BACKGROUND

From Nature to Sustainable Innovation

The Starting Point – Learning from Nature

The development behind these innovations has its origin in a fundamentally different approach to research and problem-solving.

Throughout my work, I have consistently chosen to study what takes place in nature rather than simply follow established research paths or reproduce approaches already explored by others.

This has not merely been a philosophical choice. I have never had the financial resources to spend on extensive trial-and-error development, where numerous alternative formulations are tested in the hope that one of them will eventually produce a useful result.

I therefore chose another path.

My starting point has been nature itself.

Nature has had millions of years to develop, test and refine solutions to problems such as microbial attack, biological degradation, environmental stress and the protection of living materials. Through evolution, natural systems have continuously been exposed to these challenges. Solutions that provided protection and survival were retained and further refined over generations.

This led to a simple but fundamental question:

How does nature solve the problem?

Instead of beginning with an existing chemical technology and attempting to modify it, I chose to observe plants and other natural systems that appeared to possess an inherent ability to protect themselves against various forms of biological attack.

By studying these natural protective mechanisms and identifying principles that appeared relevant, I sought to translate those observations into practical chemical compositions.

The development philosophy can therefore be described as:

Nature → Observation → Understanding → Biomimetic Principle → Chemical Composition → Testing → Evidence → Practical Application

The intention was not simply to create another chemical formulation among many existing alternatives. The intention was to understand whether principles already demonstrated by nature could be used as a foundation for developing practical, sustainable solutions for human and environmental benefit.

From Observation to Chemical Innovation

The resulting development work has focused on chemical compositions based on substances and combinations selected with consideration for their occurrence in natural and everyday biological systems.

The underlying concept has been to investigate whether carefully selected combinations and concentrations could provide useful functional properties without relying on unnecessarily hazardous chemical principles.

This approach has resulted in a family of formulations developed for different applications and under different practical requirements.

The formulations are not identical. Rather, they represent adaptations of an underlying development philosophy to specific applications, materials and technical conditions.

This distinction is important.

The objective has never been to claim that one formulation solves every problem. The objective has been to develop compositions whose characteristics can be adapted to different practical situations while retaining the fundamental principle of seeking effective and sustainable solutions inspired by nature.

From Laboratory Principle to Practical Application

One of the most important stages in any innovation is the transition from an idea or laboratory formulation to a product that can function under real industrial conditions.

The development of the timber-protection application provides an example of this transition.

The formulation identified as **TT40** was subjected to independent testing by RISE - (see the reports under “Appendices”). The subsequent practical development resulted in **TT41**, in which the viscosity was adapted to meet the requirements of existing industrial spray equipment.

This was not a change in the fundamental concept, but an adaptation intended to make the formulation compatible with an established industrial process.

This distinction illustrates an important principle of the development work:

Innovation is not complete when a formulation works in principle. It becomes an innovation when it can be translated into a practical and repeatable application.

The treated timber was subsequently evaluated under practical conditions by Stenvalls Trä.

The experience gained from this application has been particularly important because it connects the development process with an existing industrial production environment rather than requiring an entirely new application infrastructure.

Protection of Sawn Timber

The timber application was developed with the objective of reducing biological deterioration of sawn timber exposed to environmental conditions.

The intended protection concerns biological attacks such as black mould, algae, fungi and rot.

A particularly relevant application is the temporary protection of freshly sawn timber stored outdoors, where exposure to moisture can create favourable conditions for biological growth and deterioration.

The practical significance is therefore not limited to the chemical treatment itself. Protection during storage may potentially contribute to maintaining the quality and value of timber between production and subsequent processing, transport or use.

The development with Stenvalls Trä has provided an important practical reference point for this application.

TT41 has been used by Stenvalls Trä since the third quarter of 2021, and the company placed an order for **1 metric tonne, supplied as four 250-litre units, in September 2026**.

This practical history is significant because it represents experience from an industrial user rather than solely a laboratory observation.

TT51 – Antimicrobial Development

A separate and important part of the development has been the formulation identified as **TT51**.

The development of TT51 extended the application of the underlying chemical concept into the field of antimicrobial activity.

To investigate this property under controlled laboratory conditions, TT51 and a subsequent version, **TT51 V2**, were evaluated at the **School of Medical Sciences, Örebro University**, by Hazem Khalaf, Associate Professor (Docent) - (see the reports under “Appendices”).

The study was specifically designed to determine the antimicrobial activity of the innovative and biodegradable test solutions developed by Trulstech Innovation KB on behalf of Biomimetic Technology Ltd. The test organisms included *Staphylococcus aureus* and *Escherichia coli*, with resistant strains including MRSA and ESBL-producing *E. coli* also examined.

The investigation used the broth microdilution method and determined both **minimum inhibitory concentration (MIC)** and **minimum bactericidal concentration (MBC)**.

Reported Results

The results provide an important piece of independent laboratory documentation.

According to the report, **TT51 produced complete inhibition of bacterial growth at a final concentration of 12.5%, corresponding to an 8× dilution, for the tested *S. aureus* and *E. coli* strains**.

The report further states that **TT51 V2 demonstrated a stronger inhibitory effect**, with a final content of approximately **1.5–3.1%, corresponding to 32–64× dilution**, being sufficient to suppress growth of the four indicator strains tested.

The study also examined whether inhibition of growth was accompanied by elimination of the bacteria.

For TT51, the reported MBC values ranged from 4× to 8× dilution depending on the organism. For TT51 V2, the report states that a 32× dilution eliminated *E. coli*, MRSA and ESBL, while *S. aureus* required a 16× dilution.

The report concludes that TT51 and TT51 V2 demonstrated broad-spectrum antimicrobial characteristics under the laboratory conditions used and notes potential commercial applications including detergent and disinfectant applications in hospitals and clinical settings. The report also explicitly states that the effects were validated at Örebro University using standard *in vitro* methods.

These results should be understood in their proper context: they document antimicrobial activity under the specific experimental conditions of the Örebro University study. They constitute laboratory evidence supporting further investigation and development; they do not, by themselves, establish every possible real-world application or performance claim.

A Common Principle Behind Different Applications

At first sight, fire protection, timber protection and antimicrobial applications may appear to belong to completely different technical fields.

From the perspective of the underlying development philosophy, however, they are connected.

The common principle is the search for chemical compositions that can interact with a material or biological environment in a useful way while avoiding an unnecessary dependence on conventional hazardous chemical approaches.

This has led to investigations into applications including:

- preventive and active fire protection;
- impregnation / coating / of textiles such as cotton, hemp and jute to reduce ignition when exposed to an open flame;
- protection of sawn timber against biological deterioration;
- antimicrobial applications;
- and other potential applications where the characteristics of the compositions may provide practical value.

Each application must, of course, be evaluated on its own technical, regulatory and performance requirements.

The broader opportunity lies in the possibility that the same development philosophy can generate solutions across several application areas.

From Invention to Innovation

An invention begins with an idea.

An innovation begins when that idea can be translated into a useful, repeatable and commercially relevant application.

The development described here has therefore progressed through several distinct stages:

Observation of nature

The process began with the study of natural systems and their ability to protect themselves against biological and environmental challenges.

Development of a principle

Observations were used as inspiration for identifying principles that might be translated into chemical formulations.

Creation of formulations

Specific compositions were developed and subsequently adapted for different applications and technical requirements.

Independent testing

Selected formulations were subjected to external testing, including RISE testing of treated timber and antimicrobial testing of TT51 and TT51 V2 at Örebro University.

Industrial adaptation

The formulations were further adapted to existing industrial processes where necessary, as demonstrated by the development of TT41 for practical use with established spray equipment.

Practical experience

The use of TT41 by Stenvalls Trä AB since 2021 represents an important step from development toward practical industrial application.

This progression illustrates the central philosophy of the work:

The purpose of research is not research for its own sake. The purpose is to transform understanding into practical solutions that can create lasting value.

Sustainability as a Guiding Principle

Sustainability has been present from the beginning of the development process rather than added afterwards as a marketing concept.

The starting point has been nature.

If nature itself is regarded as the ultimate long-term testing environment, then solutions that have survived evolutionary processes provide an important source of inspiration for developing new approaches to human problems.

This does not mean that a natural origin automatically makes a substance safe, sustainable or effective. Such properties must be established for each specific composition and application through appropriate scientific evaluation.

The development philosophy is instead that **nature should be studied as a source of principles**, while modern science and testing should be used to determine whether those principles can be translated into safe, effective and sustainable practical solutions.

This combination of natural observation and scientific validation forms the foundation of the work.

A Different Route to Innovation

The development described in this Background therefore represents an alternative route from idea to innovation.

It did not begin with substantial financial resources, large research programmes or extensive trial-and-error.

It began with observation.

It began with a willingness to look at what already exists in nature and ask why certain organisms and plants are capable of protecting themselves against challenges that have existed for millions of years.

From that starting point, the work moved step by step toward chemical formulations, practical applications and independent testing.

The guiding question has remained remarkably simple:

How does nature solve the problem?

The ambition is equally straightforward:

To transform lessons from nature into practical, sustainable solutions that can benefit people, industry and the environment.

That is the foundation on which the subsequent development and applications should be understood.