A genuine silver lining - from deity to practicality

Silver is, to my way of thinking, more subtle in appearance than gold, softer and more approachable than platinum, and infinitely more mysterious than either. Perhaps those were the qualities that led the ancients to treat it with reverence and to ally it to moon worship.

The English name derives from the Anglo-Saxon *siolfur* (the origin of the symbol Ag in the table of elements comes from the Latin word *argentum*), but mankind has been using silver since pre-history. It is mentioned in Genesis in the Old Testament. Slag heaps in Asia Minor and on islands in the Aegean Sea indicated that man learned to separate silver from lead as early as 3000 B.C.

But what of the series of fortunate 'happenstances' that moved the metal from semi-deification to medical beneficiary? Early records indicate that the Phoenicians, for example, used silver vessels to keep water, wine and vinegar pure during their long voyages. The Greek, and later the Roman, civilisations used silver for both medication and purification, and Gaius Plinius Secundus (otherwise known as Pliny the Elder) records the use of silver for speeding the healing of wounds received in battle and for the cleansing of water. Hippocrates, regarded as the father of modern medicine, wrote that silver had beneficial healing and anti-disease properties.

In America, pioneers moving west put silver and copper coins in their water barrels to keep it clean. In fact, to be 'born with a silver spoon in his mouth' is not a reference to wealth, but to health. In the early 18th century, babies fed with silver spoons were healthier than those fed with spoons made from other metals, and silver pacifiers found wide use in America because of their beneficial health effects. In a modern world concerned with the spreading of virus and disease, silver is increasingly being applied in situations where its bactericidal properties are of immense value and it is used in treatments for conditions ranging from severe burns to Legionnaires Disease.

While silver's importance in the bactericidal context has only been documented since the late 1800s, nowadays silver compounds are regularly used to accelerate healing in burn victims, where medical staff use the metal's ability to absorb oxygen and thereby oxidise harmful bacteria. Twenty years ago it was common for the wounds of severely burned patients to become infected, which delayed healing and sometimes led to death. Today silver sulfadiazine is used by hospitals worldwide to kill bacteria allowing the body time to restore the area naturally. Sulfadiazine is a known antibacterial agent. But combined with silver, studies show it is at least 50 times more active than other antibacterial agents. As a naturally occurring metal ion, silver has been shown not to contribute to the creation of 'super bugs', as apparently has the overuse of antibiotics and other antibacterial agents.

Silver spoil

In the final quarter of 2003 a US-based magazine published comment suggesting that the use of silver as an anti-bacterial agent in apparel was detrimental in particular to freshwater fish. The basis of the argument seems



X-Static fibre was used in the production of the English team kit for Euro 2004.

Umbro

to have been a series of washing trials where the discharged effluent was found to contain minute amounts of colloidal silver that could not be filtered out and therefore found its way into the natural environment. The sub-text ignored the fact that the metal is a naturally-occurring and widely dispersed element that will be present in most running water.

Had the authors sought to ally the potentially damaging effects of the process used in separating raw silver from its inevitable proximity to lead-bearing galena ore, then there might have been a case to make, but even the filters used to treat effluent water often use a form of silver ion technology as the means to the end. However, it is perhaps the following quotation originating with researchers from The Silver Institute that will settle the argument: 'An antibiotic kills perhaps a half dozen different disease organisms but silver kills some 650. Moreover, silver is virtually non-toxic'.

In apparel the controlled release of silver ions can be engineered to provide continuous anti-microbial protection for the life of the finished product. Compounded into some polymer resins or coated onto others and natural fibres, the finished product is used to provide integral protection against a broad spectrum of bacteria, fungi and other microbes many of which contribute to the creation of unpleasant body odours. X-Static silver fibres, manufactured by Noble Fiber Technologies, Inc., favour the plating technique and eliminate odour by inhibiting the growth of bacteria and binding with ammonia and denatured proteins. Additionally, the fabric wicks moisture away from the skin, dries quickly and regulates body temperature. First on the 'silver as an anti-odour product' scene, X-Static has made brand founder William McNally a ten-year overnight success – during the last five of which he licensed his silver-coated fibres to more than 100 manufacturers and brand-owners worldwide. England's Euro 2004 football squad were fully kitted in X-Static fabrics under the Umbro brand.

Besides its bactericidal abilities X-Static, as its name implies, acts as an anti-static and as a good heat conductor, two other notable properties of silver that have applications in the palliative treatment of diabetes. Even the fittest can benefit as was recognised two years ago when the US Army bought multi-million pairs of socks containing X-Static, after soldiers wear-tested products from six manufacturers. Five national teams competing in the 2002 Winter Olympics were kitted out with uniforms made using X-Static fibres. And a little silver goes a long way in killing bacteria: depending on the fabric, X-Static constitutes no more than 5% of the garment to which it is applied, and at 99.9% pure silver, (a higher rating than sterling) is said to last for more than 250 wash cycles.

X-Static applications in the medical market are also far-reaching. There is a $2 billion accident after-care market globally and antimicrobial bandages using silver ion technology are particularly popular because their usage means less frequent – and therefore less painful – dressing changes for burns victims.



The split shirt used by Milliken in Visa-Endurance wearer trials.

Milliken and Company

Smart silver

Given the company's reputation for developing 'smart' fabrics, it was hardly surprising that South Carolina-based Milliken and Company launched itself into the silver arena a couple of years ago. Its Visa range of polyesters competes in the comfort and moisture management sectors, but two years ago it added another version to the pack – VisaEndurance, a silver ion-impregnated polyester with impressive claims for performance and durability.

To prove the point – and to avoid criticism relating to any lack of substantiation – Milliken released hundreds of VisaEndurance T-shirts to retailers, selected activists and a few journalists, and invited them to do their worst. Reply-paid report cards encouraged feedback in plenty and nobody pulled any punches.

The results were impressive and now form a substantial part of the marketing package. Pro-activity was the keynote of a courageous campaign that involved users on two levels. In the first instance over 600 activists were given a special two-piece shirt, but were not told which half carried the Endurance processed fabric. Over an average period of three months each participant kept a usage log of 'real world' wear and care that required them to check and report on both halves of the garment. The final analysis at this stage concluded that 70% of the respondents preferred the Endurance fabric, listing comfort, moisture management, handle, and odour control as the plus features.

At the 2002 Summer Outdoor Retailer show Milliken handed out over 300 T-shirts and complementary response cards to retailer visitors. Feedback from this group indicated a surprisingly high, 80%, level of activity. Ranked in order of preference the performance features were:

1. Moisture management
2. Odour control
3. Soft handle

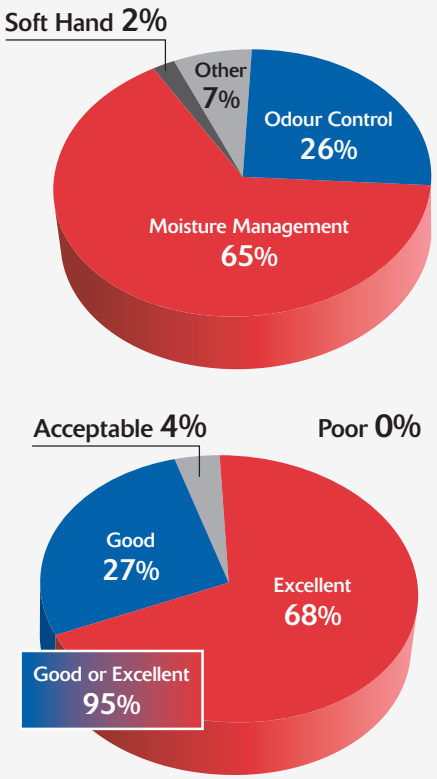
The combined results from the user reviews are shown as 'primary benefit' and 'odour control performance' in the diagrams below.

Versatile silver

Although the majority of topical silver-based treatments place the element in juxtaposition with polyester, early in 2003 Korea's Hanyang University in Seoul announced that one of its top researchers had developed a method of processing silver onto polypropylene fibre.

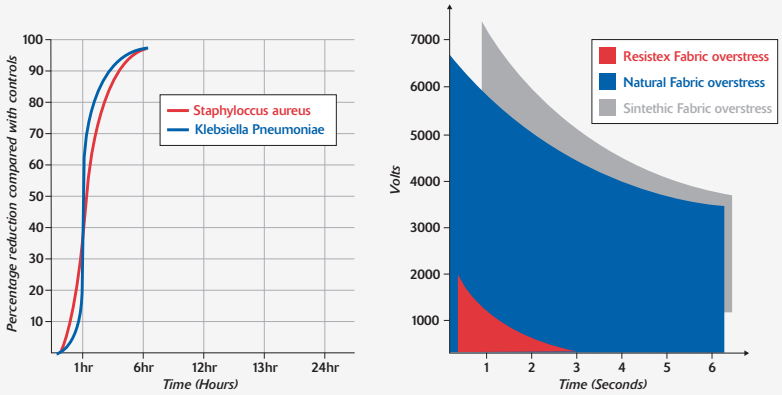
Professor Sung H Jeong and graduate student Sang Y Yeo used nano-sized particles to maximise the available skin/surface interface and achieve the optimum antibacterial effect. They already found that the fibres containing silver in the core had no antimicrobial activity. Moving the silver particles out to the sheath of the fibre produced an immediately beneficial effect.

By combining silver and polypropylene to produce an organic/inorganic fibre, Professor Sung Jeong had produced a safe, anti-microbial with a wider range of possible applications.



Results of Milliken VisaEndurance user trial showing the products primary benefit (top) and odour control performance.

Source: Milliken and Company



Antibacterial Resistex Silver is characterised by special dissipative, anti-static fibres which guarantee protection to the body from electrical charges, providing an antibacterial function and reduction in unpleasant smells. Its effectiveness against various bacteria is shown in the graphic on the left while the EOS/ESD chart on the right compares the electrical overstress and electrostatic discharge of Resistex against natural and synthetic fabrics.

Source: Tecnofilati

Almost anything from carpets to surgical masks has been suggested as viable possibilities.

Korea's Hyosung textile group has developed another alternative, Mipan Nano-Magic Silver, where the silver element is infused into polyamide fibres – a process that is also said to improve the effect of post-manufacturing processes (dyeing is specifically mentioned) and improve the handle. Hyosung claims 99.9% infection prevention.

Mipan-Magic Silver fibres were launched in March 2004 and it is anticipated that finished apparel – notably underwear and sportswear – will be on the consumer market by the end of the year.

Italian specialist fibre group Tecnofilati includes a highly-developed silver yarn in its Resistex range. Said to be suitable for both protective wear and work wear, and capable of being applied to natural and synthetic yarns, Resistex Silver is entirely coated with pure metal but retains its textile characteristics.

The silver element provides an effective antibacterial action, thermal regulation and protection from electromagnetic and UVA radiation.

Tecnofilati adds that these properties are unaffected by either time or numerous washes.

Resurrected silver

It is fair to say that the therapeutic use of silver could be termed 'resurrected' technology in the light of its exceptionally long history in the service of mankind. The wonder is that its use in context was ever allowed to fall out of sight, although undoubtedly the modern interest in nanotechnology has played a significant part in the renewal. As we work and travel in increasingly crowded conditions then our apparel, specialised or otherwise, can benefit from the application of a little silver – as our dreams benefit from the influence of the moon.