WoundSan™

Advanced Antimicrobial Wound Technology

A gentle yet effective wound irrigation solution

Hybrisan®
protect not infect

About Hybrisan

Hybrisan is a biotechnology business based in Port Talbot, South Wales.

Hybrisan develops innovative solutions for infection control with a key focus on chronic infection. The company has established an expert reputation in antimicrobial materials following participation in international research projects and industry contracts.

Our Technology

Hybrisan's team of advanced antimicrobial specialists have developed a unique antimicrobial technology with an independently proven low cytotoxicity, fast action, high antimicrobial activity and biofilm disruption and prevention capabilities.

The Hybrisan antimicrobial technology is a platform which offers an alternative to existing technologies such as silver, compatible with a range of materials and manufacturing processes. This platform is particularly focussed on the chronic wound market.

Purpose

To improve the quality of lives impacted by chronic infection through innovation.

Vision

A world without chronic infection.

Mission

To continuously break down the barriers of science to provide superior technological solutions for infection control, preferred by Healthcare Professionals, ethical and affordable to all.

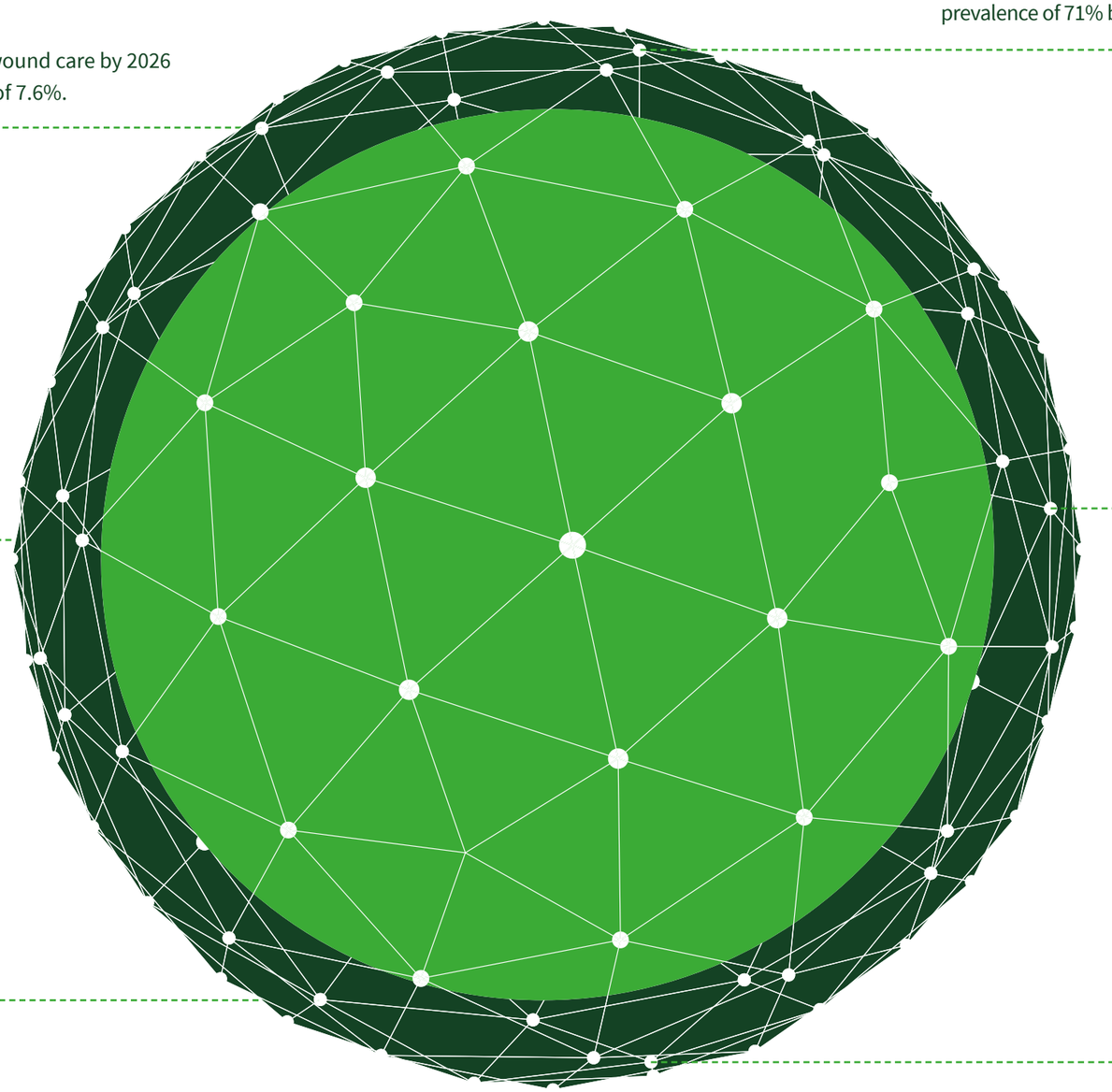
The Wound Care Market

3.8 million

The estimated number of patients with a wound managed by the NHS in 2017/18 with an increase in prevalence of 71% between 2012/13 and 2017/18.

$27.8 billion

The projected value of the global wound care by 2026 from $19.3 billion in 2021, a CAGR of 7.6%.



£8.3 billion

The cost of wound care management on the NHS in 2017/18.

$16.36 billion

The value the global chronic wound care market size is projected to reach by 2027, CAGR of 6.2% from $10.12 billion in 2019.

$15.3 billion

The estimated value of the advanced wound care market size was valued by 2027, a CAGR of 11.6% from $9.3 billion in 2019.

54.4 million

The annual number of district/community nurse visits attributed to wound management, in addition to 53.6 million healthcare assistant visits and 28.1 million practice nurse visits.

The Problem

Biofilm

Over 90% of chronic wounds contain bacteria and fungi living within a biofilm[1].

The biofilm within the wound is distinct, with differing characteristics based upon the aggregation of different species of microbe.

[1] Attinger, C., & Wolcott, R. (2012). Clinically Addressing Biofilm in Chronic Wounds. Advances in wound care, 1(3), 127–132. https://doi.org/10.1089/wound.2011.0333

What is a Biofilm?

A biofilm is a community of one or more types of microorganism *(including bacteria and yeast)* which can grow on a variety of surfaces.

Biofilms form when free-floating *(planktonic)* microorganisms adhere to a surface and "put down roots".

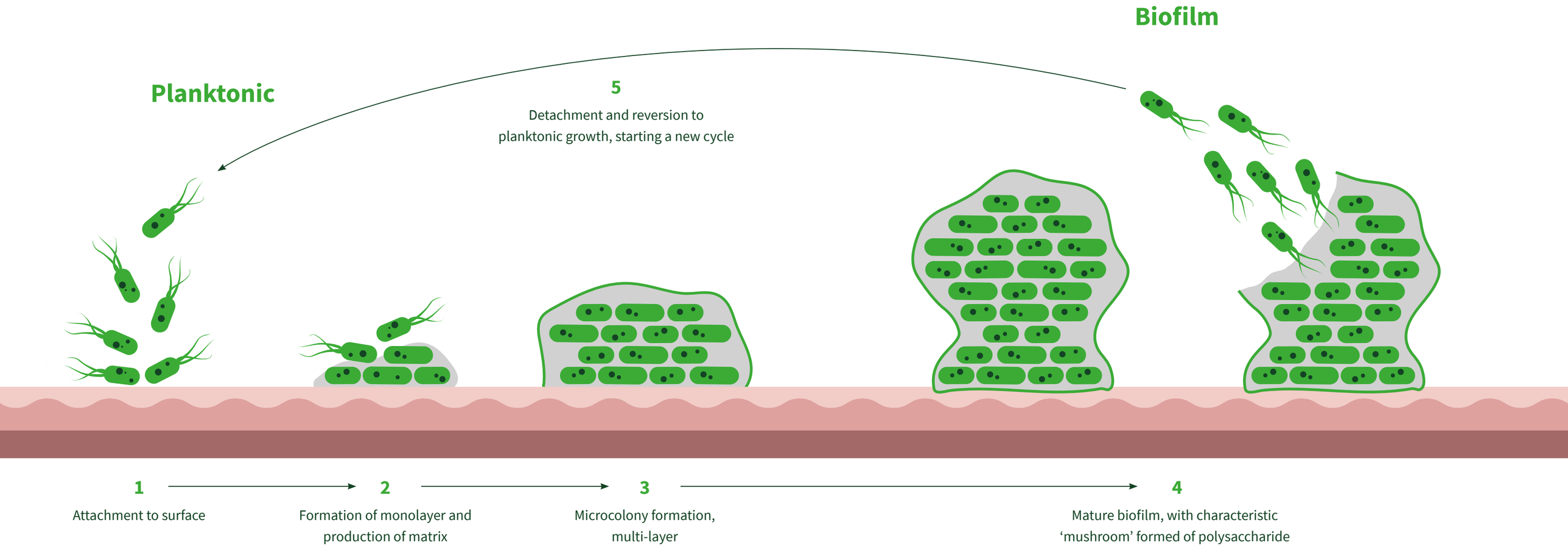
These "roots" are a thick, gooey substance known as extracellular polymeric substance *(EPS)*. EPS allows microorganisms to stick together in a biofilm offering them protection from topical agents.

Once adhered, the biofilm will grow in size as a result of multiplication of existing cells, and the recruitment of other planktonic cells through quorum sensing.

Quorum sensing is used by microorganisms as a form of communication, allowing them to act as a community rather than individual cells.

As the biofilm develops, it reaches the final stage of dispersion, where the EPS is degraded and the microorganisms are released, leading to recolonisation. This process is also regulated by quorum sensing.

Biofilm Process



Why is Biofilm an issue in Wound Care?

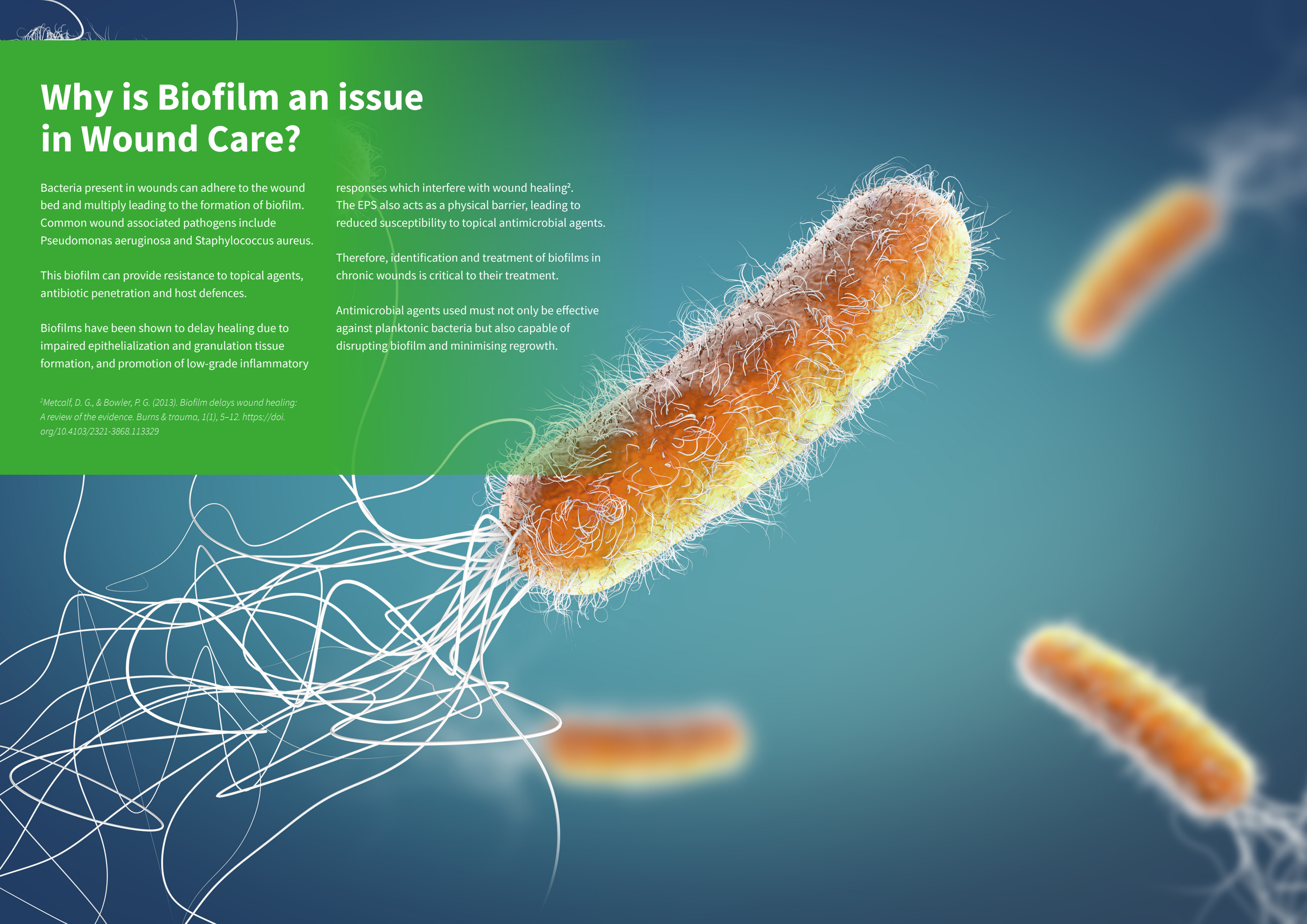
Bacteria present in wounds can adhere to the wound bed and multiply leading to the formation of biofilm. Common wound associated pathogens include Pseudomonas aeruginosa and Staphylococcus aureus.

This biofilm can provide resistance to topical agents, antibiotic penetration and host defences.

Biofilms have been shown to delay healing due to impaired epithelialization and granulation tissue formation, and promotion of low-grade inflammatory responses which interfere with wound healing[2]. The EPS also acts as a physical barrier, leading to reduced susceptibility to topical antimicrobial agents.

Therefore, identification and treatment of biofilms in chronic wounds is critical to their treatment.

Antimicrobial agents used must not only be effective against planktonic bacteria but also capable of disrupting biofilm and minimising regrowth.



[2] *Metcalf, D. G., & Bowler, P. G. (2013). Biofilm delays wound healing: A review of the evidence. Burns & trauma, 1(1), 5–12. https://doi.org/10.4103/2321-3868.113329*

The Solution

The presence of biofilm has been acknowledged as the predominant cause of delayed wound healing[3].

This has led to primary objectives in wound care focussing on the prevention and management of biofilms in wounds.

Hybrisan has developed **WoundSan**™, a wound irrigation solution containing Hybrisan's proprietary antimicrobial technology with low cytotoxicity, fast action and independently proven efficacy in preventing and disrupting mature biofilm.

WoundSan™ is a blend of surfactants combined with Hybrisan's proprietary antimicrobial ingredient for fast, safe and effective treatment of established biofilms.

Hybrisan Technology: A Breakdown

Surfactants

Surfactants reduce the surface tension within the wound bed which facilitates the removal of dirt, debris and biofilm.

Chelating Agent

A chelating agent strongly attracts and binds metal ions which hold the EPS together, facilitating the removal of biofilm.

Antimicrobial Agents

Broad spectrum antimicrobial agents with proven low cytotoxicity. It is capable of entering bacterial cell membranes where it can damage DNA preventing growth and cell division, and disrupt the cell membrane resulting in leakage of key nutrients and structural failure. It is also capable of disrupting quorum sensing, a key driving force of biofilm formation.

[3] *Attinger, C., & Wolcott, R. (2012). Clinically Addressing Biofilm in Chronic Wounds. Advances in wound care, 1(3), 127–132. https://doi.org/10.1089/wound.2011.0333*

WoundSan™

A gentle yet effective chronic wound irrigation solution

- **Fast Acting**
- **Low Cytotoxicity**
- **High Antimicrobial Efficacy**
- **Advanced Biofilm Disruption and Prevention Capabilities**

The Data

WoundSan™ has been vigorously tested independently in terms of its antimicrobial efficacy, antibiofilm efficacy and cytotoxicity.

Antimicrobial Efficacy

The antimicrobial activity has been proven with a low minimum inhibitory concentration and minimum bactericidal concentration – the minimum concentration required to inhibit growth and kill bacteria respectively – against Gram-negative and Gram-positive wound relevant organisms.

The fast action of **WoundSan**™ has been demonstrated when tested in accordance with BS EN1276:2019 with a contact time of 1 minute.

Table 1. Minimum Inhibitory Concentration (MIC) and Minimum Bacteriacidal Concentration (MBC) of WoundSan against 2 common wound pathogens.

		MIC	MBC
P. aeruginosa	ppm	23	47
S. aureus	ppm	1	4

Table 2. Antimicrobial efficacy of WoundSan against a number of pathogens when treated with WoundSan for 1 minute. Tested according to BS EN1276:2019.

Species	Control Density	Percentage Reduction
P. aeruginosa	7.32	>99.999%
S. aureus	6.79	>99.999%
E. coli	7.00	>99.999%

Antibiofilm Efficacy

The antibiofilm efficacy of **WoundSan**™ has been proven in a number of commercially recognised biofilm models. This has shown it to be fast acting with a required contact time of less than 5 minutes.

Minimum Biofilm Eradication Efficacy (ASTME2799-17)

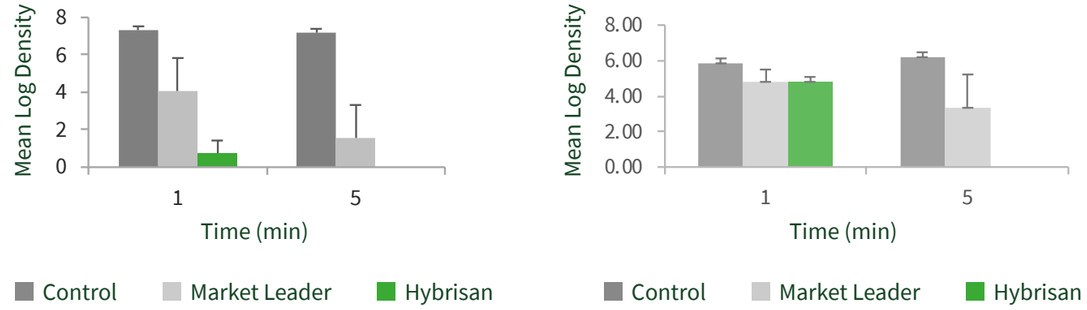


Figure 1. Graphs showing log reduction of WoundSan compared with market leading wound irrigation solution tested using the MBEC assay against P. aeruginosa (left) and S. aureus (right) for 1 minute and 5 minutes.

CDC Biofilm Reactor (ASTM E2562 – 17)

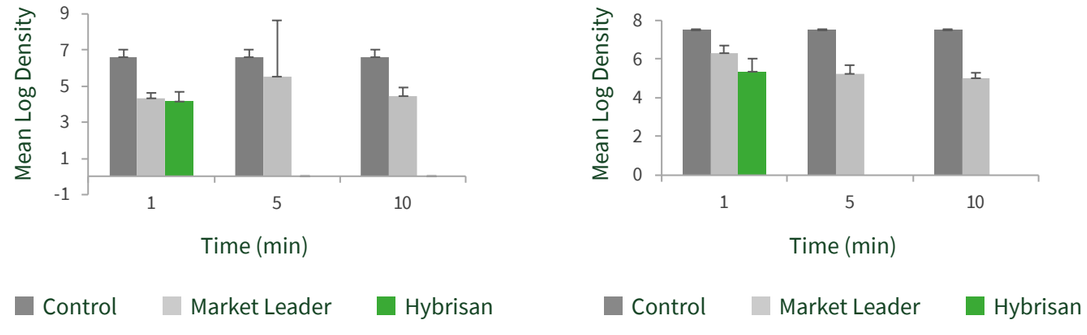


Figure 2. Graphs showing log reduction of WoundSan compared with market leading wound irrigation solution tested using the CDC Bioreactor against P. aeruginosa (left) and S. aureus (right) for 1 minute, 5 minutes and 15 minutes. This work was carried out independently by a UKAS ISO 17025 and ISO 13485 accredited laboratory.

Drip Flow Biofilm Reactor (ASTM E2647 – 13)

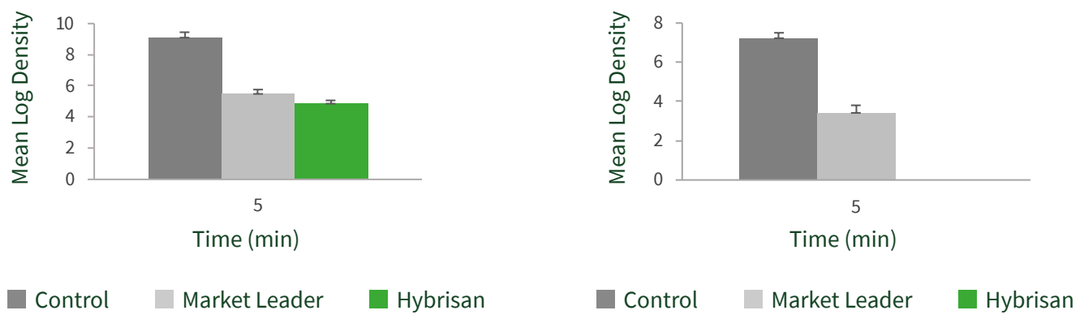


Figure 3. Graphs showing log reduction of WoundSan compared with market leading wound irrigation solution tested using the Drip Flow Biofilm Reactor against P. aeruginosa (left) and S. aureus (right) for 5 minutes. This work was carried out independently by a UKAS ISO 17025 and ISO 13485 accredited laboratory.

Cytotoxicity

An in vitro study was carried out to determine cytotoxicity of **WoundSan**™ against L929 cells. Results show **WoundSan**™ to be less cytotoxic than the market leading wound irrigation solution at all time points.

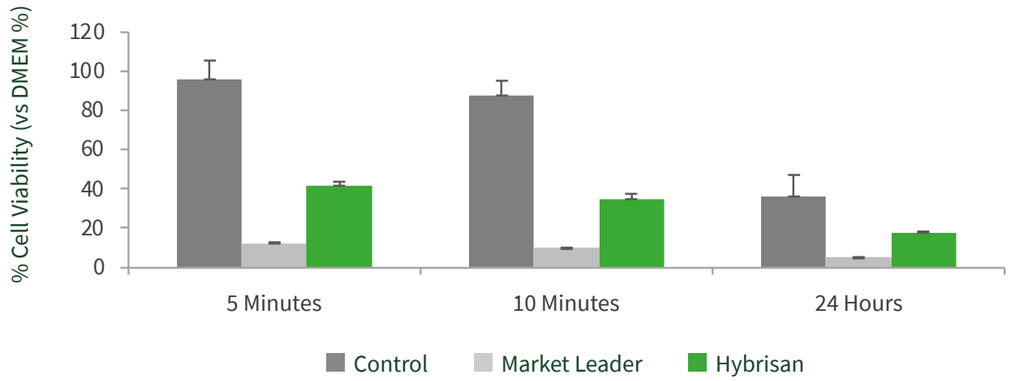


Figure 4. Graph showing percentage cell viability (%) of mouse fibroblast cells, L929, when treated with WoundSan™ and a market leading wound irrigation solution, for 5 mis, 10 mins and 24 hours when tested according to ISO 10993:5-2009 (a higher percentage number shows that more cells are viable). This work was carried out independently by a UKAS ISO 17025 and ISO 13485 accredited laboratory.

WoundSan™ Overview

Hybrisan has developed an advanced antibiofilm irrigation solution, **WoundSan**™, with potent antimicrobial and antibiofilm activity with low cytotoxicity requiring a short contact time of up to 5 minutes. Independent in vitro data has proven its effectiveness to be greater than that of a market leading solution.

The Problem

Biofilms form when free-floating *(planktonic)* microorganisms adhere to a surface and "put down roots". These "roots" are a thick, gooey substance known as extracellular polymeric substance *(EPS)*. EPS allows microorganisms to stick together in a biofilm offering them protection from topical agents.

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The Solution

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The Data

WoundSan™ has been tested in terms of its antimicrobial efficacy, cytotoxicity and antibiofilm efficacy. It possesses potent antimicrobial and antibiofilm efficacy with a fast action and a low cytotoxicity. When compared against the market leader, **WoundSan**™ has a greater efficacy, faster action and lower cytotoxicity. Accelerated aging testing has shown **WoundSan**™ to remain stable for over 2 years when tested according to ASTM F1980-07.

Next Steps

Having completed in vitro testing Hybrisan is now seeking a strategic partner to collaborate with the next stages of clinical development.

This will include clinical trials, CE and UKCA marking and route to market.

Data in Summary

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