



# ANGEL GUARD

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# KELT-7

The Versatile, Antimicrobial Polymer

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# Company profile

Angel Guard is a water management company that seeks to save time, money and most importantly lives, founded on the experience of Managing Director Jonathan Waggott and Director of Sales and Marketing Elaine Waggott, both very well experienced in the world of water health and plumbing.

With its offices and manufacturing both based within the UK, Angel Guard is proud to be part of Made in Britain to encourage growth and production within the country. Each Angel Guard product has been created with the consultation of respective experts within their field to target critical issues within the water health sector.

Angel Guard are the creators of the world's first clinical washbasin unit which utilises AI technology, as well as the world's first remote water monitoring system with biofilm detection. Angel Guard has one goal - saving time, money and most importantly lives through the deployment of many innovative, scientific, and technological solutions.



Innovation of the Year 2023



SME Recognition Award



Technical Innovation of the Year - Products



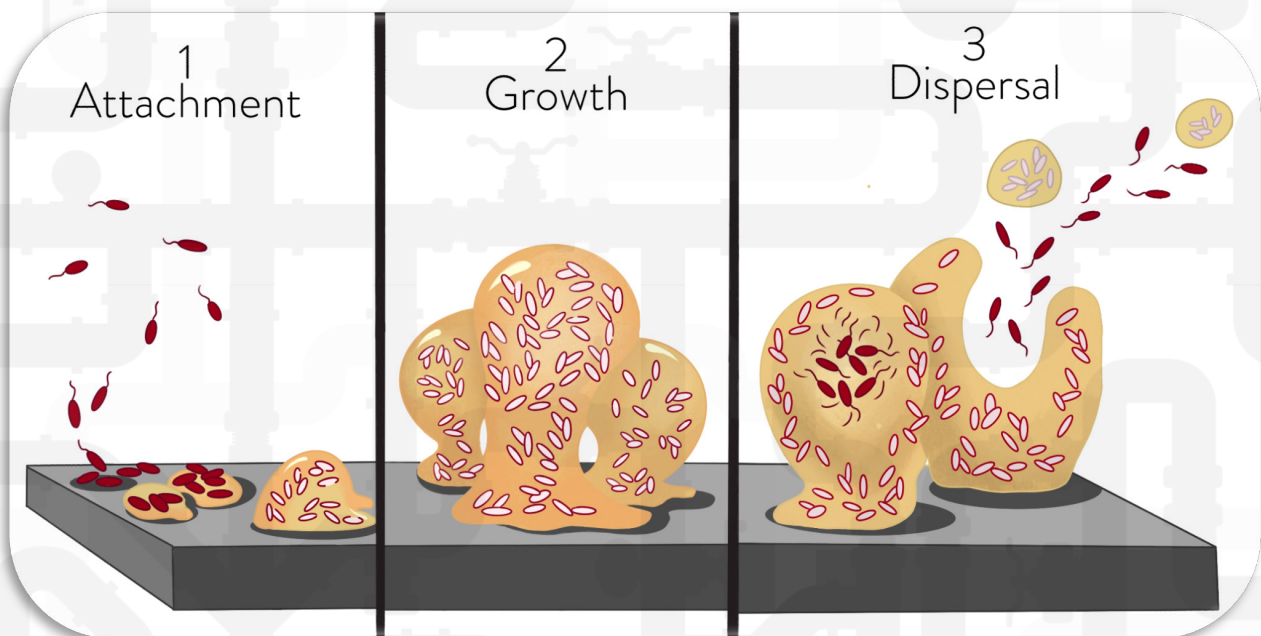
Clinical Washbasin of the Year

# How pipework systems can make water unsafe

## Nosocomial infections, and what they can lead to

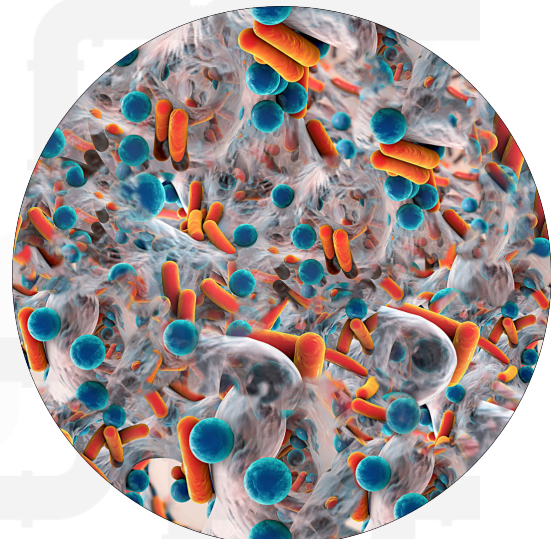
Nosocomial infections, or healthcare acquired infections (HCAs) are infections contracted within a healthcare environment and not prior to or afterwards. In one year alone, HCAs were estimated to have cost NHS England alone £2.1 billion. These costs cover additional bed space, litigation costs and the cost of specialist drugs and treatment. Commonly, the cause of these infections can be found within the water systems of hospitals and other healthcare settings.

Failing to put the proper measures or remote water monitoring systems in place can cause once-safe water systems to rapidly degenerate into breeding grounds for harmful bacteria. These water systems then begin to house water-borne pathogens and gives them a greater chance for transmission.



## Biofilm

Bacterial biofilms are excreted by clusters of bacteria that have stuck together and attached themselves to a surface. This often tends to look like a layer of slime, when in reality it is essentially a huge colony of bacteria, able to disperse as particles through water and air. Unfortunately, biofilms pose an even bigger threat to public health, as they can be highly resistant to conventional antibiotics, which only furthers the threat of antibiotic resistant pathogens.

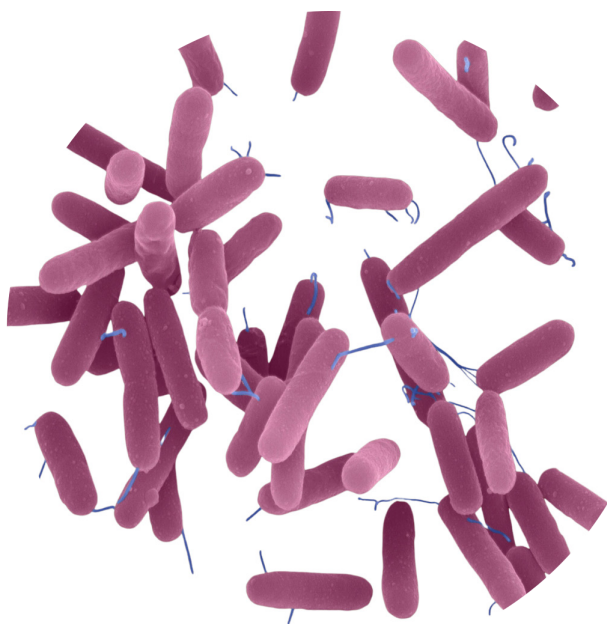
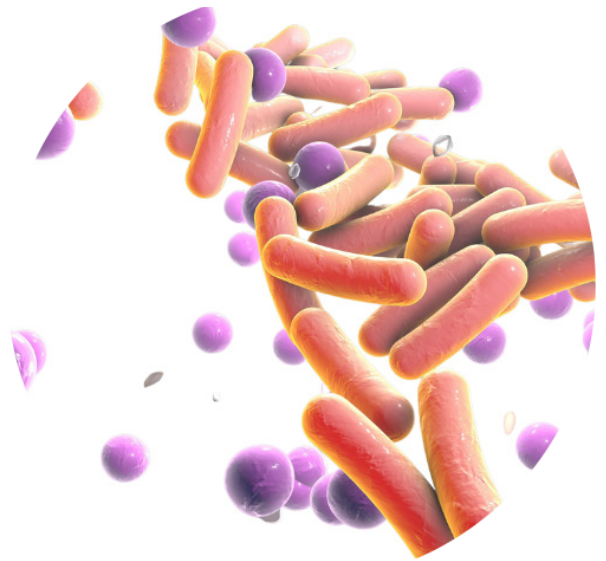


# The harmful bacteria that can often be found in water systems

Including, but not limited to:

## Legionella

Genus of pathogenic gram-negative bacteria. Capable of causing Legionnaire's disease, legionella grows especially quickly at temperatures between 30 degrees Celsius and 45 degrees Celsius. To ensure that your water system remains legionella-free, you will need to guarantee that your cold water is kept at under 30 degrees Celsius, and hot water kept above 55 degrees Celsius. Another essential safeguard to prevent legionella is to keep water moving and ensure suitable flushing of taps in low use areas.

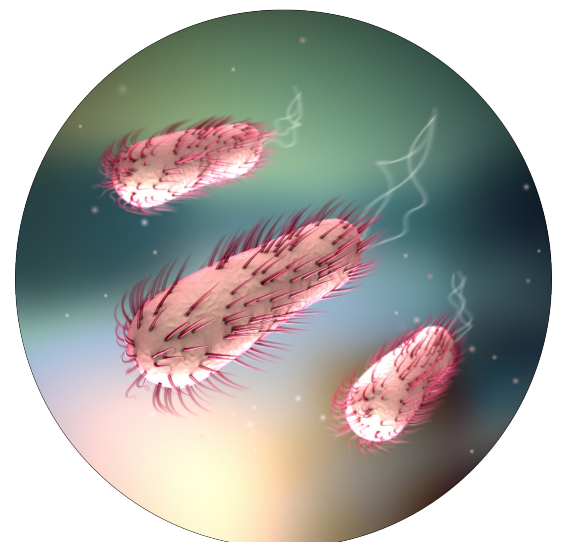


## Pseudomonas Aeruginosa

Pseudomonas Aeruginosa is a common bacterium, capable of causing disease in plants, animals, and humans. Known for its intrinsically high level of antibiotic resistance, this bacterium can prove incredibly dangerous to immunosuppressed people. Unfortunately, pseudomonas aeruginosa is capable of thriving up to two metres before point of use, meaning not only the outlet but everything leading up to it, including pipework and the waste trap can become contaminated. Preventing pseudomonas aeruginosa necessitates the regular flushing of taps and fitting outlets without plastic parts that avoid retrograde contamination risks.

## E. Coli

Escherichia coli (E. coli) bacteria are frequently found in the intestines of humans and animals. E. coli is often spread through water contaminated with fecal matter, leading to further, serious illness in the form of severe stomach cramps, bloody diarrhoea and vomiting. Like other water-borne pathogens, regular hand washing, flushing and temperature control are vital in preventing any further spread of serious illness.

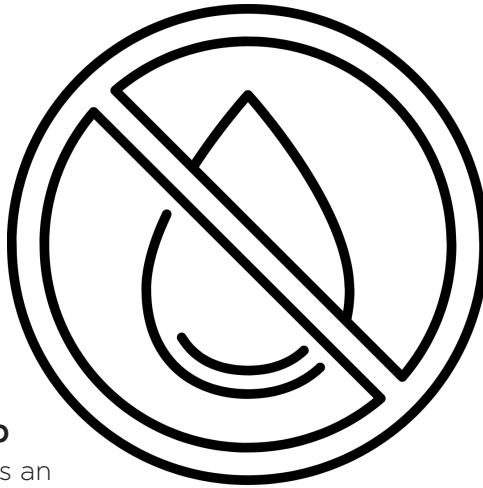


# What problems do antimicrobial solutions face?

In an industry where one of the main focuses is to help fight antibiotic resistant bacteria, there are a few key areas in which plastics and plastic solutions can improve upon. These points have also been taken into consideration to develop KELT-7, Angel Guard's versatile, antimicrobial solution and polymer.

## Incapable of withstanding continued water exposure

Presently, most polymers that have antimicrobial properties (namely made with silver and zinc additives), fail to maintain their protection when submerged within water.

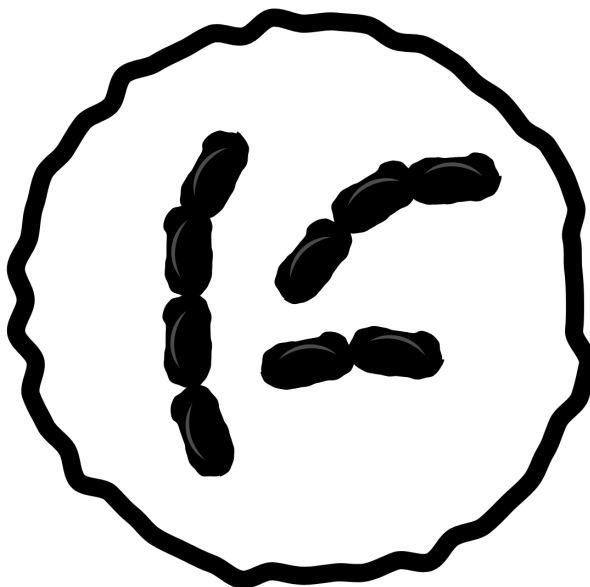


## Persistent biofilm build-up

Biofilm and pathogen build-up is an ongoing issue for many surfaces, especially within pipework and other plumbing systems. As said before, the lack of antimicrobial coatings that can withstand continued exposure to water means that pathogens like legionella and pseudomonas aeruginosa are able to persist within these systems.

## The problem with biocides

Silver and zinc, commonly used in polymers, are classed as biocides. Their use in antimicrobial polymers leads to lengthy and costly accreditation processes, and their use is also banned in certain countries, limiting when and where you can export or install your products.



## Lack of versatility

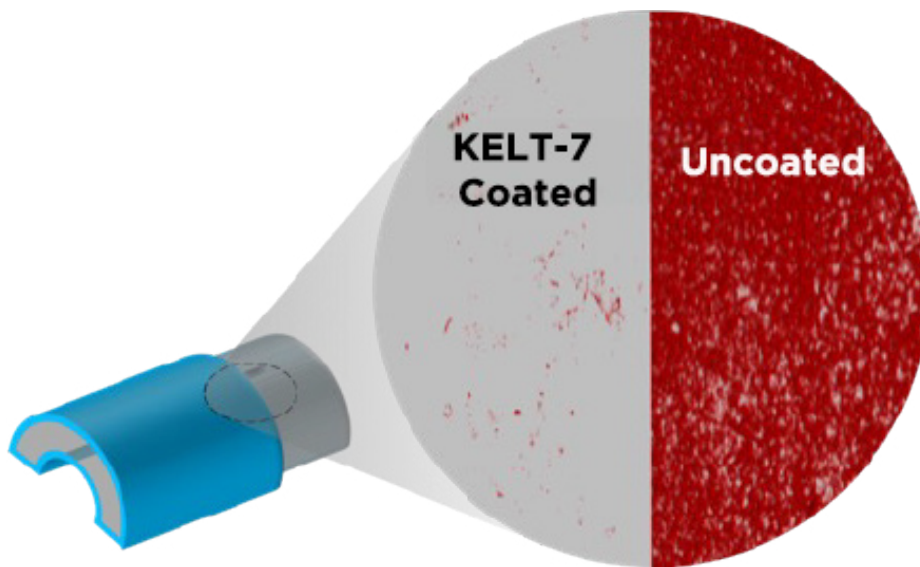
Plastic antimicrobial solutions tend to be restrictive in their applications. At the moment, the only method of providing antimicrobial protection is through additives being added to a master batch, rather than having the added option of being able to coat existing components.

# Why choose KELT-7?

KELT-7 is the innovative new polymer developed by Angel Guard, capable of creating surfaces that biofilm and pathogens cannot adhere to, significantly reducing biofilm build up. Due to KELT-7's status as a non-additive polymer, it is not classed as a biocide.

## Antimicrobial properties

Unlike silver and zinc additive solutions which often lose their benefits when immersed in water, this world-first polymer discourages pathogen and biofilm growth even when submerged in water, making it a very attractive option for use in water, sanitary fixtures, fittings and plumbing systems amongst many other applications.



## Tried and tested

KELT-7 has undergone rigorous testing in order to become the groundbreaking polymer it is today. Angel Guard have already partnered with prestigious international universities in order to test not only KELT-7's antimicrobial properties, but also its ability to maintain adhesion and functionality even when submerged in water.



## KELT-7: Versatility at its core

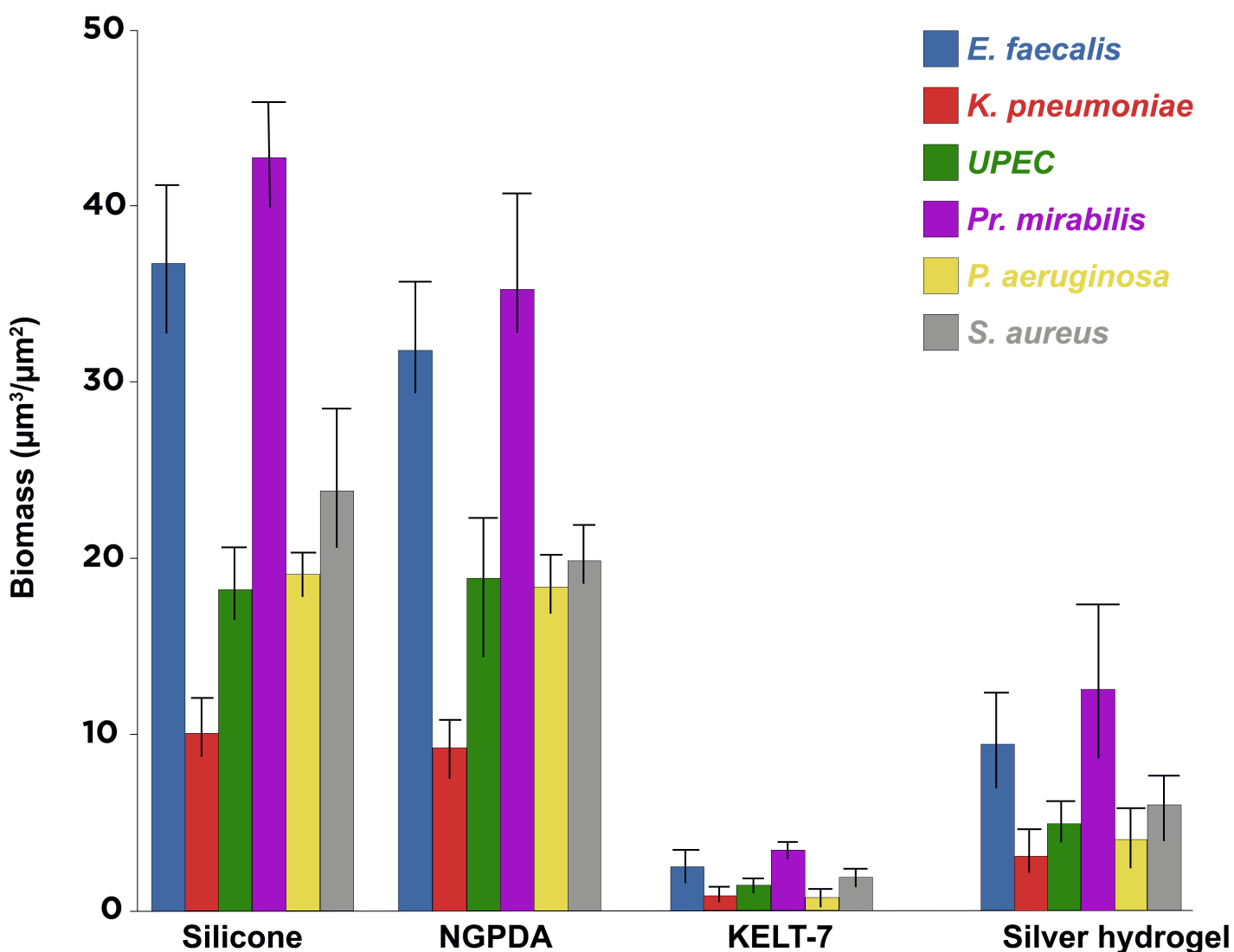
KELT-7 is available in a variety of forms. It can be received in a granule form, for use as a master batch to construct whole materials. However, it is also available in liquid form, for spraying or dip coating. Its versatility and safety benefits allow KELT-7 to be used in a variety of markets and applications. Whether in plumbing, sanitaryware, surfaces or even delicate objects like small toys, KELT-7 is the solution.

# Disruptive anti-biofilm technology

KELT-7 has already been tested on several different types of pathogens, to prove its efficacy as an anti-biofilm polymer. In order to demonstrate KELT-7's effectiveness, other traditional coatings were used for comparison. Whilst further bacterial testing can be carried out, KELT-7's anti-biofilm technologies have been proven to prevent pathogen adherence to plumbing products and sanitaryware surfaces.

## Testing

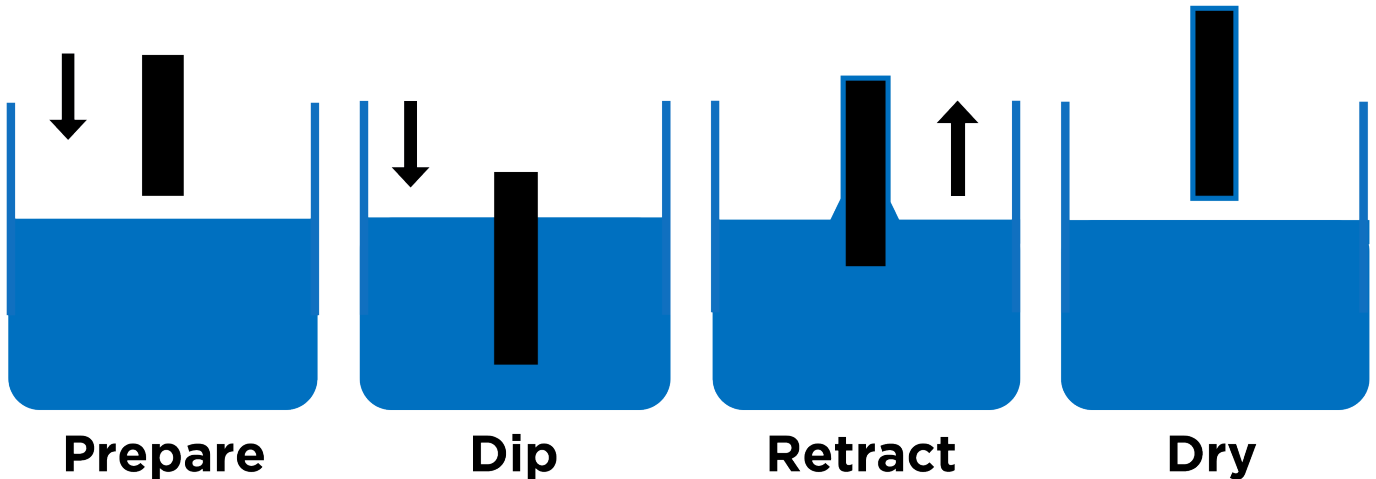
The aforementioned testing was performed using six different bacteria, including *Enterococcus faecalis*, *Klebsiella pneumoniae*, *Escherichia Coli*, *Proteus Mirabilis*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*.





# The versatility of KELT-7

As stated previously, KELT-7 can be used in a variety of ways. One of the applications is through a dip testing method. These coatings are applied in the process demonstrated below. The polymer solution has been developed to allow for versatility and further widespread protection.



## Non-toxic mechanism

KELT-7 can be used in a variety of ways, due in part to the polymer being non-toxic. KELT-7 can be used not only for sanitaryware, but is safe enough to be a material used in food and drinks production facilities, or to be used in the fabrication of plastic surfaces or appliances.



## Simple and scalable

The versatility of KELT-7 is something that Angel Guard wishes to capitalise on, leading to several major design decisions. The end result is an antimicrobial polymer that is capable of being integrated into both projects large and small. Another added benefit of a simple polymer is the molecular structure allows for an easy breakdown of the structure, allowing the polymer to be recycled far easier than its more complex counterparts.



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