James Rapley, Product Development Engineer at Microban® International, discusses a new class of heavy-metal-free antimicrobial technologies designed specifically for water-based paints and coatings

Keeping it clean: a new antimicrobial additive for water-based paints

Cleanliness concerns have risen sharply in recent years, alongside a growing public awareness of microbes and their potential negative impacts. Walls and surfaces decorated with paint have been part of our environment for millennia, and the potential growth of microbes on painted or polymer-coated surfaces needs to be controlled as much as anywhere else. Microbial attack can cause odours, stains and early deterioration of a paint or coating, which can limit the useful lifetime of materials, particularly in settings where products are frequently exposed to humid environments. Ultimately, this can lead to higher volumes of waste entering landfill, damaging the environment and costing money to replace. Manufacturers and consumers alike are therefore looking for sustainable and durable antimicrobial additives for water-based paints and coatings.

BUILT-IN SOLUTIONS FOR CONTINUOUS PROTECTION

Paints and coatings are ubiquitous in our residential, commercial, and institutional environments, with water-based paints dominating the household decorating market[1]. Regular surface cleaning with standard disinfectants simply cannot keep at bay the micro-organisms that cause odours, stains and premature degradation, owing to the ability of microbes to multiply exponentially, doubling in number in as little as 20 minutes on unprotected surfaces[2]. Furthermore, the harsh chemicals typically contained in cleaning products can discolour and damage the painted surfaces that they are intended to clean. Adding built-in antimicrobial chemistry into the paint during manufacture is therefore an effective solution to provide product protection that lasts in between surface cleaning routines and reduces the need for harsh chemicals.

Unfortunately, many antimicrobials designed for use in water-based coatings are unstable in UV light, limiting their usable lifetime[3]. There are also challenges associated with incorporating antimicrobials into water-based coatings at the point of manufacture. This is primarily due to the tendency of additives to aggregate and sediment out at the mixing and dispersing steps, which can result in clouding and discolouration[4]. This not only makes end products less visually attractive to the consumer, it also makes their use impossible in any application that requires a transparent coating.

UNDENIABLE ADVANTAGES OF A NOVEL SOLUTION

LapisShield™ by Microban has been developed in direct response to this issue, creating a new class of heavy-metal-free antimicrobial technologies designed specifically for use in water-based paints and coatings, as well as demonstrating the company's continuing drive to deliver more sustainable solutions to deter microbial growth. This latest development uses sodium pyrithione to disrupt membrane transport, thereby disrupting the metabolic activities of micro-organisms to prevent proliferation and growth (**Figure 1**). Manufacturers can use this highly effective easy-to-implement technology to protect their paints and coatings against the detrimental effects of microbes, with the added confidence that the additive is completely free from heavy metals.

As a pioneering newcomer, LapisShield successfully answers many of the demands from manufacturers for superior incorporation of antimicrobials into their coatings over traditional technologies. The technology

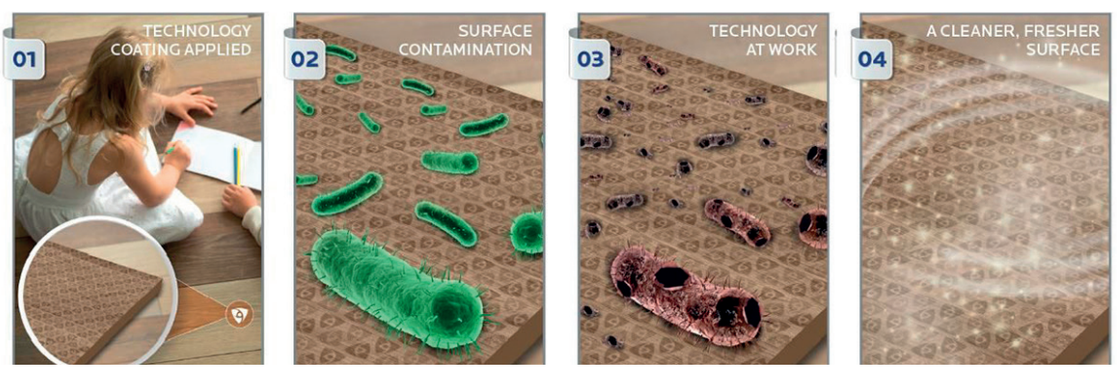

Figure 1. LapisShield prevents the growth of bacteria, moulds and mildews within paints and coatings to provide around the clock protection

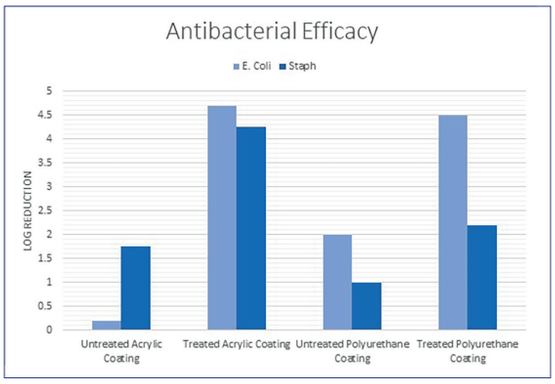

Figure 2. Comparing the antimicrobial performance of polyurethane and acrylic coatings treated with LapisShield with untreated coatings

Figure 3. LapisShield has minimal optical impact on the appearance of end products in comparison with traditional microbials, which are known to induce yellowing, speckling or clouding

demonstrates proven antimicrobial and antifungal efficacy, inhibiting bacterial growth by up to 99.99%[5]. It also works to prevent mould and mildew growth on treated surfaces and, as a built-in technology, and is designed to last the lifetime of the coating or paint, promoting a cleaner environment. Tests that compared the antimicrobial performance of treated and untreated polyurethane and acrylic coatings revealed that, exclusively with protection, materials showed a >2 log reduction of Gram-negative (*E. coli*) and Gram-positive (*Staphylococcus spp.*) bacterial activity (**Figure 2**). The technology is also continuously active in the coating, working around the clock to inhibit microbial growth in between cleaning schedules.

The incorporation of traditional antimicrobials into water-based solutions typically comes with unavoidable aesthetic issues, due to the induction of aggregation during the manufacturing process, which can reduce clarity or produce speckling. LapisShield preserves the appearance of a coating due to its UV stability and transparency, minimising any impact on the optical features of end products, such as yellowing (**Figure 3**). Once dry, the chemistry remains clear and avoids undesirable speckling, making it ideal for use in thin, clear water-based coatings.

MULTIPLE CAPABILITIES FOR IMPROVED MANUFACTURING SUSTAINABILITY

LapisShield has been designed to allow seamless addition to existing processes, offering easy incorporation and maximum dispersion with minimal or no mixing. This helps to avoid problems associated with improper mixing, such as clumping, non-uniformity and coating defects. The LapisShield liquid remains stable throughout the entirety of coating production, and the final treated coating can be applied to a range of surfaces through a variety of standard coating processes, such as spraying, roll-to-roll, dip and others. These capabilities improve the overall manufacturability of antimicrobial coatings for paints, ensuring minimal impact on product yields. A treated coating batch can be conveniently stored for later use, and even frequently opened and reused over time, without leading to permanent settling of the antimicrobial, and with no negative impact on coating pot life. This allows for optimal use of resources and prevents unnecessary wastage to improve the sustainability of the manufacturing process.

THE IDEAL CANDIDATE FOR A SUSTAINABLE FUTURE

This adaptable technology is now available for coatings manufacturers worldwide and is registered with both the U.S. Environmental Protection Agency and the EU Biocidal Products Regulation. Numerous markets can benefit from the features of LapisShield for high throughput and cost-efficient production of antimicrobial water-based coatings. The resulting superior durability offers treated products a long shelf life and reduces waste – imperative to sustainability efforts – by protecting against the detrimental effects of microbes. This breakthrough in non-heavy metal, water-compatible antimicrobials represents a huge opportunity to extend the lifetime of a multitude of products due to the widespread use of water-based paints and coatings, especially for clear substrates where transparency is vital. LapisShield unlocks the potential to extend the lifetime of any product using water-based paints or coatings, promoting reusability, contributing to a reduction in waste and supporting crucial sustainability goals.

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With more than eight years of experience working on new product development, James Rapley oversees coating technology projects for a variety of substrates at Microban. James possesses a solid understanding of dispersion and formulation, in addition to polymer formulation containing pigments, dispersion agents, surfactants and binding agents for use in coatings. James holds Bachelor of Science and Master of Science degrees in Chemistry.
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