Probiotic cleaning and hygiene

The basics

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PhD in Microbiology

Introduction

Over the last few years the following headlines have become more frequent: “dangerous drug-resistant superbugs. More and more diseases, fewer antibiotics. People and animals are threatened!”

The cause of the above problems are due to our own behaviour and misunderstanding. With antibiotics and disinfectants we kill everything to protect ourselves. This thought process is outdated and wrong!

For 25 years Chrisal, has pioneered the development of sustainable cleaning products which combine efficiency with durability. Only then can we give our children a healthy bright future in a world where humans, animals and the environment live in harmony together.

The great challenge of our time in terms of hygiene is the rise of resistant microorganisms. We must find a way to live WITH microorganisms, instead of thinking that we can totally destroy them.

Chrisal has found the solution and it is now rapidly spreading in different sectors around the world. Given the revolutionary nature of this technology, many questions are asked. We have developed this document to answer questions about the absolute basic concepts of microbiology, the current issues and our solution.

After reading this document, you will understand why you and others need to switch today to the sustainable technology of Chrisal.

We hope you find this useful!

Dr. Robin Temmerman
CEO

1. Microbiology

Microbiology is the science of micro-organisms. **A microbiologist** is someone who studies microorganisms and offers solutions based on that knowledge that improves the life of humans, animals and the environment.

1.1 What are micro-organisms?

A **micro-organism** or **microbe** is an organism that is too small to be seen with the naked eye. Only when there are many do they become visible. The most important examples of micro-organisms are viruses, bacteria, fungi, yeasts and algae. Bacteria are the most common and are about 1 micrometer in size, which is a thousandth of a millimeter (1000 bacteria in a row is not more than 1 millimeter)!

Micro-organisms can be found everywhere in nature. In large numbers, they occur on the skin, in the digestive tract, in the soil, in water and in the air.

The majority of micro-organisms are benign, useful or even necessary for humans, animals and the environment.

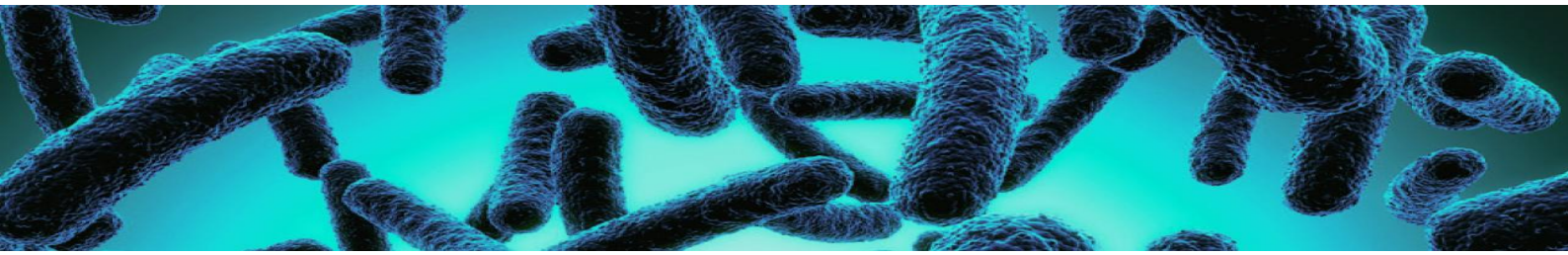
Some examples where micro-organisms are very useful:

- Digestion: our food cannot be digested without the billions of bacteria in our gut
- Composting: dead material from nature (eg leaves, grass, dead animals) are processed by microorganisms into the smallest nutrients, then naturally reused to form new plants or animals.
- Food production: a lot of food can only be made using microorganisms such as yeast for bread and wine, or bacteria for yogurt and cheese.

There are unfortunately a number of micro-organisms that are harmful to humans, animals or the environment, which we call **pathogens**. Although they are a minority, they give the microorganisms a very bad reputation.

Some examples of micro-organisms that are harmful:

- Disease: different microorganisms can cause diseases such as colds, pneumonia, flu, wound infection, tetanus, ... Plants can be made sick by microorganisms, making them unable to bear any fruits or sometimes causing death.
- Food Spoilage: mainly bacteria can cause spoiled or contaminated food which we get colitis and diarrhea after eating this food. Salmonella, E. coli, Listeria and Clostridium are the most important forms of these bacteria.



1.2 The microbial community

Despite their size (or rather smallness) microorganisms are very smart. They know perfectly how to work together in order to survive. The first traces of micro-organisms on Earth have been 3 billion years old, so they have a lot more experience than humankind.

No matter where they occur (soil, air, water, animals, plants), the micro-organisms organize themselves into communities: known as the **microbial community or microflora**. Such communities can be very diverse and very complex. Each type of microorganism has its role and contribute to the community. Together, they have only one goal: survival of all as long as possible.

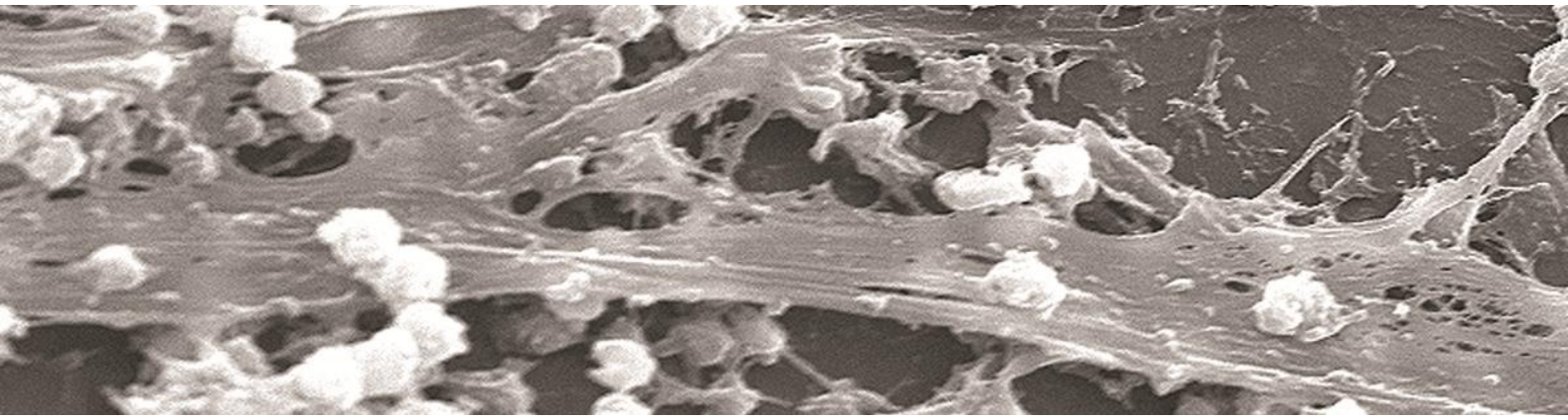
If such a microbial community or microflora is on a solid surface (material, teeth, skin, leaves, ...) it is called a **biofilm.** A well known example of biofilm is the black tile grout in a shower. A biofilm consists of many different types of microorganisms and various substances that they produce. These substances can be used as food or as protection against external influences. So the microorganisms house themsleves in this protective layer and live together. Unfortunately biofilm often have adverse effects on humans. It creates visual pollution, is a source of odor, nuisance and also a refuge for many germs or pathogens

What does a microbial community need to survive?

Nutrition: As every living creature a micro-organism can not survive without food. The diet can be very diverse and is also microscopic. Major food sources are sugars, fats and proteins, but also special things such as urine or sweat. Not all micro-organisms can use all the nutrition, so they work in the biofilm together to exchange nutrients together.

Moisture: Also without drinking, no micro-organism can survive. Micro-organisms can not really drink, they absorb moisture from the environment. Similar to like a sponge being absorbent. If there is not enough moisture present their activity will decrease rapidly. As with animal or humans, a micro-organism may live much longer without food than without humidity. Moisture is very important to their survival.

Safety: In order to survive the environment must also be favorable. Through the biofilm, the microorganisms protect themselves against fluctuations in the environment, such as temperature, pH and humidity.



1.3 The microbial dynamic

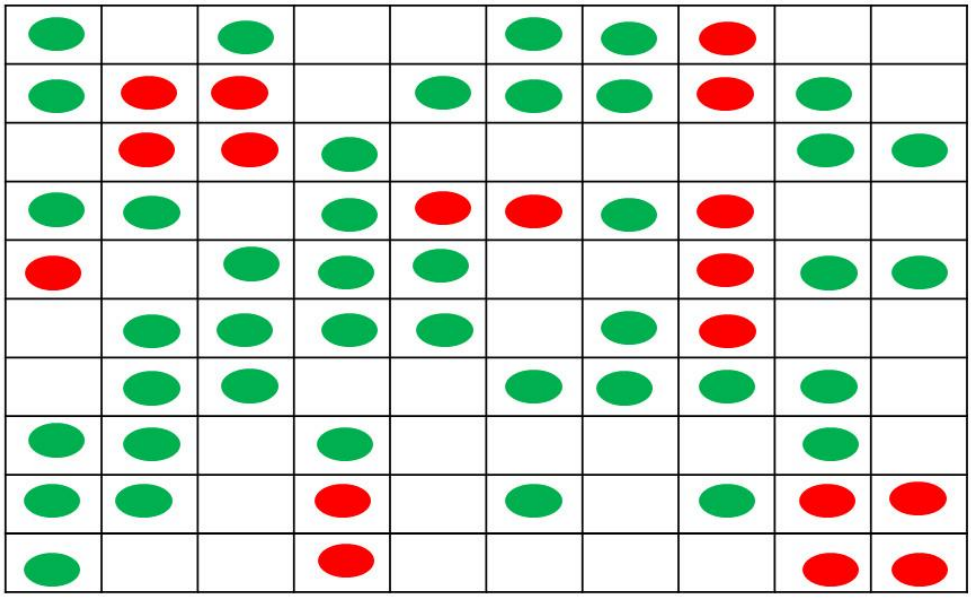
The microbial community, microflora and biofilm are a living entity, with continuous changes depending on the conditions (humidity, power, temperature ...). Despite these changes, it is the aim of the microbial community to continue existing, and remain alive as long as possible The microorganisms can do that by adapting to the circumstances and by communicating (called **quorum sensing)** with each other.

An example:

Suppose one has a surface that provides adequate nutrition, moisture and space with a microbial community of up to 100 micro-organisms.

The present micro-organisms interact with each other to ensure that they do not exceed that limit, preferably remaining a little below the limit to ensure they do not have a sudden problem. An example of such a surface is set out below:

DIAGRAM 1 (Total 100: 42 good, 18 bad, 41 empty)



The surface is covered with harmless microorganisms (green spheres), harmful micro-organisms (red spheres) and some spaces that serve as a backup.

Since the micro-organisms have an average life span of a few days, there will be a process of continuous dying and growing from micro-organisms, and the total microbial community remains approximately constant.

Without human influence, there is a **microbial ecosystem or natural microflora balance.**

In the next chapter, we show you the influence of chemical cleaning and disinfection on the microbial balance.

2. Chemical cleaning and disinfection

Because the detection of micro-organisms was mainly linked with diseases, humankind had the idea that all micro-organisms are dangerous. Besides the search for resources to fight the diseases (antibiotics), more attention was also given to our hygiene and our environment. Therefore, products were designed to clean and disinfect.

2.1 Cleaning and disinfection

There is an important difference between cleaning and disinfection, as well as between surfaces and our bodies.

Cleaning: The removal of dirt on a surface (material or our skin). This is done with soaps (or detergents).

Disinfection: To make a surface free of micro-organisms by eliminating them. This is performed with biocides (or disinfectants).

Soaps and chemical biocides are fully chemical in composition, wherein the biocides contain an active substance which is bactericidal. Nowadays, soaps and biocides are sometimes combined with a product that should do both the cleaning and the killing (eg Dettol).

The ultimate goal of cleaning and disinfection is to ensure that no micro-organisms and their food source (= dirt) remain present anymore.

2.2 The resistance problem

The use of detergents and disinfectants initially appeared to work well and you could quite easily make a surface free of dirt and micro-organisms. However, because of their long time on earth, microorganisms learned quickly to adapt to changing circumstances.

Over several decades after the introduction of disinfectants, the microorganisms found ways to circumvent this threat, which today we call resistance. This is to say that the micro-organisms become increasingly aware on how to survive an attack of disinfectants. The efficiency of disinfectants is therefore diminished.

Also in terms of cleaning, there is a growing problem. One of the mechanisms used by the micro-organisms to defend themselves against these chemical attacks is through the formation of increasingly persistent biofilms. This ensures that cleaning agents (soaps, detergents) are no longer able to remove the dirt on surfaces, because the dirt is often trapped in biofilms that are almost impermeable to soaps.

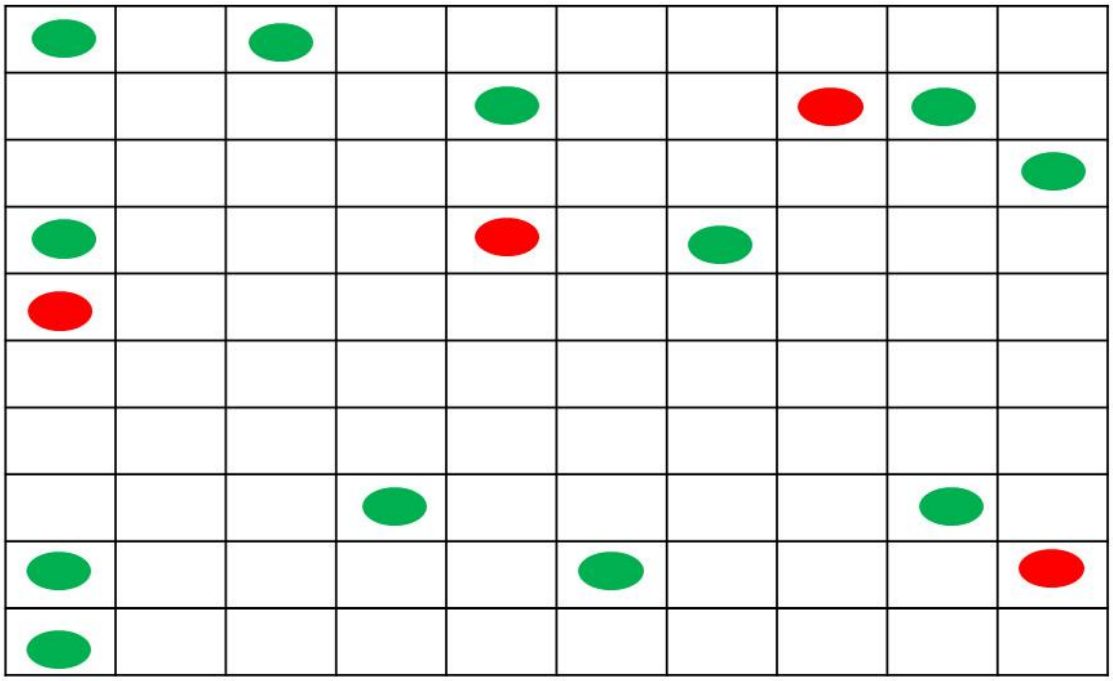
2.3 The disinfection paradox

However, there is a greater danger lurking behind chemical cleaning and disinfection. The impact on the microbial dynamics is the creation of harmful microflora.

What happens with chemical cleaning and disinfection:

If we take as an example again, of a surface where food, moisture and space is available to keep a microbial community of 100 micro-organisms alive. **Immediately after disinfection**, the micro-organism count will have fallen sharply.

DIAGRAM 2 (Total 100: 12 good, 4 bad, 84 empty)

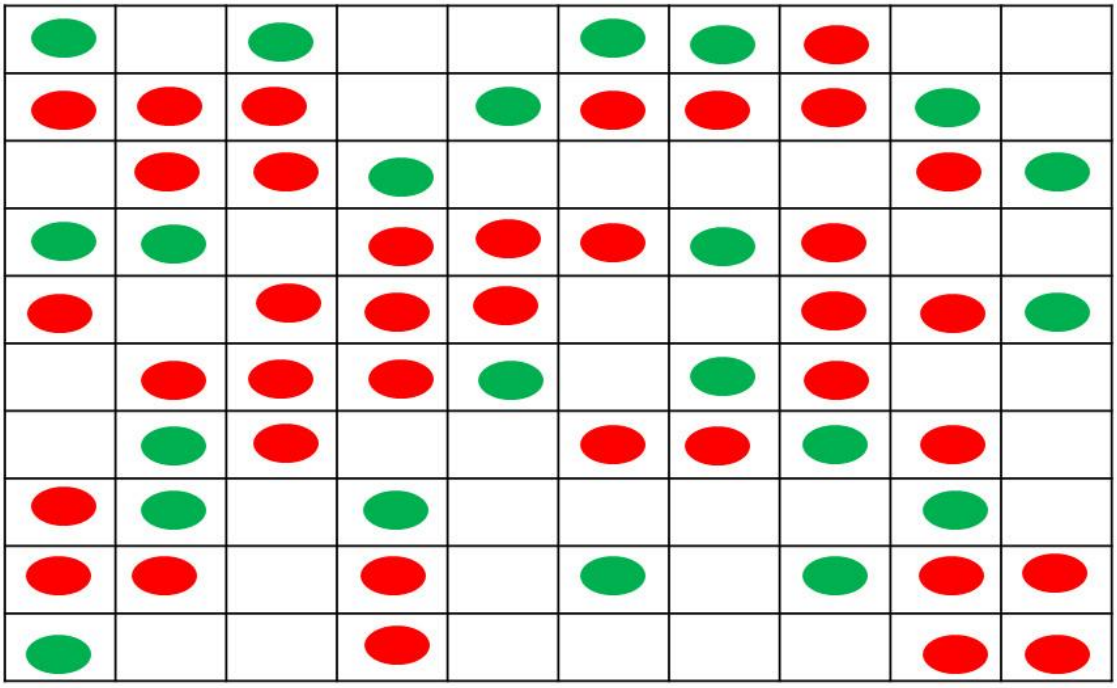


In fact, because of the resistance, a number of micro-organisms will survive disinfection. A disinfectant has no aftereffect, so after a few minutes the survivors will begin to regrow. They now suddenly have a lot of space (the vacant spots of eliminated microorganisms), a lot of food (the eliminated(dead) micro-organisms themselves serve as a food source) and moisture (come with the disinfectants).

Since resistant harmful germs can survive a disinfection attack, and therefore regrow much faster any disinfection will result in a microbial community that contains more and more resistant harmful germs. Again, this new microbial community will stabilize itself using a safety margin to ensure that they do not occupy all the places so they can survive as long as possible.

After a number of disinfections the new microbial community that has even more harmful microbes will look like the following diagram:

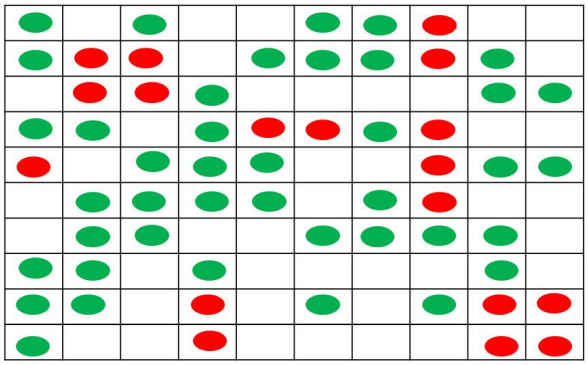
DIAGRAM 3 (Total 100: 22 good, 38 bad, 41 empty)



For clarification we compare the diagram of the natural microflora (Diagram 1) to the diagram showing the microflora after disinfection (Diagram 3):

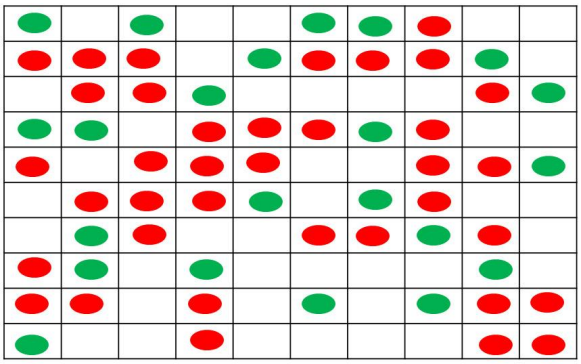
Natural microflora

(Total 100: 42 good, 18 bad, 41 empty)



Microflora after disinfection

(Total 100: 22 good, 38 bad, 41 empty)



Both surfaces still have the same quantity of micro-organisms but the total number of harmful microbes is, because of the resistance problems, much higher when disinfection protocols are used.

As we use more disinfection, more harmful microbes are found. This is the disinfection paradox.

3. Probiotic cleaning and hygiene

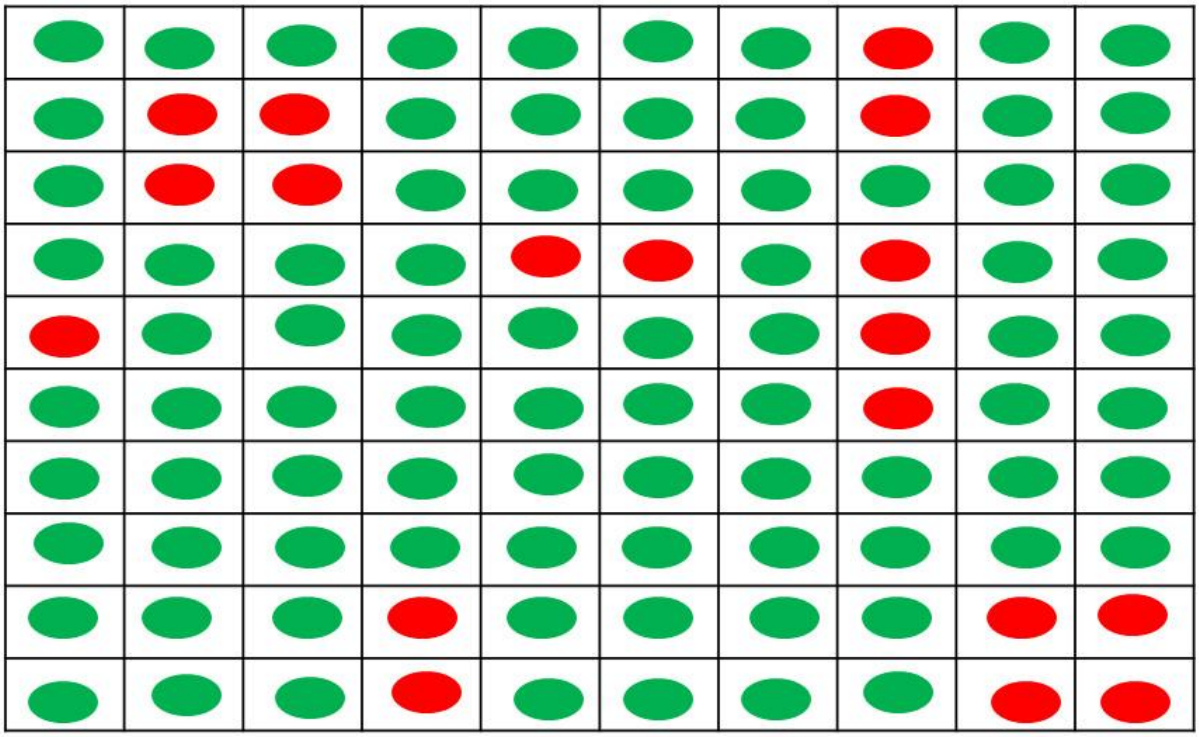
Chrisal for many years has been aware of the problem of resistance, and after years of research has found a solution. This solution makes use of nature. There are good micro-organisms, also known as **probiotics**, which are used to form a healthy microflora and maintain it.

3.1 How does it work ?

Chrisal has developed a series of probiotic cleaners that provide a layer of good micro-organisms that act on the surface during and after use. Wondering how you can solve the problems with harmful micro-organisms by adding a lot of extra bacteria? The microbial community through its own dynamics (as explained in section 1.3) provides the solution.

We take again a surface where food, moisture and space is available to keep a microbial community of up to 100 micro-organisms alive. **Immediately after the first probiotic cleaning**, the probiotics will occupy all the empty places on the surface. No other micro-organisms are killed or replaced, there is only the addition of good micro-organisms (probiotics) on the surface. The microbial community will look like this:

DIAGRAM 4 (Total 100: 82 good, 18 bad, 0 empty)

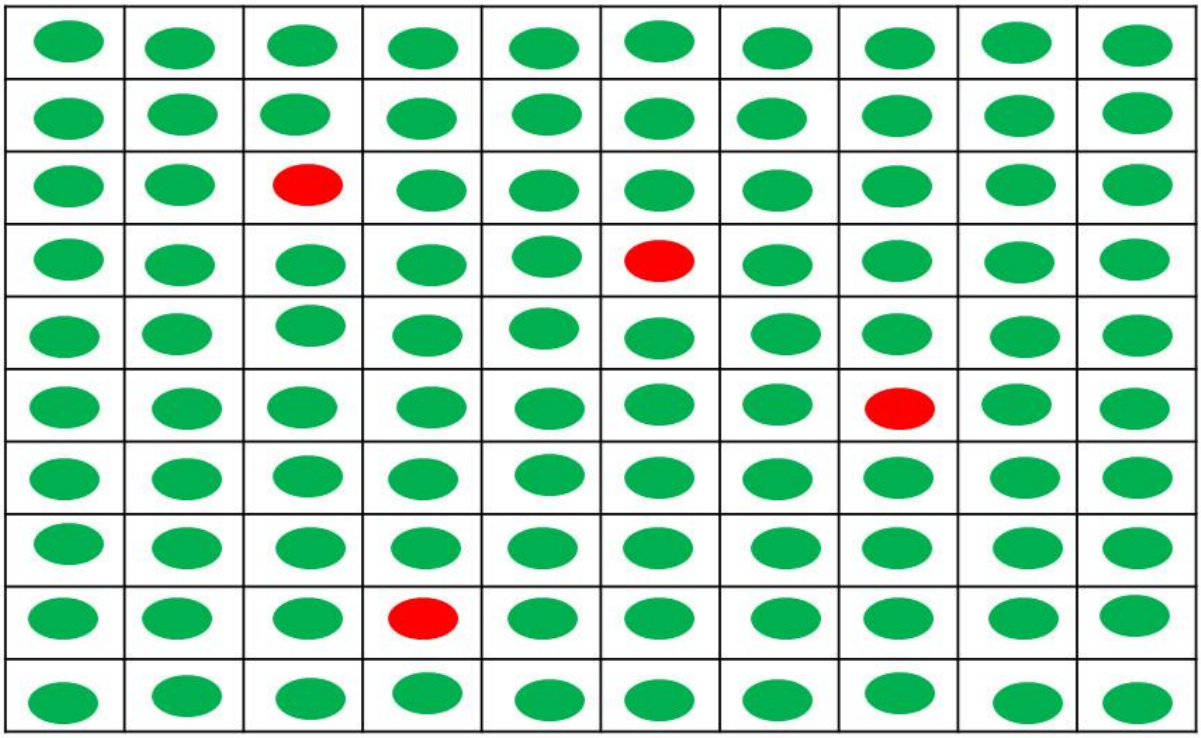


The surface is now ocuppied with the maximum of 100 micro-organisms. What happens thereafter is revolutionary.

Since the maximum 100 micro-organisms on the surface is immediately reached, the micro-organisms send out a **signal (quorum sensing) in order to reduce their activity**. Already after a few days, a large number of micro-organisms have died of old age and by the reduced activity, no new micro-organisms are quickly replaced. This state is maintained on the microbial community untill their number is decreased again to below 100 micro-organisms. Only then, will they switch back to normal activity. However, as a new charge of good microorganisms is added on each probiotic cleanining, despite the decreased activity of the microbial community, their numbers never fall below 100. The probiotic cleaning keeps the number of micro-organisms to 100 or more.

By continuing to use probiotic cleaning, the original microbial community will thus be forced to continuously decreased activity, so that the original micro-organisms will disappear with age from the community. After several cleanings, the probiotic microbial community will be changed as follows:

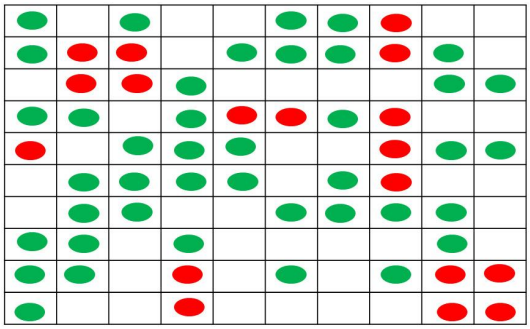
DIAGRAM 5 (Total 100: 96 good, 4 bad, 0 empty)



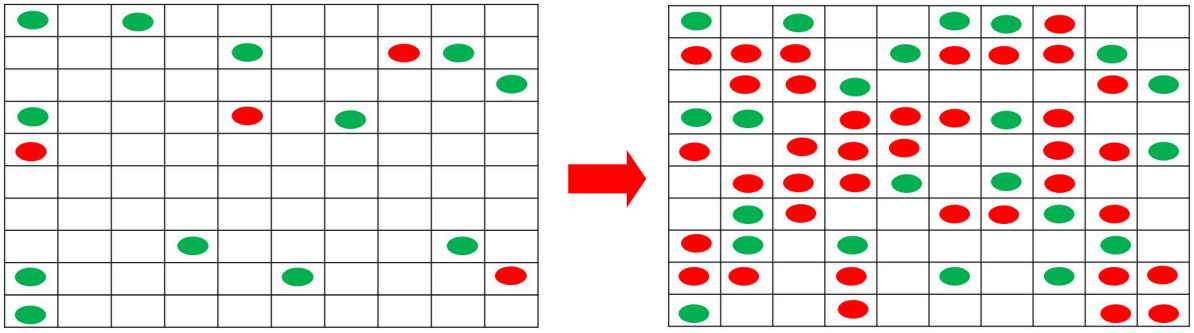
This surface has been largely occupied with good micro-organisms, and this has been achieved without having to use biocidal chemistry. We rely on the self-regulating effect of nature to obtain healthy microflora with probiotics.

We would like to show the different situations together as a comparison:

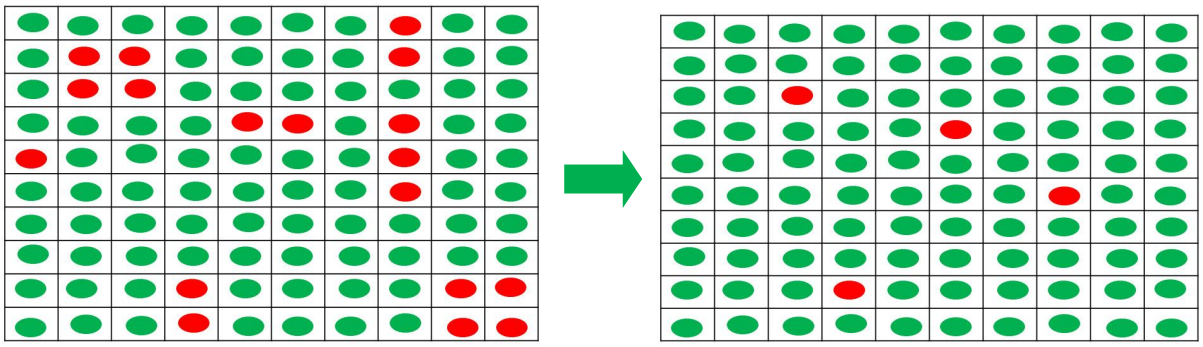
The starting situation, a natural microflora:



Chemical cleaning and disinfection (immediate effect on the left and final effect on the right)



Probiotic cleaning (immediate effect on the left and final effect on the right)



For our theoretichal surface of 100 availale spots the end result is:

disinfection: **(22 good, 38 bad, 41 empty)**

probiotic cleaning: **(96 good, 4 bad, 0 empty)**

Thus, it is clear that through the use of probiotic cleaning, a healthy microflora is created, without killing harmful micro-organisms.

3.2 What are the benefits?

The most important advantage of probiotic cleaning was made clear from the above explanations, namely, the installation of a healthy microflora which remains healthy as long as the probiotic cleaning is applied. We know from experience that some questions are always made, such as those below.

- **Don't the harmful germs become resistant to probiotics?**

  No, the microorganisms can not become resistant to other microorganisms, only to chemicals that threaten them. There are no biocide chemicals in the probiotic cleaning, so no resistance.

- **Are the probiotics safe?**

  Definitely. The probiotics used by Chrisal are internationally approved for use in food. Moreover, Chrisal performs some additional tests to be absolutely sure.

- **Why don't we stop with cleaning to maintain the natural microflora?**

  There are places where people and animals live together or are simply dirty, which creates an additional burden on microbial space. In these places, it must be cleaned in order to keep the situation livable. Therefore, better probiotic cleaning than chemical.

- **Is it a lot of work to apply probiotic cleaning?**

  Not more than with regular cleaning. You use the products just like the other products, with a minimum of twice a week for optimal effect.

Besides the great advantage in terms of microbiology, the probiotic cleaners have many other advantages, such as:

- **Deep cleaning**: The probiotics remove dirt and biofilm deep into the surface.
- **Odor control**: odors are often formed by undesirable micro-organisms, also these are replaced by the probiotics that don't produce odors.
- **Safety**: Unlike many of the chemical cleaners and disinfectants, the probiotic products are very safe to use.
- **Environment**: the probiotics are not only 100% natural, but they actively collaborate when it comes to wastewater treatment. They are environment enhancing instead of only environment friendly.

More information and details about these benefits of probiotic cleaning can be found in other documents of Chrisal NV. Contact us for more information.

Resolution

With probiotic cleaning Chrisal has introduced a true revolution, and found a proven solution to the growing problems with resistant microorganisms. The excellent performance in terms of cleaning, coupled with their safety, durability and environmental friendliness, ensure these products provide sustainable sanitation which we all need.

Over the next years this technology will be applied in more and more sectors. You can help us build a more sustainable future!

Contact

For all your questions and remarks we are available. Contact us through one of the below channels:

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Together providing sustainability