AXEON®

ASYNBIO™

Eco-Friendly
Water Sanitization

asynbio™

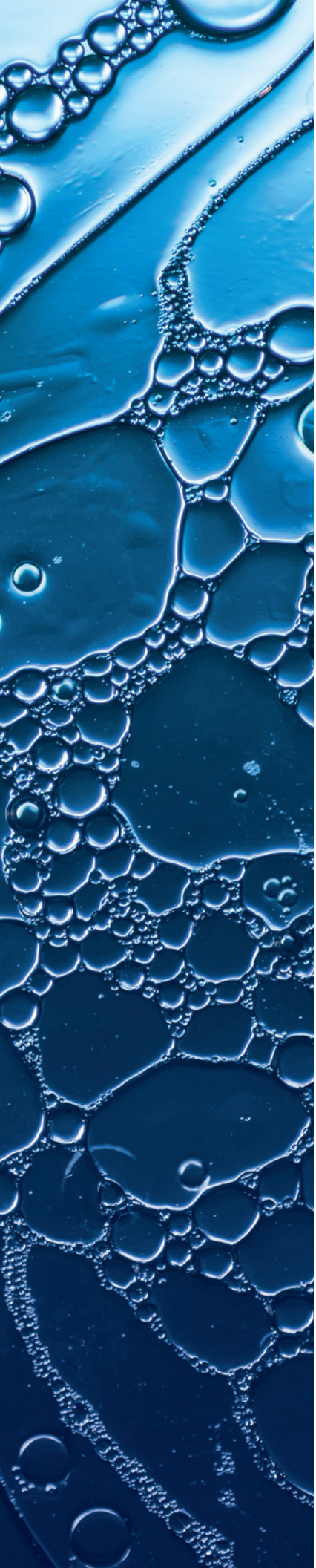
Designed by Nature
Perfected by Science

Aqua Guard Pro™ uses a new and patented pre + probiotic rich formula as an all-natural and organic sanitizer, to help keep water systems, components, and plumbing healthier and free of biological buildup (biofilm), pollutants and contaminants. Easily applied and safe, Aqua Guard Pro™ offers a sustainable approach to extending the life of systems while reducing costs.

- 100% Non-GMO
- Biodegradable
- Non-Volatile
- Eco-Friendly
- Proprietary Blend of Pre + Probiotics
- Effective for Preventative Maintenance
- Eradicates Microscopic Contaminants
- Promotes a Healthy Biome

100% SAFE
NON-FLAMMABLE
NO HARSH CHEMICALS
ECO FRIENDLY
100% GMO-FREE

FOR MORE INFORMATION
VISIT AXEONWATER.COM/ASYNBIO



LIVING WATER

Water plays an important role in production processes within many industries. It is very useful for all kinds of applications, such as heating, cooling, rinsing, cleaning and humidifying.

However, water is also the source of life, and this frequently leads to **unwanted microbiology-related problems** in many of these water applications. When too much microbiology develops in a water system, it may lead to a wide range of issues:

- Odor formation and biofilm (slime formation, clogging of pipes)
- Excessive growth of unwanted organisms (algae, pathogens, etc.)
- Yield/performance reduction of the installation

For many decades, the industry has been using disinfectants (biocides) to kill all microbes, hoping to prevent and solve the problems they cause. However, it has become clear in the past years that the excessive use of biocides and disinfectants induces microbial resistance, which leads to superbugs that are extremely difficult to kill. On top of that, biocides and disinfectants can be aggressive to infrastructures, dangerous to work with, and detrimental to the environment.

This document gives a general overview on ASYNBIO biotechnology. While it is straightforward, most applications require a tailor-made approach.

AXEON ASYNBIO meets the following criteria:

1. All probiotics used belong to ATCC safety class 1 (= highest safety)
2. The pro/prebiotics are 100% natural and not genetically modified (non-GMO)
3. The pro/prebiotics are included on the list of safe ingredients of the European Food Safety Agency (EFSA) for processing in food
4. Food safe according to the American FDA (GRAS status)
5. Passed the following official OECD safety tests:
   - OECD 403 inhalation toxicity
   - OECD 404 acute skin irritation/corrosion
   - OECD 405 acute eye irritation/corrosion
   - OECD 406 skin sensation
6. AXEON ASYNBIO products meet the EU Ecolabel criteria
7. The prebiotics and probiotics meet the criteria for use in cosmetics

ATCC®

EU Ecolabel www.ecolabel.eu

efsa European Food Safety Authority

OECD BETTER POLICIES FOR BETTER LIVES

BRIEF INTRODUCTION TO THE WORLD OF MICROBES

A **microorganism or microbe** is an organism too small to see with the naked eye. Only when there are a large number of them do they become visible (such as grout in a shower). The most important types of microbes are viruses, bacteria, molds, yeasts and algae. Bacteria are the most common microbes and are about 1 micrometer *(µm)* (1 millimeter divided into 1000 pieces) in size.

Microorganisms are found everywhere in nature. They are present in large numbers on skin, in our digestive tract, in soil, water and the air. The majority of microorganisms are beneficial, useful or even necessary for the survival of humans, animals and the environment.

Unfortunately, a number of dangerous or "unwanted" microorganisms also exist. They might cause disease in plants, humans or animals, produce unpleasant smells, or cause food spoilage and contamination. Despite the fact that these "bad germs" are only a small portion of the total number of microorganisms, they give microbes a bad reputation.

Wherever they reside (soil, air, water, humans, animals, plants), microbes have the tendency to organize themselves into communities: the **microbial community or microbiome**. Such communities can be very diverse and complex. Each microbial member of the community plays a role and contributes to the sustainment of that community. Together, all microbes have only one purpose: survive as long as possible with as many as possible.

When a microbial community or microbiome attaches to a solid surface (material, skin, teeth, tubes, leaves, etc.) it is called a **biofilm**. Very common examples of biofilm are grout in showers/floors and slime build-up in water pipes and pumps. Biofilm frequently has negative consequences to humans and animals because it causes visual pollution, odors and harbors a high number of disease-causing germs.

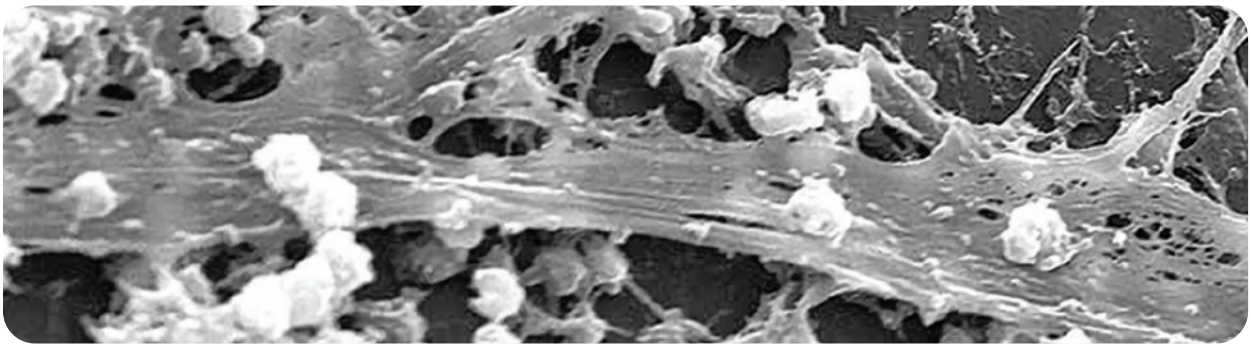
In order to survive, microbes also require food and water just like us. Food can easily be found among the abundant organic material present in water (such as plant material, slime or pulp in process/cooling water). Microbes drink by absorbing moisture or water, which is, of course, abundant in water systems. The processing of food and moisture by microbes is called metabolism, and often involves the excretion of smelly gases that we experience as bad odors. Worst still, some microbes might also produce substances that cause disease in animals, humans or plants, or that cause allergic reactions.

In order to prevent undesirable effects of microbes, it is important to create healthy microflora in water that doesn't produce any dangerous or unpleasant substances. This can be achieved with ASYNBIO water sanitization.

CHEMICAL CLEANING AND DISINFECTION

For many years, people believed that all microorganisms were bad or dangerous and that they should be destroyed. Chemical products called biocides were developed to kill microorganisms. These biocides contain microbe-killing agents and can be used alone or be processed into other products (such as disinfecting soap). The purpose of all biocide products is to prevent microbial growth and eliminate the negative effects of microbes. In water systems, a common biocide is chlorine, which is a widely used disinfection method in swimming pools and spas.

Initially, the use of biocides seemed very effective and water could be kept free of microbial growth and biofilm formation. However, very soon after the discovery of biocides, microorganisms found ways to protect themselves against these chemicals; this is known as **resistance**. This means that each year, microbes get better at surviving biocides. As a result, the efficacy of biocidal products goes down, meaning they need to be applied in higher concentrations and more frequently in order to keep the same effects. Today, the required concentrations of biocides are so high that it becomes very dangerous to work with these chemicals. Furthermore, it results in huge costs and damage to technical equipment (corrosion) and the environment.



On top of that, most water systems suffer from microbes developing intelligent strategies to survive. One of those strategies to defend themselves against the attack of chemicals is the formation of very tenacious **biofilms**. These biofilms have extremely complex structures and compositions and can be considered shelters for the microbes. Biofilms are mostly impenetrable to biocides and keep growing over time. In most water systems, this causes huge problems, such as clogging of pipes, pumps, filters and the formation of intense bad odors. The performance of a technical installation suffering from biofilm is also much lower.

The chemical substances used in these **dangerous chemical biocides** are detrimental to the health of humans, animals and plants. For instance, the Food and Drug Agency (FDA) in the USA and European Commission (Green Deal) have launched initiatives to reduce the use of biocides. In addition, the active ingredients of many biocides are strongly polluting the environment because they have low biodegradability and persist for a long time, resulting in resistance among microorganisms in nature.

A lot of dangerous disadvantages of biocides have been discovered over the years. ASYNBIO offers a sustainable solution to the emerging resistance and safety problems with biocides.

ASYNBIO BIOTECHNOLOGY

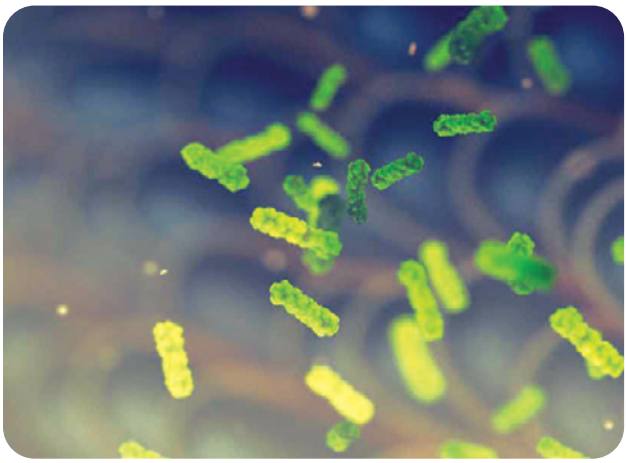
AXEON has been aware of the problem of resistance for many years, and has devised a solution for sustainable and efficient water sanitization.

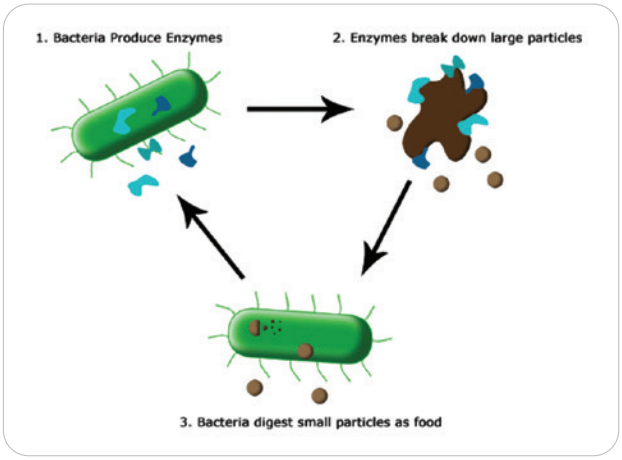
All ASYNBIO products use the power of nature and are based on good bacteria (**probiotics**) supplemented with good sugars (**prebiotics**). The combination of probiotics and prebiotics in one product is called **synbiotics**. The synbiotic products create a healthy, balanced microbiome during and after application for **optimal and sustainable water management**.

Synbiotics
The combination of probiotics and prebiotics.

Probiotics
Good bacteria that provide health benefits.

Prebiotics
Nutrients that stimulate good bacteria.





How Does It Work?: As mentioned earlier, the goal is no longer the radical control of all microorganisms, but the maintenance of a balanced and healthy microbiome. ASYNBIO's biotechnology ensures optimum water quality management by (1) keeping the formation of organic pollution under control and (2) supporting a well-balanced water microbiome.

1. Preventing organic pollution
ASYNBIO consists of a proprietary blend of 100% natural *Bacillus* probiotics that can analyze the organic pollution in water to see which type of dirt is present. They will then produce highly targeted enzymes that will break down the organic pollution in order to use it as food source. This enzyme activity is constant and results in cleaner water.

2. Supporting a balanced water microbiome
The probiotics immediately introduce a high count of good bacteria to the water system. The prebiotics will also boost probiotic activity and support the survival of good bacteria. This leads to a stable and beneficial water microbiome.

THE ADVANTAGES OF ASYNBIO SANITIZATION

1. Cleaner water system

The probiotics in ASYNBIO products are selected for their excellent capacity to consume organic matter and turn it into CO2 so the water system is purified in a 100% natural way. This prevents clogging of pipes, filters and the formation of excessive sludge. Less manual maintenance will be required, reducing the risk of shutting down production.

2. Preventing and curing odor

The organic dirt that accumulates in the water system starts to rot because some microorganisms use it as food and turn it into waste products containing volatile smelly gases, such as sulfur compounds or butyric acid. The probiotic bacteria in ASYNBIO products actively digest organic matter from the water system and turn it into non-smelling volatile compounds. As such, these organics can no longer be transformed into smelly gases.

3. Healthy water microbiome

Another major problem in water systems is the excessive growth of certain microorganisms, such as algae or *Legionella*. This leads to visual pollution or potentially dangerous contaminations that may cause disease in humans or animals. The synbiotics in ASYNBIO products establish a healthy natural microbiome in water systems with no danger to humans or animals.

4. Safety

In contrast to most biocidal products, ASYNBIO products are 100% safe to work with. The synbiotic ingredients are all food grade and the ASYNBIO cleaners have no CLP danger symbols. They are also pH neutral.

5. Sustainability

ASYNBIO products are not just environmentally friendly, but are also environmentally beneficial. The probiotic strains used in the products are well-known strains used in bioremediation and natural waste water treatment plants. As such, applying ASYNBIO products helps to remove pollutants from the environment.

6. Cost saving

The application of ASYNBIO products results in cleaner water systems that show better performance and yield with less maintenance costs.

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Air Guard Pro™ uses a new and patented pre and probiotic rich formula as an all natural and organic cleaner, to help keep plants healthier and free of biological pollutants and contaminants. Easily applied and absolutely safe, Air Guard Pro™ offers a sustainable approach to improving plant health and growth.

- 100% Non-GMO
- Biodegradable
- Non-Volatile
- Eco-Friendly
- Pre and Probiotic
- Fights Mildew and Fungus
- Eradicates Microscopic Contaminants
- Promotes Growth in Plants

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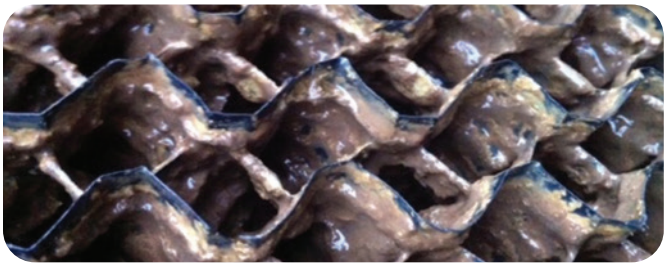
CASE STUDIES

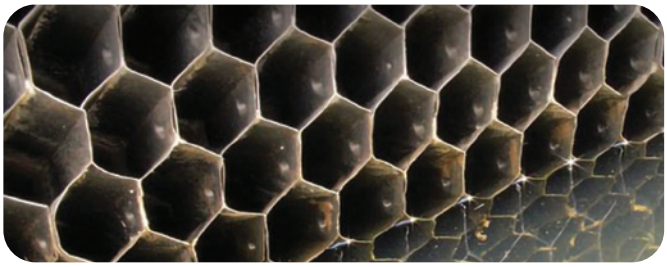
1. Cooling towers for cold room

Baltimore CXVH 253 evaporative towers were monitored to service the Freon Tower 1, Tower 2, and NH3 systems for cooling cold rooms. The towers are powered by groundwater previously treated with antiscalant, dispersant solution and a solution of biocide (hydrogen peroxide). The treatment was to fully stop using biocides, then start adding Aqua Guard Pro at an increased startup dosing for 3 weeks. Afterwards, a daily dosing of Aqua Guard Pro was applied at maintenance dosing (see product datasheet for details).

Before



After 4 weeks



The study showed that the ASYNBIO biotechnology within Aqua Guard Pro was able to digest organic pollution and clean up most of the mechanical parts of the cooling tower. After 3 weeks, most of the inorganic encrustation detached from the surfaces because the "organic glue" that supported it was digested by the probiotics. For a short period of time, the water and filters suffered from increased soluble dirt because it came lose from surfaces. Afterwards, the water and surfaces remained clean with less maintenance and higher performance (= cost reduction) of the cooling tower.

2. Paper industry—process water

AXEON's Aqua Guard Pro is frequently applied in paper industry process water. It helps to digest excessive organic dirt and keep surfaces clean without the need for mechanical cleaning. Odor reduction was very effective.

Before

After 4 weeks

CAN AQUA GUARD PRO BE COMBINED WITH BIOCIDES?

Aqua Guard Pro with ASYNBIO technology is not a biocide and should not be used as such. Although it keeps water systems clean, it may still be sporadically necessary to apply biocides. Reasons can be regulatory obligations in certain industries or special conditions where Aqua Guard Pro is less effective (such as extreme TDS, pH or temperatures).

Although it may sound contradictory, the combination of Aqua Guard Pro products with biocides is perfectly possible. The biocides will work even more efficiently because Aqua Guard Pro actively removes organic dirt that would otherwise inhibit the efficacy of a biocide. The combined application of Aqua Guard Pro and biocides requires special instructions and precautions; a tailor-made approach with assistance of AXEON specialists is highly recommended.

ASYNBIO PRODUCT OFFERINGS

The ASYNBIO product range consists of two products:

1. Aqua Guard Pro™

Aqua Guard Pro uses a new and patented pre- and probiotic rich formula as an all-natural and organic sanitizer to help keep water systems, components, and plumbing healthier and free of biological buildup (biofilm), pollutants and contaminants. Easily applied and safe, Aqua Guard Pro offers a sustainable approach to extending the life of systems while reducing costs.

- *Available sizes: 1 gallon jug or 265 gallon tote*
- *Commercial applications*

2. Air Guard Pro™

Air Guard Pro uses a new and patented pre- and probiotic rich formula as an all-natural and organic cleaner to help keep air healthier and free of biological pollutants and contaminants. Easily applied and absolutely safe, Air Guard Pro offers a sustainable approach to improving plant health and growth, as well as sanitizing spaces.

- *Available sizes: 1 gallon jug or 265 gallon tote*
- *Industrial applications*

ASYNBIO SANITIZATION SAFETY

Because ASYNBIO is new technology, AXEON has devoted attention from the start of development to demonstrate the safety of the products and especially the probiotic strains used.

ASYNBIO meets the following criteria:

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4. Food safe according to the American FDA (GRAS status)
5. Passed the following official OECD safety tests:
    a. OECD 403 inhalation toxicity
    b. OECD 404 acute skin irritation/corrosion
    c. OECD 405 acute eye irritation/corrosion
    d. OECD 406 skin sensation
6. The probiotic strains passed water toxicity tests on *Pimephales promelas*
7. The prebiotics and probiotics meet EU Ecolabel criteria
8. The prebiotics and probiotics are also used in cleaning products for hospitals

With ASYNBIO water treatment products, AXEON has launched a true revolution and sustainable solution to the emerging problems with resistant microorganisms. The superior performance of the products in terms of water purification and odor control, combined with a high level of safety and environmental friendliness, achieve the sustainable hygiene so urgently needed by humans, animals, environments and industries.

For more information, please contact AXEON or visit **AXEONwater.com/ASYNBIO**.

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