Water
Introduction

Water has an important role in industry and several recreative markets. Because of its unique physical and chemical properties, water is a valuable ‘product’ that can hardly be replaced by something else. However, water is also the source of all life and this causes a series of side effects that can become very problematic in a number of applications of water.

The following disadvantages or problems with water are very common:
- Odour formation
- Biofilm (slime formation, clogging of pipes)
- Excessive microbial growth (algae, bacteria)

Most of these problems are caused by or related to micro-organisms or microbes. For many decades people use disinfectants (biocides) to kill all microbes, hoping to solve the problems they cause. However, it has become clear in the past number of 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 are very dangerous and detrimental to the environment.

For more than 25 years, Chrisal is specialised in developing sustainable cleaning and hygiene solutions, in which probiotics are a crucial ingredient. We use nature to solve problems, instead of trying to kill nature.

Given the major importance of a good natural microbial balance in water, Chrisal has developed a probiotic product range to solve problems related to water in a natural way. This document gives a general overview of what Chrisal has to offer to the world of water. We are happy to answer all of your specific questions you might have after reading this document.

We look forward being of service to you!

Dr. Robin Temmerman
CEO Chrisal NV
Brief introduction to the world of microbes
(More information can be found in our document ‘Probiotic cleaning – the basics’)

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

Micro-organisms 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 micro-organisms is beneficial, useful or even necessary for the survival of humans, animals and the environment.

Unfortunately, also a number of dangerous or ‘unwanted’ micro-organisms 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 micro-organisms, they give microbes a bad reputation.

Wherever they reside (soil, air, water, humans, animal, plant), microbes have the tendency to organize themselves into communities: the microbial community or microflora. 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 such a microbial community or microflora attaches to a solid surface (material, skin, teeth, tubes, leaves…) it is called a biofilm. Very common examples of biofilm are for instance grout in showers and on floors, or slime build-up in water pipes and pumps. Frequently, biofilm has negative consequences to humans and animals because it causes visual pollution, odours and harbours 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 proces/cooling water). Microbes drink by means of absorbing moisture or water, which is of course abundant in water systems. The processing of food and moisture by microbes is called metabolism and very often this involves the excretion of smelly gasses that we then experience as bad odours. Worst case, some microbes might also produce substances that cause disease in animals, humans or plants, or that cause allergic reactions.

In order to obtain a good hygiene and prevent undesirable effects of microbes, it is important to create a healthy microflora in the water that doesn’t produce any dangerous or unpleasant substances. This can be achieved by means of the probiotic water treatment of Chrisal.
Chemical cleaning and disinfection

For many years people believe that all micro-organisms are bad or dangerous and that they should be destroyed. For that purpose, chemical products were developed to kill micro-organisms, the so-called biocides. These biocides contain microbe-killing agents and can be used as such, or be processed into other products (e.g. disinfecting soap). The eventual purpose of all biocide products is to prevent microbial growth so that none of the negative effects of microbes can exist. In water systems, a common biocide is chlorine.

Initially, the use of biocides seemed very effective and water could be kept free of microbial growth and biofilm formation. However, soon after the discovery of biocides the micro-organisms found ways to protect themselves against these chemicals, which is called resistance. This means that each year, microbes know much better how to survive the attack of a biocide. 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 effect. Today, the required concentrations of biocides are so high that it becomes very dangerous to work with these chemicals. Furthermore, it results in a huge cost and damage to technical equipment (corrosion) and the environment.

On top of that, most water systems suffer from some intelligent strategies of microbes 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 as bunkers and shelter 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, pomp, filters and the formation of intense bad odours. Also, the performance of a biofilm infested technical installation is 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 has started an investigation towards the safety of disinfecting soaps*. Besides safety, the active ingredients of biocides are strongly polluting the environment because they are hardly biodegradable and persist for long time, stimulating resistance among micro-organisms in nature.

Over the years, countless dangerous disadvantages of biocides have been discovered. The discovery of probiotic hygiene, fully based on natural ingredients, offers a sustainable solution to the emerging resistance and safety problems with biocides.

*http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm378393.htm
Probiotic products

The probiotic products of Chrisal have probiotics as active ingredient. Probiotics are good, useful bacteria that create a healthy environment for humans and animals.

Probiotic water treatment is done with products containing 100% natural microbes. The probiotics used originate from nature (soil and water) and were selected for their capacity to consume large amounts of organic dirt at high speed. This prevents a build-up of such dirt in water systems. In addition, the probiotics strongly reduce the risk of bad germs in the water system.

From experience we know that people have a several rightful questions regarding our new probiotic technology:

- Are probiotics safe?

   Absolutely. The probiotics selected and used by Chrisal are internationally aproved for use in nutrition. In addition, Chrisal performs a broad range of safety assessments in collaboration with acredited laboratories worldwide. Also, our production processes are fully ISO9001:2008 certified.

- Can bad germs become resistant against the probiotics used?

   No, micro-organisms can never become resistant against other micro-organisms. Resistance is only possible against a molecule or chemical substance that threatens the microbes. The probiotic technology does not involve any biocidal activity or chemical substance that targets to kill microbes. This means that the probiotic technology can be used for many years, which is referred to as sustainability.

- Why don’t we stop using biocides immediately?

   The long term use of biocides has caused many institutions, companies or people to be too familiar with the use of biocides. It is part of the daily routine and procedures. We always want to kill all microbes. Just like with biological gardening it requires a change of mind to realise the problems with biocides and change to sustainable alternatives like the Chrisal probiotics.

- Is it difficult to work with probiotic products?

   No, the use of probiotic water treatment products is extremely easy and does not require special skills or tools. Just add it to the water and let the probiotics do the work for you.

Of course many more questions exist because of interest in the technology, or the fear of change. Please do not hesitate to contact Chrisal (contact information at www.chrisal.com) to ask any of your questions, we are most happy to answer them and help you further getting familiar with the probiotic technology.
The advantages of probiotic water treatment

Water systems suffer from three major problems:

1. **Dirt and biofilm**

Process/cooling water, ponds or natural waters, all suffer quickly from an accumulation of *organic dirt* coming from decaying animal or plant material, as well as dead micro-organisms. This dirt clogs pipes, filters, pumps which in turn reduces the water flow within such equipment. On top of that, the organic dirt is a perfect food source for micro-organisms that again contribute to growing more organic matter in the water system. Sunlight and/or heat often boost the growth of organic matter and biofilm.

The probiotics in the Chrisal products are selected for their excellent capacity to consume organic matter and turn it into simple CO2 so the water system is purified in a 100% natural way. The composition of the probiotic blend in the Chrisal products is designed so that the product demonstrates a good activity in a broad spectrum of temperature and acidity (pH). This guarantees a good effect in almost any water system.

2. **Odour**

The organic dirt that accumulates in the water system starts to rot because some micro-organisms use it as food and turn in to waste products containing volatile smelly gasses, such as sulfur compounds or butyric acid. All water systems (industrial water, cooling water) suffer from odour production and can reach levels that become a problem to the environment of the facility, or that turn the end product of the production process bad (such as paper in paper factories that smell like butyric acid).

The probiotic bacteria in the Chrisal products actively digest organic matter from the water system and turn it into non-smelling volatile compounds. This prevents the formation of bad odours by other micro-organisms. Furthermore, the competition for food (organic matter) leads to a strong reduction in the risk of finding dangerous or odour forming micro-organisms in the water system.

3. **Excessive microbial growth**

Another major problem in water systems is the excessive growth of certain micro-organisms such as algae or cyanobacteria. This leads to visual polution and potentially dangerous contaminations that might cause disease in humans or animals.

The probiotics in the Chrisal products establish a healthy natural microflora in the water systems with no danger to humans and animals.
The product range

Although water treatment looks easy at first sight there exist big difference between different types of water systems. A pond for instance has totally different physical and chemical properties than industrial or cooling water. That is why the Chrisal water treatment product range has been developed to meet the specific demands of these different water systems.

The following pages briefly present the different products Chrisal has for water treatment. Detailed information on the best solution for your problem is to be discussed with Chrisal and most likely an on-site inspection is required first, certainly for industrial water or large natural water bodies.

1. Ponds and small scale aquaculture – PIP Pond Plus

Ponds are the classic example of excessive dirt and biofilm causing murky water and odour problems. Ponds harbouring expensive fish like Koi are often equipped with professional technical installations (filters, water treatment) that try to make the water clear and sterile. However, these installations often disturb the natural microflora in the water in favour of bad germs, which causes bacterial infections with the fish.

**PIP Pond Plus** creates a healthy microflora in the pond. It removes and prevents formation of biofilm, that otherwise might lead to murky water, clogged filters and development of bad germs. The final result of the product is a healthy and clear pond.

**Closed water circuit or reservoir:**
Startup: 100 ml PIP Pond Plus per 1.000 liter water / week
Standard: 10 ml PIP Pond Plus per 1.000 liter water / week

**Open water circuit:**
Startup: 100 ml PIP Pond Plus per 1.000 liter water / week
Standard: 10 ml PIP Pond Plus per 1.000 liter water / week

+ 10 ml PIP Pond Plus per 1.000 liter new water / day

**Highly polluted water:**
In case of highly polluted water, the dosage may be temporarily increased to 1 liter PIP Pond Plus for each m³ of water per week.

**Important!**
Do not combine biocide or disinfecting products with the probiotic products from Chrisal.
2. **Aquaria – PIP Water Plus**

Just like ponds, aquaria are artificial water systems that suffer greatly from too much plant and animal pollution. Because of the limited water volume this quickly results in unhealthy water conditions for the plants and fish present. A properly working biofilter and the removal of excessive organic dirt are crucial for a healthy aquarium.

**PIP Water Plus** is a probiotic product from Chrisal, specifically developed for aquaria. The probiotics will remove all organic dirt and remove it from the water system as CO2. On the other hand, the probiotics improve the functioning of the biofilter which leads to much better nitrogen processing in the water. The bacteria present in the biofilter are stimulated to convert nitrogen because they experience too much competition on the carbon food source (organic matter) due to the presence of our probiotics. The application of PIP Water Plus leads to a kind of symbiosis between the probiotics in the product and the natural bacteria in the biofilter; and they both stimulate each other. The final effect is a clear and healthy aquarium.

**Starting dose**
During the first week: daily addition of 50ml PIP Water Plus per 100 liter water.

**Maintenance dose**
- Clear water: Weekly addition of 15 ml PIP Water Plus per 100 liter water.
- Murky water: Weekly addition of 50 ml PIP Water Plus per 100 liter water.

**Important!**
In seawater aquaria some anemone might experience slower growth or reduced activity because of the probiotics. Do not combine biocide or disinfecting products with the probiotic products from Chrisal.
3. Whirlpool – PIP PLUS WHIRLPOOL

Whirlpools are becoming an increasingly popular means of relaxation and become more affordable to most people. Also, a lot of bath tubs are also equipped with a whirlpool function. Such a whirlpool system consist of many tubes and pumps, which are difficult to clean and maintain. As a result, biofilm and dirt quickly settle in these parts of the system. Because whirlpools are not used daily, odour problems exist with most systems. Most whirlpool owners start using dangerous chemical products like chlorine to try to solve the many problems and often it leads to damaged tubes and pumps.

**PIP Plus Whirlpool** is a probiotic product from Chrisal specifically developed for whirlpools and bath tubs with whirlpool function. The probiotics will remove all organic dirt in the system and prevent clogging and biofilm formation. Furthermore, the formation of bad smells is prevented. Certainly for whirlpool systems that are only sporadically used, the use of PIP Plus Whirlpool is highly recommended to keep the system in good condition. The probiotics demonstrate a long activity for several days.

**Starting dose**

During the first week: daily addition of 50ml PIP Plus Whirlpool per 1000 liter water.

**Maintenance dose**

- Clear water: Weekly addition of 15 ml PIP Plus Whirlpool per 1000 liter water.
- Murky water: Weekly addition of 50 ml PIP Plus Whirlpool per 1000 liter water.

**Important!**

Do not combine biocide or disinfecting products with the probiotic products from Chrisal.

Many industries use water in their production processes, mainly for cooling and flushing or rinsing. Such industrial water is extremely polluted with organic matter and is being recycled many times in order to avoid high wastewater costs. Heavy biofilm formation and strong odours are very likely in industrial water systems and may cause severe problems towards the environment and performance of the system. As a result, most companies use very agressive biocides in order to attempt killing all microbial life in the water system and lower odour formation. However, the efficacy of these products is extremely low because the organic matter in the water blocks the activity of the product. Furthermore, working with such chemicals is very dangerous to the workers and detrimental to the environment and technical installation (corrosion).

With the product PIP Aquatec, Chrisal has developed a very concentrated water treatment product specifically for industrial water systems such as cooling water or rinsing water. The probiotics actively remove organic pollution from the water system and prevents the formation of odours. The product increases the performance of the water system and improves the recyclable time. When the time comes to renew the water, the probiotics will contribute to the waste water treatment. For cleaning water systems when emptied, use PIP Aquatec Cleaner (see www.pipaquatec.com for more information).

**PIP Aquatec instructions:**

**Intensive dosing:**
At start-up (minimal 4 weeks) or during periods of high water system challenge the intensive dosing is required:
Daily 1 liter of PIP Aquatec per 100.000 liter of water

**Maintenance dosing:**
When the water system is no longer showing significant problems, the maintenance dose can be applied:
Daily 100 ml of PIP Aquatec per 100.000 liter of water

**Important!**
Each industrial water system is unique and requires a specific approach and follow-up. We strongly advise to contact Chrisal in order to organise an on-site visit and personalised product application. Do not combine biocide or disinfecting products with the probiotic products from Chrisal.
5. Large/natural water bodies – PIP AQUASAN PRO

Also large water bodies can cause major problems. Swimming ponds, golf ponds or even lakes may suffer from excessive microbial growth as a result of water pollution by organic dirt, nitrogen or phosphates. Very often industry, agriculture or dense population are the main cause of these water problems but this can only be changed with long term sustainable measures. Today we can only focus on treating the water itself in order to create a more healthy and natural water ecosystem so that safety for humans and nature is no longer threatened.

Because each water body has its own dynamic and problems it is important to first evaluate and study the local situation before proposing a solution. Chrisal will always do an on-site visit in order to determine the best way how to best use the probiotic products that were developed for large scale water bodies. In combination with the probiotic technology it might be necessary to apply additional techniques such as aeration of the water or induce water circulation.

The mode of action of PIP Aquasan PRO is based on the removal of excessive organic matter from the water and release it into the air as CO2 (see picture below). The Chrisal probiotics contribute to the natural carbon cycle in the water and will at the same time stimulate other specific micro-organisms to stimulate the nitrogen cycle. This leads to an intensification of the natural ecodynamics in the water body, resulting in more healthy and clean water.
The probiotic solution by Chrisal involves both a surface water treatment (spraying), as well as a deep water treatment. The surface water treatment is mainly targeting the removal of free flowing nutrients that stimulate algae and other microorganisms. The deepwater treatment is targeting the removal of decaying organic material that causes odour problems.

Application

A standard treatment cannot be proposed in this document. Chrisal will always need to perform an on-site inspection and analyse the actual situation of the water system and its problems. Only then, a specific probiotic treatment can be designed.

Contact Chrisal for more information!
The right products

You are convinced of the probiotic technology to solve problems with your water system? Perfect!

But, be careful, you have to pay attention to a number of important aspects when searching for a good supplier of probiotic products. Not all manufacturers of probiotic products demonstrate the same quality and professionalism as Chrisal.

Type of probiotics

Probiotics are mostly known from food supplements where species of good bacteria are used that optimise the function of the gut microflora. Of course, water or water systems are a totally different environment than intestines. The probiotic species used in probiotic food supplements cannot be used for application in the environment or in water. Chrisal has screened many probiotic species and selected the ones demonstrating the highest and longest efficacy in environmental applications. This guarantees a good action in the water system to be treated.

Minimal count

Of course, each application requires a specific minimum number of probiotics in the product in order to achieve good results. When too low numbers of probiotics are used it may take a lot of time to achieve an effect, or worse, never see any effect at all. Over 10 years of research at Chrisal has demonstrated that most applications require at least 50 million probiotics per ml of product (50 billion probiotics per liter of product). For a number of water applications, this minimal count is even much higher (up to 1 trillion per liter). Chrisal guarantees that even at the end of the product shelf-life the minimum required number of probiotics is still alive in the product.

Stability

Not only the type and number of probiotics in the product is important, also the stability is crucial. Because of the unique and secret Chrisal product stabilisation system, Chrisal is the only manufacturer of probiotic products in the world that can offer a minimum 2 year shelf-life for all its probiotic products. This means that the activity of all probiotic Chrisal products is remains perfect for 2 years.

Chrisal refers to the stabilised probiotics with the name ‘SPF – Stabilized Probiotic Ferment’ which can be recognised on the product label by means of the logo to the right.
Safety and environment friendliness are major advantages of the probiotic products, in contrast to the currently used chemical products and biocides. The probiotics are 100% natural organisms and they actively contribute to the preservation of the environment. The probiotics used in the Chrisal products originate from soil and water and are not genetically modified.

Chrisal also has the European EU Ecolabel certificate which proves that Chrisal is perfectly capable of developing products that meet the most demanding and recent specifications for environment friendly products. Because Chrisal is a company that invests a lot in innovation, our newest products are often ahead of legislation and are more green than the latest green legislation.

Also the production process and quality control are extremely important in order to have probiotic products that meet the highest quality standards to guarantee proper efficacy at the customer. Besides 25 years of experience Chrisal also has the ISO9001:2008 quality system in place which is subject to an annual external audit. The ISO system guarantees a good functioning of the entire Chrisal staff and infrastructure.

Whoever chooses for probiotic products from Chrisal chooses for a safe future for humans, animals and nature. He/she also chooses for top quality technology and a service that is built on more than 25 years of experience. The only thing you need to start with the probiotic technology from Chrisal is a little change of mind.
Conclusion

With the probiotic water treatment products Chrisal has launched a true revolution and sustainable solution to the emerging problems with resistant micro-organisms. The superior performances of the products in terms of water purification and odour control, combined with a high level of safety and environment friendliness, turn these products into little wonders to achieve sustainable hygiene so urgently needed by humans, animals, environment and industry.

Chrisal keeps devoting itself to the development of new probiotic products for a broad range of applications and problems. After 10 years Chrisal has taken the world number one position as manufacturer of probiotic products and can refer to a large number of nice references and achievements. The entire Chrisal team is always available to you in order to help you solve your problems in the best possible way. Please do not hesitate to contact us for any of your questions, we are most happy to help you.

Chrisal Canada ULC
11 Holland Drive, Unit 7
Bolton, Ontario L7E 1G7
Canada
P: 905-857-5553
F: 905-857-1465
info@chrisal.ca
www.chrisal.ca

Chrisal NV
Priester Daensstraat 93920
Lommel, Belgium
Tel +3211548000
Fax +3211548002
www.chrisal.com
info@chrisal.com

Together we build sustainability!