

Making a plastic-free future achievable

Is there a more environmentally acceptable alternative to using single-use surface disinfection wipes that contain plastic? **Esther Jansen** believes there is a better solution that could help hospitals reduce their impact on the environment.

Surfaces, especially those that are frequently touched, are a major source of cross-contamination and infection. This is why we frequently treat surfaces with cleaners and disinfectants, now more than ever before. Not only are we cleaning and disinfecting our surfaces more often, but we are also paying attention to more surfaces, such as door handles, elevator buttons, staircase rails, and touchscreens.

The appropriate cleaning and disinfecting of surfaces is an essential task. It contributes to creating a safe environment both in and outside the hospital for patients, staff, and the public. The consequence of our avid wiping, however, is that we have been clogging up our environment with single-use, pre-wetted plastic surface wipes. So, is there a better alternative?

Plastic, and especially single-use plastic, is more than just a nuisance. The waste it creates is a critical issue for future generations. Plastic certainly has its uses and when made and used in a sustainable manner, for example by using recycled and reusable plastic, its impact on the environment can be minimised.

Plastic is a marvellous material with a lot of value for chemical products for instance. But when it is combined into a mixed material product such as a single-use pre-wetted surface wipe, the plastic contained within the wipe can never be recovered or recycled.

An increased focus on elimination

According to the Global Commitment, the elimination of problematic or unnecessary plastic through redesign, innovation, and



Plastic wipes can be eliminated by moving to patented capsule technology.

new delivery models is a priority.¹ It is fair to say that manufacturers of surface disinfectants cannot do very much about what happens with a product after it has been used. But what manufacturers can do is make sure that the components we use to develop our surface disinfectants are as sustainable as they possibly can be. Manufacturers can do this by looking at plastic-free materials or by making any accessories as reusable as possible. But here is the complication: not all manufacturers

can, because they are anchored to producing pre-wetted surface wipes.

These wipes must be able to carry a detergent or disinfectant solution from point of manufacture to point of use (or to the end of the product's shelf life, which is usually a few years at least) without any degradation of the wipe, the chemical, or their combined ability to kill microorganisms. Plastic, the hardest and longest lasting material available, can easily achieve this. Without plastic, the basic performance criteria of a pre-wetted surface wipe cannot be achieved.

Pre-wetted, pre-saturated, or pre-packed surface wipes are made of single-use plastic. The reason is that, when they are manufactured, the detergent or disinfectant liquid is added to the pack or tub at the same time as the wipe sheets are inserted.

Manufacturers must innovate to eliminate; we must commit to eliminating single-use plastic altogether. But how can this be achieved?

Liquid and wipes then have to co-habit for as long as it takes for the pack to be opened and the wipes used. This could be months. If the wipes were made of a sustainable, replenishable material such as paper you would be handling a pack of soggy pulp. Therefore, pre-wetted surface wipes must be made of, or contain, at least some plastic otherwise they become unusable.

What are the alternatives?

An alternative to pre-wetted plastic surface wipes would be a pre-wetted surface wipe made of non-plastic materials. However, we have established that the barrier to this is that a pre-wetted surface wipe must contain at least some plastic so that it does not disintegrate in the presence of detergent or disinfectant liquid.

At the moment, no viable alternative seems to be available and, instead, manufacturers are exploring alternatives to plastics and, where possible, working to reduce the amount of plastic contained within their pre-wetted surface wipes. At the same time, hospitals are moving towards using more sustainable methods to spread the liquid over the surface. Launderable microfibre cloths for example are an excellent option.

Reducing the amount of (virgin) plastic used in pre-wetted surface wipes and using more sustainable spreaders is one way to enable hospitals to become more sustainable. But this is not enough. Manufacturers must innovate to eliminate; we must commit to eliminating single-use plastic altogether. But how can this be achieved?

Before we address this, let's first understand where pre-wetted wipes come from. Why is there a wipe and a liquid, and why are they combined?

The invention and purpose of the wet wipe

The American Arthur Julius first invented the wet wipe in 1958. Back then it was

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called the "moist towelette". Four years later he struck a deal with Colonel Sanders of Kentucky Fried Chicken to provide a free "wet wipe" with all meals, and the wet wipe revolution took off from there.

Wet wipes were developed to be useful. At the same time, they had to be less fragile than a moist tissue and more portable and disposable than a damp cloth. The reason why wet wipes were made to be useful, or convenient, is the result of the way we choose to go about our lives. The wipes meet our needs; they do what we need them to do. The material of the wipe is chosen on the basis of durability, cost, and absorbency. The material is then saturated with a liquid.

The damage to the environment is caused by the material that the wipes are made of, which is typically polyester, a form of plastic that does not deteriorate. So, if the wipe material causes damage, then could the liquid be separated from it? The only purpose of a wipe is to spread the detergent or disinfectant liquid contained within it over the surface, nothing more. The wipe is a spreader.

Decoupling the liquid from the spreader

The answer is, yes. The liquid can be separated from the spreader. This is called "decoupling". Decoupling the liquid from the spreader creates two immediate and impactful advantages:

- 1) The choice of spreader, which is defined as the medium chosen to distribute the liquid over the surface, becomes

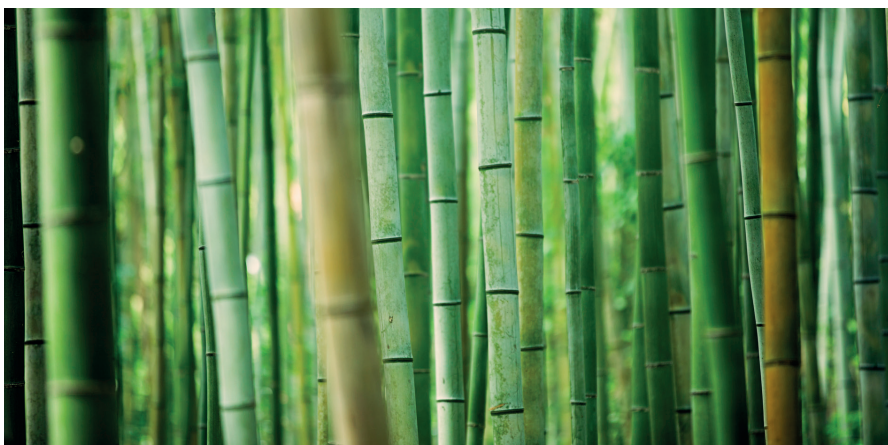
infinite when supported by EN 16615.

Spreaders can include sustainable options such as wood pulp, bamboo, and organic cotton. A spreader made of plastic need no longer be a necessity; it can be eliminated.

- 2) The choice of chemistry is instantly widened. Historically, we have been tied to using quaternary ammonium compounds (QACs), only because they are stable and convenient. QACs and plastic seemed to represent the perfect match, however in April 2022, the *Journal of Hospital Infection* concluded that QAC-based wipes were only capable of eliminating *Staphylococcus aureus* and *Acinetobacter baumannii* dry surface biofilms (DSBs) when selecting thermoplastic substrates over viscose. Neither of these materials are sustainable or biodegradable. The study highlighted the need to develop new wipe products that are more effective against biofilms.² What is more, QACs are not sporicidal and can therefore not tackle the challenges that *Clostridioides difficile* brings.

The elimination of single-use plastic is a global commitment. Rather than working out how to deal with a pile of waste, manufacturers need to prevent waste from being created in the first place. Elimination is about more than bans on plastic straws and plastic bags; it is a broad innovation opportunity. So, how can decoupling be achieved? If the liquid is not contained within the wipe, then some other storage or mixing vessel is going to be needed. These are likely to be bottles or containers, which become accessories to the wiping process, and it is likely that they will be made of plastic. However, we can change our approach to these accessories. If we design and manufacture them to be very long-lasting, potentially incorporate antimicrobial agents such as silver in the plastic composition so that they become self-cleaning, then they do not become disposable items. We can use them as permanent assets.

As mentioned before: when made and used in a sustainable manner for example by using recycled and reusable plastic, plastic has its uses and its impact on the environment can be minimised. These ►



Bamboo is a fast-growing, renewable resource and one of the options to replace plastic. It is lightweight, durable, and compostable.

bottles and containers are durable and easy to use, and they are designed to be kept forever. This transforms them from mere accessories to valuable assets for a hospital. Innovation can go even further, by incorporating a technology such as Radio Frequency Identification (RFID) to search, identify, track, and communicate with the assets, all with a view to enhancing cleaning compliance within the hospital.

The choice of chemistry

Now that we know the liquid can be decoupled from the spreader, other disinfecting chemistries that are far more effective than QACs can be considered, such as hydrogen peroxide (H₂O₂) and chlorine dioxide (ClO₂). Both chemistries are oxidising agents.

Oxidation is defined as the removal of electrons from a microorganism. ClO₂ for instance reacts with key molecules and proteins of microorganisms, leading to effective and quick inactivation or death of the cell. H₂O₂ is another example of an oxidising agent which works in a similar fashion to ClO₂.

The use of non-oxidising agents such as QACs can lead to microorganisms developing microbial resistance. ClO₂ does not allow for resistance to be developed, guaranteeing the continuance of its broad range of efficacy.⁵ In contrast to non-oxidising agents such as QACs, ClO₂ destroys microorganisms even when they are inactive. This means that the concentration of ClO₂ needed to effectively destroy microorganisms is lower than non-oxidising agent concentrations.

Biocides such as QACs and triamines have been shown in multiple studies to

contribute to the rise of antimicrobial resistance, with several resistant strains being identified, including *E. coli*³ and *C. difficile* spores⁴. Whereas with biocides, such as ClO₂, microbial resistance is not possible.⁵ This is due to the chemistry's mode of action, acting as a strong oxidiser, sequestering electrons from microbial structures and attacking the cells molecular integrity. This breaks down the membrane, disrupting protein function, inhibiting RNA synthesis, and killing the microbes.⁶

Though oxidising agents such as H₂O₂ and ClO₂ are far more effective than QACs, their germ-killing power can reduce their stability. For example, ClO₂ must be generated at point of use, instead of being provided already prepared – a plus, considering that only the concentrate need be shipped and stored prior to use. By decoupling the liquid from the spreader, which is the medium that is used to apply the liquid onto the surface, a wider choice of disinfectants is possible to be made on the combined grounds of efficacy, sustainability, safety, and economy.

Sporicidal efficacy

“Sporicide” is a term used to describe a disinfectant or an active chemical that has the ability to irreversibly remove most bacterial endospores from a surface. A disinfectant is considered sporicidal if it is proven capable of producing a reduction in the number of viable endospores of relevant test organisms according to its instructions for use (i.e., required concentration and contact time). To make this claim, a disinfectant must undergo rigorous testing to certain relevant standards and test methods.

Since the release of EN 17126 in 2018, disinfectant products claiming sporicidal efficacy within the medical area should no longer be testing to EN 13704.

QACs do not demonstrate sporicidal efficacy. Oxidising agents, such as ClO₂, do. Sporicidal efficacy is relevant to surface disinfection because bacterial spores, such as *Clostridioides difficile*, are capable of causing a common community-acquired or healthcare-associated intestinal infection. But can and should sporicides be used across the board? A general misconception is that sporicides are expensive. Another misconception is that disinfectant rotation to prevent microbiological resistance is a must, and another is that sporicides are so highly concentrated that they become unsafe for staff and incompatible with surfaces. The truth is that there is no need to use sporicides sporadically.

The cost to the hospital of a sporicide depends on the format in which it is provided. If it is provided in say a dual-compartment burstable capsule to generate 10L of ClO₂-based sporicidal solution, with a stability of five days, then the per-use equivalence to a pre-wetted surface wipe becomes indisputable. What's more, if the sporicidal solution can be applied onto the surface using any type of spreader, whether that be a paper towel, bamboo wipe or a launderable microfibre cloth, then pre-wetted plastic surface wipes can be eliminated.

Convenience culture

The thing that keeps pre-wetted plastic surface wipes in circulation is convenience culture. Convenient procedures, products and services are defined as those intended to increase ease in accessibility, save resources and decrease frustration. Pre-wetted surface wipes certainly increase ease in accessibility, which, at the same time, is part of the issue, but they do not save resources or decrease frustration. Convenience is defined as the state of being able to proceed with something without difficulty. We all agree that pulling a pre-wetted plastic surface wipe out of its flow pack or tub is convenient, but it is unacceptable that this convenience comes at the expense of the health of the world. Convenience culture is a result of companies making it increasingly easier for consumers to buy and consume the products and services they sell. Companies are capitalising on the consumer's soft spot for purchasing anything that saves time or effort. It is to some extent understandable why consumers reach for “convenient” products, but the problem is that the cost of this addiction to convenience is insurmountable if left unaddressed.

The environment is paying the ultimate price. When plastic and packaging materials used to create “convenient” products are



A dual-compartment burstable capsule to create 2,000 sustainable surface wipes.

disposed of after one use or after drying out in their pack, they create a huge amount of waste, not to mention the resources, money and energy that were required to manufacture them in the first place.

Single-use items are the epitome of convenience culture. It is difficult to move away from convenience culture because it has been part of society and people's psyche for so long. There is a need for more awareness about our actions and their implications, so that we can be more conscious, reduce our ecological footprint and reduce unnecessary spending.

Every time a disinfectant wipe for universal use is pulled out of its pack, the 'can' that represents the necessary and long-overdue change is simply 'kicked down the road'.

Innovate to eliminate

Plastic is a critical issue for future generations. David Attenborough highlights the urgency of environmental action: "It is one world, and it is in our care. For the first time in the history of humanity, for the first time in 500 million years, one species has the future in the palm of its hands."

Manufacturers are demonstrating progress largely driven by recycling, but recycling does not cut the mustard. The Global Commitment's latest report on 2021 states that alarmingly little investment in efforts to reduce the need for single-use plastic is observed.

Most current efforts to eliminate problematic or unnecessary plastic involve substitution to other plastics or paper, not solutions that reduce the need for single-use plastic in the first place. The solution lies with elimination and sustainable reuse solutions.⁷

UK-based manufacturer Tristel recently introduced a new surface disinfectant range, designed to shake up common practice and eliminate single-use, pre-wetted plastic wipes from hospitals. At the heart of the range, branded Cache, is a patented capsule technology that delivers the sporicidal power of chlorine dioxide to surfaces.

The capsule requires up to 97% less packaging than pre-wetted plastic surface wipes. One pallet of capsules equates to 150 pallets or six loaded lorries of pre-wetted plastic surface wipes. The capsules are filled, sealed, and packed in the UK, and to reach NHS Alfreton they only need



Pre-wetted plastic surface wipes in their plastic packaging.

to travel 134 miles, *versus* the 12,000 miles required for products manufactured in China.

Hospitals need no longer be tied to ineffective QACs and single-use plastic. By decoupling the liquid from the spreader, any sustainable spreader can be used, whether that be a bamboo or paper wipe, or a launderable microfibre cloth. Single-use, pre-wetted plastic surface wipes are eliminated.

The world cannot recycle and reuse its way out of the problem. The only truly impactful strategy is to break free from convenience culture and innovate to eliminate.

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About the author

Esther Jansen graduated from Zuyd University (Maastricht (NL)) in International Business & Languages (BA) in 2007, and from Lord Ashcroft International Business School (Cambridge (UK)) in Marketing & Innovation (MA) in 2008. As part of her career with Tristel, Esther has been stationed in the UK, Spain, Hong Kong, Shanghai and the Netherlands, developing a broad understanding of different healthcare settings and the challenges they face. Esther has 14 years' experience in the medical device decontamination industry. She currently works for infection prevention company Tristel as group head of marketing.

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