COPPER

Giving patient safety a boost

Written by Bryony Samuel, Copper Development Association

Bryony Samuel of the Copper Development Association, discusses the latest information on the use of copper surfaces to boost infection prevention and control in hospitals

The healthcare environment is increasingly recognised as a significant and continuous reservoir of microbes that can cause infections. Whilst regular cleaning and disinfection, good hand hygiene and other existing measures can be effective, they rely on human intervention and – even when fully implemented – can't eliminate the risk posed by contaminated surfaces.

Augmenting hospitals with continuously-active antimicrobial copper surfaces offers a simple and effective hygiene boost, requiring no change in human behaviour, working alongside a bundle of infection prevention and control measures to improve patient safety.

WHAT IS ANTIMICROBIAL COPPER?

There are many technologies and materials currently marketed as being antimicrobial, but none are as effective under typical indoor conditions as copper. Copper rapidly destroys microbes that can be picked up, unseen, from frequently-touched surfaces in the environment, potentially spreading infection. These include bacteria (such as E. coli), viruses (such as Influenza and the 'winter vomiting bug' norovirus), and resistant organisms such as MRSA and VRE. Fewer microbes on surfaces mean a lower risk of infections spreading by touch. Copper's antimicrobial efficacy extends to over 500 copper alloys – including brass and bronze – creating a large family of metals collectively called 'antimicrobial copper'.

Evidence shows that upgrading the most frequently-touched surfaces in a healthcare environment to antimicrobial copper can reduce the spread of costly infections and improve patient outcomes. This article presents a summary of the body of research and considers some of the practicalities and economics of upgrading key surfaces to copper.

TYPICAL INDOOR CONDITIONS

Copper's antimicrobial properties have been documented in scientific literature for more than a century, but it was not until 2000 that its efficacy against the pathogens responsible for healthcare-associated infections (HCAIs) began to be assessed. Sixteen years on, more than 60 papers report copper's broad-spectrum, rapid efficacy against bacteria, viruses and fungi. No pathogen tested has been able to survive on copper.

Claims of antimicrobial efficacy made for many antimicrobial products are based on JIS Z 2801 and ISO 22196 tests, conducted at over 90 per cent humidity, 35°C and over 24 hours under a plastic film. These basic tests are described as a proof of principal, and do not indicate how a material will perform in the field.

To better represent actual in-use conditions when testing copper, researchers developed new protocols to reflect typical room temperature and humidity, and used representative contaminants. Laboratory research on the antimicrobial efficacy of copper and copper alloys has been carried out and verified at institutions around the world, with results peer-reviewed and published in respected journals. They exhibit efficacy under typical indoor conditions, unlike silver-containing materials and triclosan, which showed no antimicrobial efficacy under these conditions.

Augmenting hospitals with continuously-active antimicrobial copper surfaces offers an effective hygiene boost

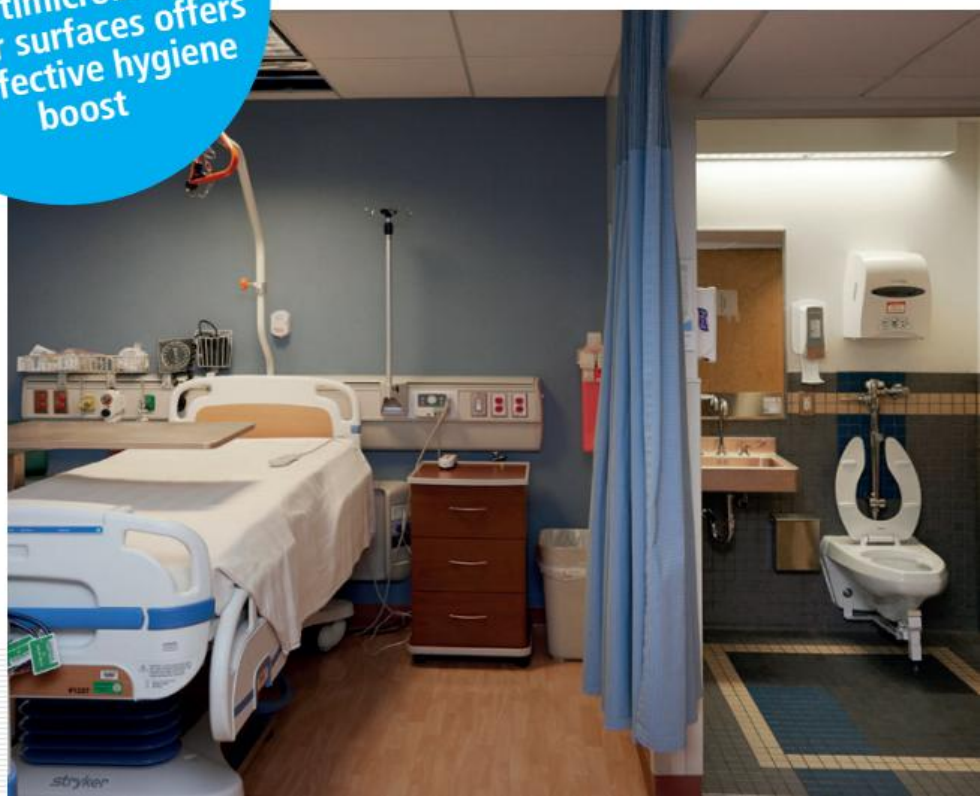
HOW DOES IT WORK?

A leading researcher in this field is Professor Bill Keevil, chair in Environmental Healthcare at the University of Southampton, and his work includes investigation of the mechanisms by which copper exerts its antimicrobial effect. For bacteria, the current consensus among researchers is that there are several interacting mechanisms for so-called contact killing. The nature of these leads researchers to believe it is unlikely bacteria will develop resistance to copper.

Professor Keevil explains: "Copper works in completely different ways to antibiotics or common biocides. It punches a hole in the cell membrane, like a balloon, and the bacteria collapse. It stops them respiring, goes into the cell and destroys their DNA. Mutation happens because you get small changes in DNA in cells. The beauty of copper is it destroys the DNA; there is nothing left. We've shown this for bacteria, fungi and viruses. They can't mutate. They have no time."

The Southampton team has also investigated the contribution antimicrobial copper surfaces can make to combating the rise of antibiotic resistance – a global threat that a joint UK government and Wellcome Trust review recently said could kill 10 million people a year across the world by 2050. The team assessed the ability of two different strains of bacteria to pass genetic material conveying antibiotic resistance between them on copper and stainless steel. While this took place on stainless steel, it did not happen on copper.

Copper could therefore contribute to the fight against antibiotic resistance in two ways – by reducing the spread of infections and thus the need for antibiotics, and by preventing the transfer of resistance between bacteria on surfaces.



CHALLENGING CLINICAL CONDITIONS

Antimicrobial copper has also been put to the test in real clinical environments. Numerous trials have been conducted in different healthcare systems – such as the UK, US, Germany, Finland, Poland, Chile and Japan – and different clinical environments, including nephrology, geriatric, general medical and ICU wards. They report a continuous and greater than 80 per cent reduction in bacterial contamination on antimicrobial copper surfaces compared to non-copper surfaces, with trial leaders concluding that antimicrobial copper can provide an additional measure to reduce the spread of HCAIs.

It is important to note that these trials have used solid materials since the effective surface will not wear away, or be susceptible to reduced efficacy over time, unlike coatings and composites. A multi-centre clinical trial in ICUs, funded by the US Department of Defense, explored the effect this reduction in surface bacteria has on HCAI rates. It found that replacing just six key, near-patient touch surfaces reduced the incidence of infections by 58 per cent.

Official recognition of copper's potential to boost infection control is growing as the evidence base and experience of use grows. The evidence-based EPIC 3 guidelines included copper as an emerging technology in 2014 and, last year, the CMJ (Poland's National Centre for Quality Assessment in Healthcare) recognised copper's potential to boost infection control in its new hospital accreditation scheme. With this proven efficacy in mind, the next question arising will naturally concern the cost of installing antimicrobial copper touch surfaces.

COST BENEFITS

HCAIs are very common and very costly, both financially and in terms of human life. Approximately 20 per cent of ICU patients in European hospitals get HCAIs, and in 2011 they affected 4.1 million patients, necessitating 16 million extra days in hospital. 37,000 deaths were recorded as being caused by HCAIs, plus 110,000 deaths where they were a contributing factor, and they had a direct clinical cost in excess of €7 billion.

York Health Economics Consortium (YHEC), a leading global health economists based at the University of York, developed a fully-referenced cost benefit model for hospital managers to illustrate the economic rationale of an antimicrobial copper installation.

Using researched data for cost of infection, industry data for cost of antimicrobial copper and standard components, and a conservative infection rate reduction of 20 per cent (where the US trial reported a 58 per cent reduction), the model considers a planned refurbishment or new build. It predicts the cost of replacing the six key touch surfaces in a 20-bed ICU with antimicrobial copper equivalents will be recouped in less than two months, based on fewer infections and the resulting shorter lengths of stay. It also calculates a positive impact on bed days and quality-adjusted life years offered by antimicrobial copper.

Dr Matthew Taylor, YHEC's director and one of the model's authors, concludes: "After the initial two months, ongoing cost savings will accrue from the reduction in blocked beds and better-directed staff resources."

HOW TO PRIORITISE SURFACES FOR UPGRADE

In the copper clinical trials, multi-disciplinary teams have prioritised high frequency touch surfaces to upgrade to copper. The factors considered include known hotspots (from microbiological testing) and likely hotspots (based on experience and understanding of staff/patient/visitor dynamics).

Based on a review of international research, the United States Centers for Disease Control published a checklist of high risk surfaces based upon the likelihood of touch and contamination. These were bed rails, chairs, IV poles, over-bed or tray tables, door and cabinet handles, grab rails, light switches, push plates, sinks, toilet seats and flush handles.

From the experience gained by hospitals adopting this technology, it is clear that when considering which components to upgrade in a particular facility, input should be sought from the infection control team and ward staff to ensure that all key touch surfaces are identified. The regular environmental swabbing carried out by infection control teams to assess the state of cleanliness will also indicate contamination.

SPECIFYING ANTIMICROBIAL COPPER

Help with identifying products is available in the form of an industry stewardship scheme: the Antimicrobial Copper brand and Cu+ mark are used by leading manufacturers of hospital equipment, furniture and fittings to indicate their products are made from solid, approved antimicrobial copper alloys, and that the organisation adheres to strict usage rules guiding their understanding of the underlying technology and its deployment.

Copper alloys offer a wide palette of colours, from the gold of brasses to the rich brown of bronzes, right through to the silver/white shades of copper-nickels. Copper alloys will naturally darken over time, but this does not impact their antimicrobial efficacy. More colour-stable technical alloys, traditionally used in demanding applications, are available.

CONCLUSION

Antimicrobial copper surfaces are an adjunct to, not a replacement for, existing infection control measures. Alongside good hand hygiene and regular surface cleaning and disinfection, they will continuously reduce surface contamination and consequently the risk of infections being passed between people via these surfaces.

Installations have already taken place around the world, in more than 25 countries, including several UK facilities. In these places, the importance of taking a multidisciplinary approach to making the decision of where to deploy antimicrobial copper has been clear. ■

FURTHER INFORMATION

www.antimicrobialcopper.org