 2016, Swedish brand Haglöfs has pledged to choose the most sustainable materials. In its baselayers, it now uses Sciessent Lava, an anti-odour technology that does not contain a biocide.

Haglöfs / Hans-Johansson

They thrive on heat, humidity and sweat. When a garment is washed, they lie dormant, awaiting the right conditions to wake up and multiply. They are invisible, but odour, a by-product that betrays their presence, clings tenaciously to sports clothing and shoes and is particularly pungent on synthetics. And though we are mostly aware of the beneficial and necessary contributions can bacteria provide to our health, we prefer them to play as discreet a role as possible. This is what functionalised textiles that curb the growth of microbes claim to do. Some brands, such as Nike, avoid mentioning odour or bacteria, skirting the function altogether. Others, specifically Lululemon, address it head on. Its website features an entire category of clothing called 'anti-stick gear'. The yoga and fitness apparel company promotes its anti-odour solution under the brand name Silverescent, specifying that it is 'powered by X-Static' and 'inhibits the growth of odour-causing bacteria'.

Between these two extremes, a few brands have run into murky territory for making antimicrobial claims that violated the United States Federal Insecticide, Fungicide and Rodenticide Act of 1972 (FIFRA). In a 2010 out-of-court settlement with the US Environmental Protection Agency (EPA), clog maker Crocs agreed to pay $230,000 in penalties and removed certain claims from its website, advertising and packaging. The North Face faced similar charges in 2009 and was fined $207,500 for stating that some 60 shoe references inhibited the growth of disease-causing bacteria. The outdoor brand has since adopted a low profile, listing 'odour-resistance' as one of the characteristics of its baselayers. No health claims or mention of germ-killing bacteria that would fall under the jurisdiction of the US pesticides act.

Stricter legislation

More than other performance textile functions, anti-odour or antimicrobial properties are the subject of strict, and ever stricter, regulations. The latest news to impact this field was the vote to ban triclosan, a biocide, for use in consumer products, by the European Commission on January 27, this year. This decision contrasts with a May 2015 EPA ruling not to ban the chemistry in the United States. It is a confirmation that Europe, and specifically its Biocidal Products Regulation (BPR), continues to lead in phasing out chemicals considered dangerous in consumer products.

By nature, biocides will always be under close scrutiny, on both sides of the Atlantic. In Europe, Scandinavian countries are said to be the main opponents of the use of biocides in clothing. In the United States, Minnesota has banned triclosan (it will be phased out by January 2017) and it is the subject of an ongoing assessment under the US Endangered Species Act (ESA).



X-Static XT2 is the company's silver-based antimicrobial label.

X-Static

Products currently sold on the market must, obviously, comply with legislation, leading to added cost for their manufacturers. This is considered a good thing by many leading suppliers. "It enhances traceability and results in some products being prohibited. It is consolidating the market with fewer, better suppliers," says Stephen Hobday, UK sales and marketing manager for Polygiene. It is our duty to offer a product that is safe, says Sanitized's textile manager, Urs Zihlmann. "We need clear rules to protect consumers and the industry needs rules that provide a fair, competitive environment."

Anti-odour vs antimicrobial

The choice of words used to market products with anti-odour or antibacterial properties is critical, a situation the suppliers of the textile additives that provide these functions are well aware of. In addition to complying with regulatory authorities, they also impart detailed recommendations as to which claims are allowed and which are not.

As references to bacteria and germs are regarded as off-limits, brands prefer to indicate an anti-odour property or refer to the notion of 'freshness'. But as seen at Lululemon, speaking of stink no longer seems to carry its former stigma, signalling a shift in the market. "It has been a category opener for Lululemon. And for us, it has been a learning experience that women do not mind hearing about body

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odour," says X-Static co-founder and chief commercial officer of Noble Biomaterials, Joel Furey. The new claim for XT2, the company's antimicrobial label, addresses the issue straight on with the tagline, 'I will not stink'. Europe managing director Noble Biomaterials Stephen Winnen, says a taboo has fallen and believes that using the 'S' word is now more acceptable in performance sportswear. "Consumers want a solution for synthetics. They have clearly expressed a need for garments that do not smell," he says referring to a consumer survey of more than 40,000 individuals.

"Consumers want the function, they don't want to hear about microbes," says Sanitized's Urs Zihlmann. The true benefit to the consumer, contends Mr Hobday at Polygiene, is odour control. The company's tag line is 'Stay Fresh' which he says is "user-friendly" whilst avoiding any spelling discrepancies between US and British usage (odor versus odour).

The silver standard

In the form of salts or metal, silver is by and large the most common biocide used in active sportswear. Products sold by X-Static, Polygiene, Silvadur, HeiQ, Sciessent and Sanitized all derive their properties from the presence of silver. It is the standard today, says Braz Costa, head of the Portuguese textile research and testing institute Centi. He says odour-absorbing materials, be they mineral or chemical such as cyclodextrins, are trickier to handle because "their ability to capture odour depends on a specific level of temperature, humidity or pressure and they need to be calibrated to achieve the right effect at the right time."

"We believe silver inherently poses no risk to human health nor to the environment, when properly used," says Mr Furey. "Silver metal is permanently bonded to the fibre, the only thing that is released are silver ions. This is why we believe our technology is safe," he adds, noting that the company started operating in the medical and clinical world before moving to sportswear. This is also the case for Polygiene.

The silver many antimicrobial products contain is no longer mined but recycled (often from electronics), as it is at X-Static and Polygiene. After an in-depth selection process, Patagonia chose Polygiene and promotes the Swedish brand as 'the best-performing and most environmentally friendly anti-odour technology available'. Polartec and adidas also apply Polygiene to their fabric collections. It is the textile finish used by Arc'teryx and, more recently, by UK sports bra maker Freya Active (a division of Wacoal). Mr Hobday considers these to be "pretty strong endorsements".

Suppliers also readily point out that their products require very small quantities of silver. Dow Chemical claims that its Silvadur technology "requires less silver than competing products". This is a trend that Mr Zihlmann at Sanitized confirms, adding that "we provide guidance to optimise the application process in order to reduce water and energy consumption".

To top off its eco-credentials, the silver ions that stop bacteria from reproducing, are 'deactivated' in effluent sludge and landfill, a point put forward by HeiQ.

The Swiss chemicals company has recently rebranded its textile additives under the HeiQ umbrella brand. Pure, the first product it launched ten years ago, is now called 'HeiQ Fresh Tech' and includes six different anti-odour solutions, five of which are based on silver. A sixth, based on quats (quaternary ammonium compounds), is available for brands that prefer non-silver solutions. HeiQ CEO, Carlo Centonze, insists that silver is "the best available technology". He says quats "need to be used in higher concentrations, pose a risk to aquatic life, work for some bacteria but not all and are difficult to handle for mills." Clearly his second choice.



The Sanitized portfolio of 'freshness' solutions will soon include a new film-based technology that will inhibit microbe growth.

Sanitized AG

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Switzerland-based Sanitized likewise offers several active ingredients depending on the effect its customers want to achieve and the type of article to be treated. The active ingredients it uses include silver, zinc phyrithione, silane quat and folpet.

Silver can also be added to a synthetic fibre during spinning, as Turkish company Korteks does in its range of performance fibres. Once inside the fibre, the anti-odour function will last the life of the product, but despite this, the company says it remains a niche product.

Alternatives to biocides

With growing resistance to biocides, and increasing pressure from regulators, brands and suppliers are scouting out alternative chemistries that reduce unwanted odours without containing a biocide. It is another sign that smell, not microbes, is the offending party.

In 2013, Swedish outdoor brand Haglöfs switched from Polygiene to Sciessent's Lava finish. "It is not a biocide, it absorbs odour and is bluesign-approved," says Lennart Ekberg, the brand's director of sustainability. It is present in the company's baselayers, though even here, Haglöfs is pushing wool as a natural odour-resistant solution. "In 70% wool/30% polyester blends, the wool covers the odours that may arise from the polyester," he says.

Massachusetts-based chemicals company Sciessent has released two new products this past year: Lava XL, which adsorbs odours thanks to its 'high surface area minerals', and Agion Active XL, a dual-action textile finish containing both Lava and silver. Both have the ability "to self-regenerate", says Sciessent CEO, Paul Ford. While first generation Lava requires a wash-dry cycle to empty out the odour compounds and recharge the system, Lava XL is said to not only attract and adsorb odour compounds, but also degrade them, thus regenerating without needing a washing and drying cycle.

Pluma, a non-biocidal coating, is in the works at Sanitized and should be rolled out later this year. Currently in testing and trials on humans, it won a Swiss Technology Award in 2013. "It is a completely new approach based on a modified fabric surface that bacteria cannot adhere to," says Mr Zihlmann. A potential game-changer based on a film, it would require neither EPA nor BPR approval.

HeiQ is also working on a new technology based on photocatalysis, by which light destroys the volatile organic compounds that form smell. It is currently in pre-launch stage, says Mr Centonze, and should be released in 2016. Containing titanium dioxide, it is activated by sunlight but HeiQ would like it to function indoors as well. "We are working on enhancing the system so that it requires lower light energy sources," says Mr Centonze. He adds that this solution will cover all sources of odour and will complement the company's existing range. "Bacteria will always be an issue as they generate 30% of odours," he says.

In the cosmetics industry, a new approach inspired by probiotics could constitute an alternative solution to controlling how the human skin microbiome manages odour. AOBiome, a biotech start-up based in Massachusetts, has recently launched Mother Dirt, a line of skincare products containing what the company calls "sweat-eating bacteria". This could be yet another novel strategy to keep odour under control.

Less odour, less laundering?



Polygiene is working hard to inspire consumers to 'wear more, wash less', a message that the Swedish company has been pushing for the two past years, recruiting bloggers to convey the message online. The notion is appealing and the data compelling, but winning over users might not be easy.

Washing garments less often is an unintended benefit of using X-Static, says Joel Furey, co-founder and chief commercial officer. "Our market research shows that 're-users' are a surprisingly large part of the population and that they wear a sports garment on average 3.5 times before washing. We believe this to be a combination of altruism for the environment and convenience. But it is the kind of discovery a consumer has to make on its own," he says and is hesitant to market it directly.

Washing less is a natural consequence of choosing a product that controls bacteria growth and odours, enabling the garment to stay cleaner and fresher longer and thus leading to less frequent laundering, says Sciessent's CEO Paul Ford. "There is no question there is an increase in environmentally friendly practices and we don't see that going away, nor should it. Consumers having garments treated with these technologies will not need to launder them at the same rate as similar, untreated garments. That saves water, time and money."

Polygiene has conducted a lifecycle analysis on the subject, finding that consumer usage accounts for 80% of a product's impact on the environment – though the relative importance of manufacturing to usage remains an ongoing debate. Stephen Hobday points out that washing machines consume high quantities of water, energy and chemicals in the form of detergents. "If a consumer washes a garment just two times less frequently, that could have a really big impact, but the reality today is that consumers have habits that may be difficult to change."

Meanwhile, a new issue linked to clothing and laundering is emerging as data and awareness grow regarding microplastic fibres, which some researchers say is the most abundant form of plastic debris in the ocean. These invisible fibres that our clothes shed when washed may yet turn into another tricky matter for all companies involved in garment, textile and textile additives manufacturing.

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