evogen
microbial products

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SULPHIDE CONTROLLER

An **Evogen Microbial** product

Liquid additive that is designed to help combat odours associated with reduced sulphur compounds by modifying microbial respiration in combination with *Bacillus* bioaugmentation.

What is it?
Liquid sodium nitrate-based solution with unique consortia of *Bacillus* microorganisms.

Uses
For impacting anoxic zones that are producing reduced sulphur compounds.

Eco credentials
Contains non-pathogenic Class 1 microorganisms that are both environmentally responsible and safe for the end user.

How it works
A combination of chemistry and microbiology provides ability to both modify and out-compete sulphide producing bacteria.

Liquid product

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PRODUCT AT A GLANCE

Liquid product designed to help combat odours associated with reduced sulphur compounds.

Mixture of chemical and biological component works synergistically to impact sulphate reducing bacteria.

Chemical component gives bacteria a better option for metabolic activities which leads to nitrogen generation instead of sulphide.

Biological component outcompetes sulphate reducing bacteria for resources and space.

Can impact the formation of biofilms upon surfaces that may harbour sulphate reducing bacteria.

Broad metabolic capability of *Bacillus* consortia able to degrade wide range of COD sources including Fats, Oils and Grease. Can help improve effluent parameters as well as tackling odours.

Non-pathogenic, environmentally responsible and easy to use.

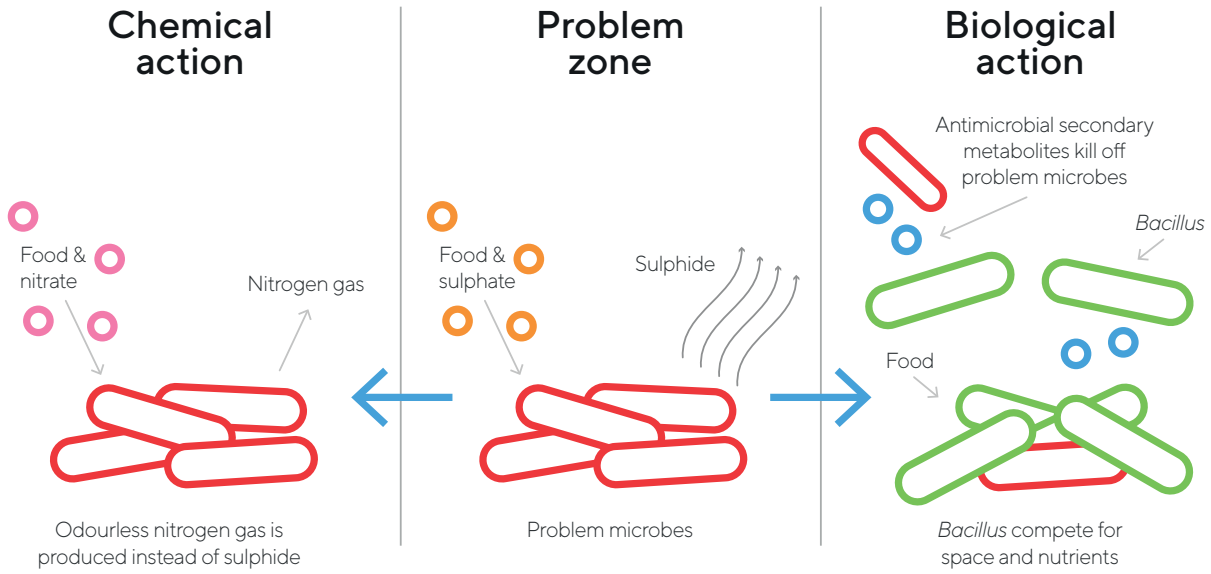
Robust heterotrophic growth parameters allow for growth across a range of conditions conferring resilience against system shocks.

Manufactured in accordance with recognised international standard ISO 9001 to guarantee quality, integrity and reproducibility.

Can be used to improve plant performance to meet emissions directives.

APPLICATIONS

- Municipal and industrial wastewater plants
- Lagoons and ponds
- Cess and slurry pits
- Tackling sulphate reducing biofilm
- Areas suffering with anaerobic issues



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OUR APPROACH

Classical microbiology

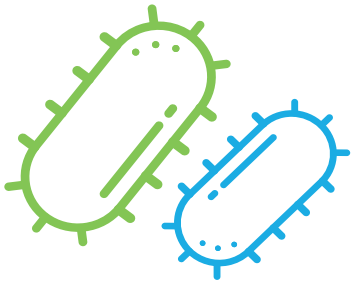
Cutting edge genomics

→ Informed product design through advanced microbiology

→ Environmentally responsible and safe to use

→ Application specific and efficacious

→ Professional and accessible technical support as standard



What is *Bacillus*?

Bacillus are a genus of Gram-positive microorganisms found across the globe in a range of environments.

They are metabolically diverse and with a few notable exceptions are non-pathogenic and safe to use. They are able to survive when conditions move outside of those needed for survival through the production of spores.

Spore formation allows this type of bacteria to be grown in very high concentrations and blended into a stable product with a long shelf-life.

This makes it ideal for industrial applications where often a large amount of *Bacillus* cells are needed to amend a system.

Why is Genesis different?

At Genesis we ferment all our own bacteria to the highest standards (ISO 9001) so we can guarantee that the *Bacillus* we deliver are correct in both species and concentration and are free from contaminants. We have taken time to design our products to ensure they have minimal impact upon the environment and end user, whilst at the same time offering an efficacious and prolonged result.

As *Bacillus* is our main technology, we ensure that we understand each of our isolates. We have invested in cutting edge genomic techniques to fully comprehend the potential of each of our *Bacillus* species, and in doing so we have created effective and truly application specific technology. All of our products come with expert technical support as standard.

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THE TECHNOLOGY

Evogen Sulphide Controller has been specially formulated to tackle odours and issues associated with reduced sulphur compounds (rotten egg smell) within oxygen deplete zones.

The product is a liquid that features a sodium nitrate base combined with different *Bacillus* species with a diverse metabolic capability.

How it works

Evogen Sulphide Controller uses both a chemical component and a biological component to deliver a multi-pronged challenge to the most common cause of reduced sulphur compounds – sulphate reducing bacteria (SRB).

The delivery of sodium nitrate into zones favouring sulphate reduction, offers the resident microbes a better, higher energy electron acceptor (see electron tower diagram). This means the bacteria can gain more from their food using nitrate rather than sulphate. This decreases sulphate reduction because instead of 'breathing' sulphate the microbes instead breathe nitrate, and thus, instead of expelling reduced sulphur compounds the bacteria produce nitrogen via denitrification.

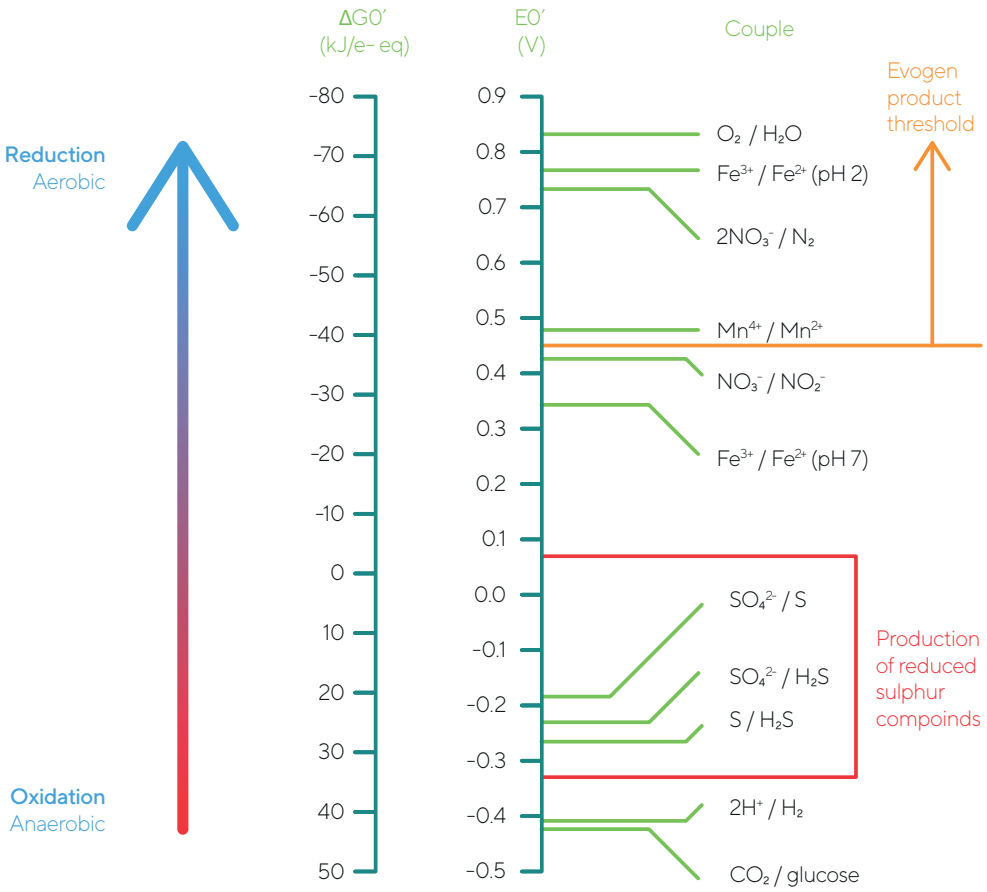

Figure above shows the electron tower of microbial metabolism and the redox potential (E0′) at which certain reactions are thermodynamically favourable. The couple column shows electron acceptors and their end products with the associated Gibbs free energy (ΔG0′) generated by this activity is shown on the orange bar. The more negative this value is, the more energy there is available for the bacteria. Hence it is better to breathe oxygen or nitrate compared to sulphate as it provides more energy.

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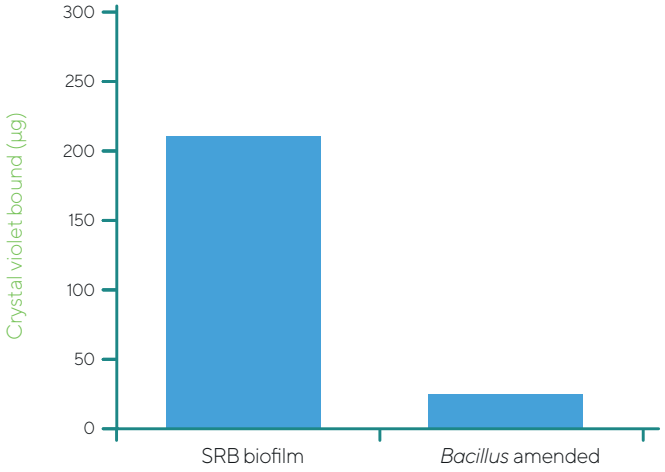
THE TECHNOLOGY

The biological component contains a blend of *Bacillus* strains that have been selected through both laboratory and genomic methods to outcompete and disrupt the growth of sulphate reducing bacteria. The diverse metabolic capability of the *Bacillus* combined with a wide range of extracellular enzymes ensure that potential fuel for SRB is strongly competed for. Furthermore, a broad range of antimicrobial secondary metabolites expressed by the *Bacillus* help supress the growth of SRB, which could in turn prevent corrosion, particularly with regards to biofilms formed upon steel and metal surfaces, where dosing of the *Bacillus* consortia within Evogen Sulphide Controller has been shown to lower biofilm coverage and interfere with biofilm-based sulphate reduction.

In addition to helping to combat reduced sulphur odours, the product will also help with improving effluent parameters by contributing to BOD/COD removal as well as impacting a range of other potential odour compounds such as volatile fatty acids like propionic and valeric acid.

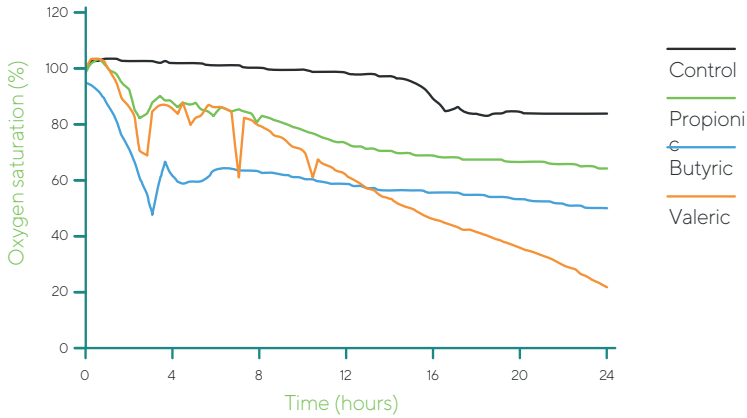
Via a combination of cell cytotoxicity assays and genomic screens for toxin production, we can confirm that all *Bacillus* species and strains within the product are safe to use, should harbour no toxicity towards humans or animals and do not have a negative impact upon the environment. From analysing the DNA of our *Bacillus* strains we can confirm a lack of mobile genetic elements, which strongly indicates a low potential for transmission of antimicrobial resistance (AMR) genes.

Graph showing reduction of SRB biofilm using the *Bacillus* within Evogen Sulphide Controller



The addition of *Bacillus* was able to degrade and disrupt a nuisance biofilm that harbour sulphate reducing bacteria. By doing so the production of sulphide was greatly decreased.

Graph showing the ability of *Bacillus* consortia in Evogen Sulphide Controller to degrade volatile compounds



Compounds such as volatile fatty acids can act as fuel to facilitate sulphide generation. The *Bacillus* within Evogen Sulphide Controller are able to degrade these compounds resulting in increased competition for food and other resources.

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DIRECTIONS FOR USE, CONSIDERATIONS AND LIMITATIONS

Evogen Sulphide Controller is supplied in 20L, 200L and 1000L containers and should be dosed directly into the effluent downstream from the problem area.

As the product contains nitrate, care should be taken to ensure enough retention time and appropriate conditions are present within the system to account for the extra nitrogen. Our technical support team are able to provide assistance where necessary.

Where it is inappropriate to dose a nitrate containing product we suggest trying our Evogen Clarity product, which is a blend of *Bacillus* combined with a chemical carrier that slowly releases oxygen into a system, helping to aerate deep anoxic areas shutting down sulphate reduction and the generation of odorous compounds.

Recommended use

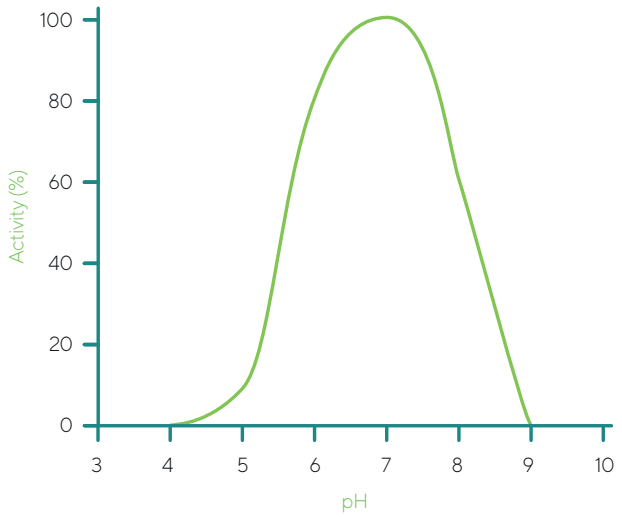
Ideally suited towards effluent rich in organic materials such as proteins, fats, oils and grease, biomass and carbohydrates. Is able to degrade a range of volatile fatty acids and impact biofilms such as those formed upon clarifier plates. Can be used in areas of odour including wet wells and septic tanks, where liquid retention times permit.

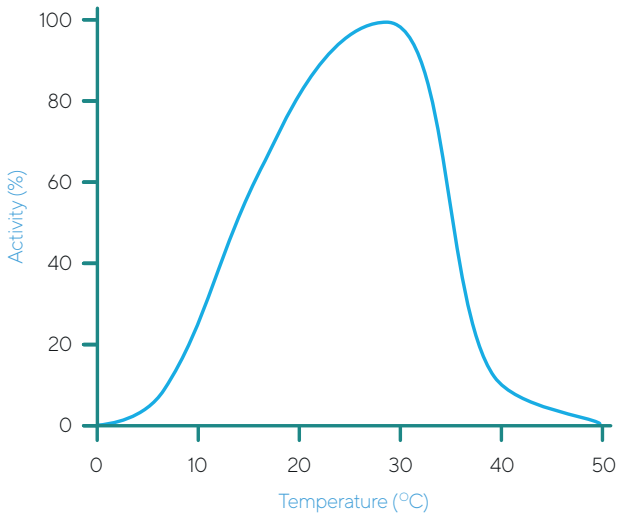
Limitations

The product will perform poorly in highly alkaline (>pH 9) and highly acidic (<pH 4) effluents and will also lose activity at low (<15°C) and high (>40°C) temperatures. Effluent types should have appropriate carbon and phosphorous content to support microbial growth.

For specialised effluent types contact our technical department for more information.

Performance of Evogen Sulphide Controller under simulated conditions with varying pH and temperature





genesis
BIOSCIENCES

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PRODUCT SPECIFICATION

Count
1E+9 CFU/g *Bacillus*

Appearance
Tan coloured liquid

Fragrance
Fresh (eucalyptus and mint)

pH
pH 7.0 – 8.8

Shelf life
24 month (unopened)
if opened store in a cool dry place to maintain product integrity

ENVIRONMENTAL CONDITIONS

Salinity
Freshwater to seawater and above (no impact upon performance between 0 - 50 g/L)

pH
pH 5 – to pH 8.5 (Optimum between pH 6 and pH 7.5)

Temperature
10°C – 40°C (Optimum between 20°C and 35°C)

Effluent type
Organic rich effluents, (municipal, paper and pulp, dairy, bakery)

Recommended products

Evogen General Effluent Improver
Powder designed for general effluent improvements.

Evogen Clarity
Powder to tackle odour associated with anoxic conditions.

Evogen Odour Neutraliser
Liquid for use in misting and nebulising systems.

Evogen Biobricks and Evogen Bioblocks
Slow release products for larger plants.