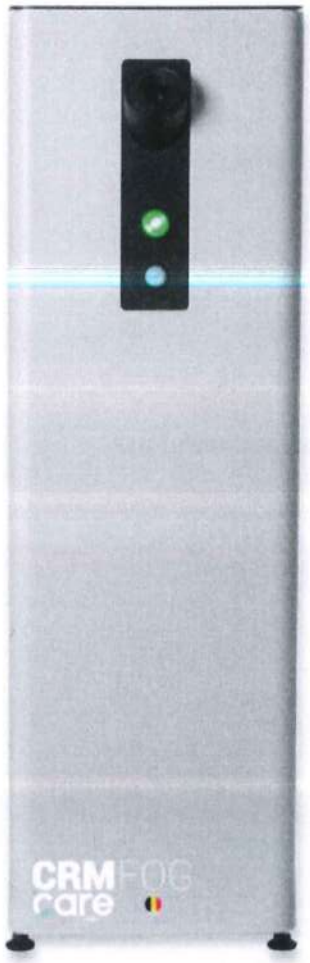
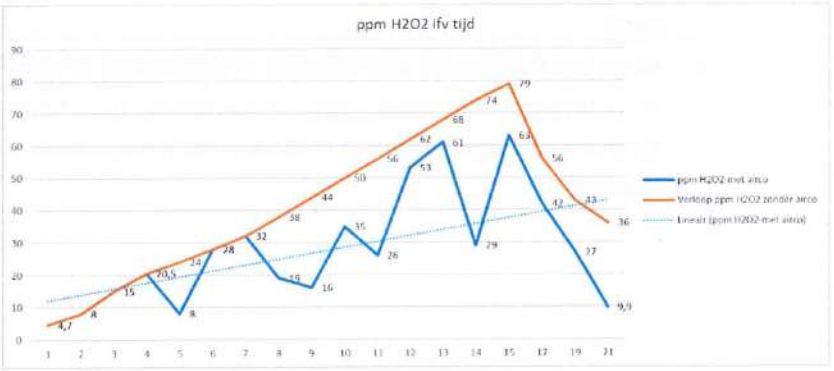
CRM FOG



Dry nebulised stabilised hydrogen peroxide as the prime oxidising agent and pre-eminent disinfectant in the fight against all micro-organisms

Effectiveness and advantages of the CRM.Fog including the associated lab tests



CRMFOG

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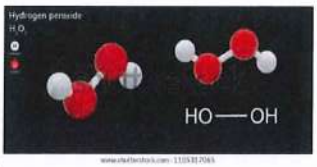
A. Preface - What you should know about "Disinfecting with... "

1. What is hydrogen peroxide, or H_2O_2?

This is a water molecule (H_2O) with one extra O-atom.



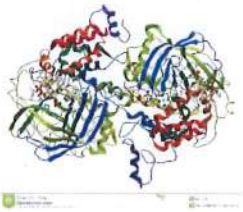
This molecule is unstable, and can disintegrate in different ways:

Either: Hydrogen peroxide disintegrates into water and oxygen: $H_2O_2 \rightarrow H_2O + O_2$
(by electron transfer = redox reaction)

This occurs naturally, for example in a bottle of hydrogen peroxide dissolved in water - So: in order to store it, it must be stabilised in some way.
For this purpose, Ag ions (Ag+) are added, which act as a catalyst to slow down the process in which H_2O2 decomposes into $H_2O + O_2$ (stabiliser).

(see below: **stabilised hydrogen peroxide**)

Conversely, this also happens in the liver, for example, when alcohol and other substances are rendered harmless, whereby the by-product hydrogen peroxide is released and is broken down by the enzyme catalase.



In all these reactions, H_2O_2 is simply broken down, without any side effects apart from the release of heat (exothermic reaction).

Or: When "impurities" are added to the mixture of H_2O_2 in water, that peroxide molecule will easily decompose **into free radicals**, being hydroxyl radicals (OH°).

$H_2O_2 \rightarrow 2\ OH°$

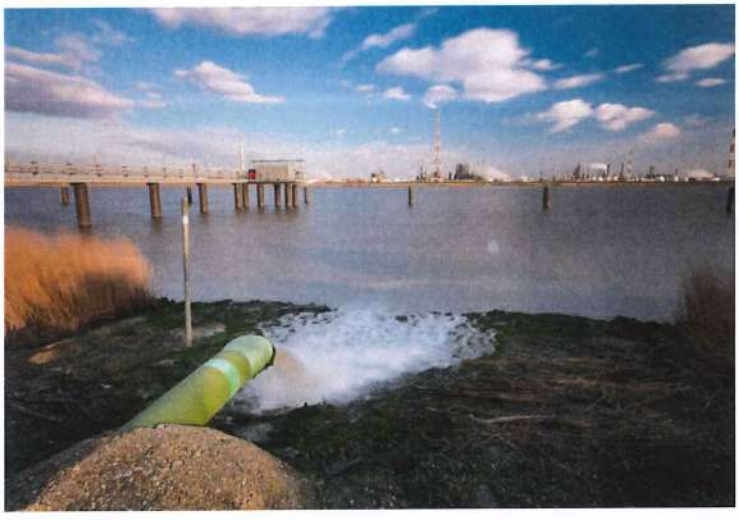
These highly **aggressive free radicals** will cause a **chain reaction** in which **an avalanche of other radicals** (originating from O_2 and H_2O) are formed in the mixture (formation of O° and OH° radicals). **The so-called OXIDANTS.**

This avalanche of aggressive radicals will attack "anything susceptible to oxidation", with varying consequences.

Examples are:

- Attack on contaminants, e.g. metal and organic contaminants – these will disappear (see image)
- Attack on pigments - which will cause e.g. linen to lose colour.
- The formation of steroids and other molecules in the human body
- **Attack on micro-organisms, e.g. bacteria, fungi, spores and viruses will be killed.**

As is often the case, the oxidants can have both positive and negative effects. Especially in the human body when - due to all kinds of causes such as smoking, too much alcohol, synthetic sugars, stress, lack of exercise, etc. - too many oxidants (free radicals) are formed, which can lead to (rapid) ageing and diseases.



Let us continue with the way hydrogen peroxide attacks micro-organisms.

2. Effects of H_2O_2 on micro-organisms.

2.1 The effect of hydrogen peroxide is mainly based on oxidation.

Everyone is familiar with the rusting of iron (Fe) under the influence of water and air (oxygen).

$Fe + O_2 \rightarrow Fe_2O_3$ (= rust) - Iron rusts due to a reaction with oxygen.
This is a classic example of oxidation by oxygen.

The generated substance (rust) has completely different properties than the original substance iron!
In other words, oxidation of substances can have devastating effects!
Oxygen (or its free radicals) is one of the strongest oxidisers, so its effects can be gigantic, the so-called oxygen bomb (*)!

Thus, micro-organisms are killed, namely by oxidationof proteins and especially lipids (fats) from which they are built.

For example, **Covid-19** is easily killed by H_2O_2 because it is an enveloped virus, i.e. it has a fat mantle covered with spikes. Fat molecules are oxidised (or broken down) very easily, causing the virus to

"explode" and thus be killed.

Furthermore, the RNA/DNA of the virus can also be broken down or disrupted because it gets penetrated by radicals, which causes the virus to be completely switched off.

2.2 The effectiveness of H_2O_2 depends on 5 factors, namely:

- **pH**

- the presence of **catalysts**, e.g. certain metallic catalysts like Fe, Cu, Mn etc. can speed up the conversion of H_2O_2 into OH-radicals, which are even stronger oxidisers than H_2O_2, and consequently speed up the reactions!
  The oxidation potential of H_2O_2 is just under that of OZONE but higher than Cl_2 and ClO_2. (See image below)
  This is the reason why H_2O_2 is transported in polyethylene, stainless steel or aluminium containers (with metal containers, this could lead to powerful explosions at high concentrations, due to the exothermic chemical reaction).

- Temperature - Higher T causes an increased decomposition and therefore a reduced **effectiveness** of H_2O_2 (the effect disappears) - between 20° and 100° C this is accelerated 2.2 x with every 10° C increase.

- the concentration of H_2O_2

- and the reaction time (the time during which the H_2O_2 reacts).

-

  (*) Oxygen disintegrates easily into free radicals, albeit covalently bonded, for a special reason (quantum mechanics), which we will not go into here.

3. Overview of some oxidants

3.1 General

In addition to metal catalysts, ozone or UV light in combination with H_2O_2 is also used to form highly reactive O-radicals - e.g. peroxone (i.e. H_2O_2 with O_3) or with UV light. This is used to remove very strong contaminants in groundwater or industrial wastewater, traces of organic material.

Again, by means of **OXIDATION**. Strong oxidising agents are therefore important in everything that has to do with disinfecting, cleaning, decontaminating... think of the use of Chlorine tablets for disinfecting water in a swimming pool (see below Cl_2).

Image: Overview of strong oxidising agents:

Oxidising agent	Oxidation potential
Fluorine	3
Hydroxyl radicals	2,8
Ozone	2,1
H_2O_2	1,8
KMnO4	1,7
ClO_2	1,5
Cl_2	1,4

The disinfection rate (the extent to which the pathogens are killed) directly depends on the oxidation rate or oxidation potential.

However, a strong oxidation agent is not always (suited as) a strong disinfection agent or disinfectant (= an agent that efficiently kills pathogens).

3.2 H_2O_2 is both: a strong OXIDANT as well as a strong DISINFECTANT.

a) As an OXIDANT: H_2O_2 is deployed to remove easily **oxidisable contaminations** (e.g. Fe en sulphides) as well as contaminations that are hard to oxidise (e.g. solvents, petrol and pesticides)!
Also for bleaching, since it attacks pigmentations with its free radicals (it is used to bleach hair and textiles or for whitening teeth).
It can also be used to prevent loss of colour and taste, limescale, corrosion, by breaking down contaminants such as Fe, Mn, Sulfates.

b) As a DISINFECTANT against e.g. enveloped viruses through the free O and OH radicals that can oxidise the membrane wall (fat mantle) and/or simply attack and tear open the cell wall aggressively (in bacteria) and then penetrate and destroy the DNA/RNA (highly biocidal). Especially when using **stabilised** H_2O_2 (see below).

4. Overview of disinfectants and their effect

4.1 General

This table illustrates once again the position of H_2O_2 as compared to the various other commonly used disinfectants.

Table 2: disinfectant effectiveness spectrum

DISINFECTANT	APPLICATION CONCENTRATION	1	2	3	4A	4B	5	6
Alcohols	60-90%							
-ethanol		+	-	+	+	+	+	+
-isopropanol		+	-	+	+	-	+	+
Biguanides								
-chlorhexidine	0,1 – 1 (4)%	-	-	-	-	-	-	-
Iodine compounds								
-iodine	1% in ethanol 70%	+	±	+	+	+	+	+
-povidone iodine	0,1 – 10%	+	-	±	+	+	±	+
Chlorine compounds	250-1000 ppm							
-sodium hypochlorite	Free chlorine	+	±	±*	+*	+*	±	+
-sodium dichloroisocyanurate		+	±	±*	+*	+*	±	+
-tosylchloramide		+	±	-	+	+	-	±
Aldehydes								
-glutaraldehyde	2%	+	+	±**	+	+	+	+
Phenols								
-various preparations	Depending on the preparation	+	-	+	+	-	+	+
Peroxides								
-hydrogen peroxide	3%	+	±	+	+	+	+	+
-peracetic acid	0.01% to 0.2%	+	+	+	+	+	+	+
Quaternary ammonium compounds								
-various preparations	Depending on the preparation	+	-	-	+	-	±	+

Legend to table 2

+ = effective
± = lower effectiveness or incomplete spectrum
- = not effective
*= 1000 ppm: +
** = at 50° C: +

1 = vegetative bacteria
2= bacterial spores
3 = mycobacteria
4a = lipophilic viruses
4b = hydrophilic viruses
5 = fungi
6 = yeasts

What are "mycobacteria"?

They mainly cause respiratory infections, e.g. TB.
But also, leprosy and others.
The risk groups are mainly: elderly people, people with chronic conditions or with reduced resistance.

What is peracetic acid (PAA)?

This is a substance composed of H_2O_2 and acetic acid.

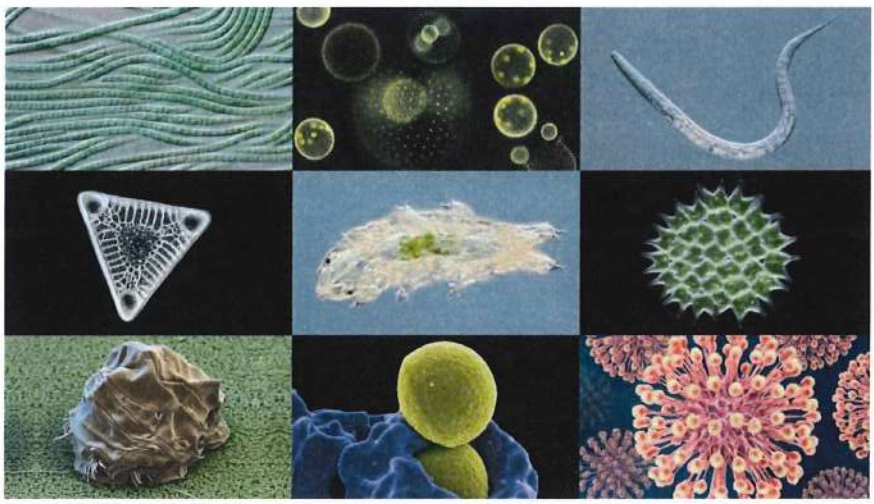
Advantages of stabilised H_2O_2 as compared to PAA?

The stabilised form of H_2O_2 is a much stronger oxidiser and therefore a stronger disinfectant than PAA.

Hydrogen peroxide with a concentration above 10 % is a very efficient killer of bacterial spores.

4.2 CONCLUSION on H_2O_2 as a disinfectant (biocide):

Provided the concentration is sufficiently high, hydrogen peroxide is a universal broad-spectrum microbiocide.
The CRM.Fog uses concentrations of H_2O_2 between 6 and 12.5 %, which is more than enough to be an effective KILLING agent.



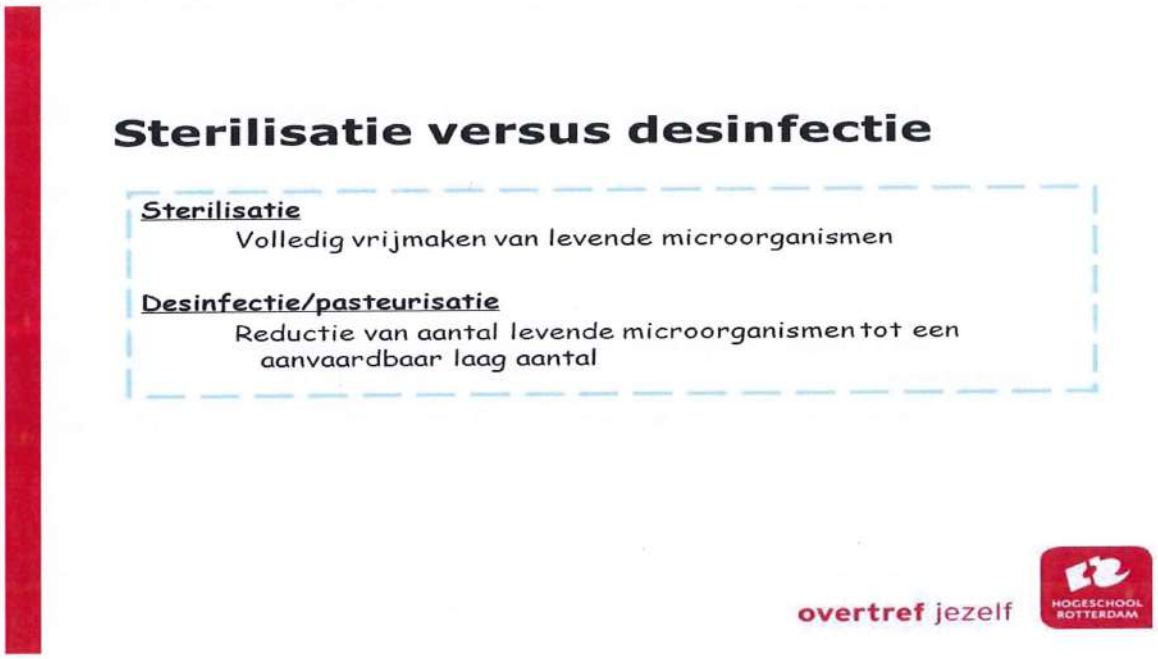
4.3 Difference between sterilisation and disinfection?

When **cleaning**, you remove visible filth such as dust, food residues and other particles from a surface. You can do this, for example, by sweeping, vacuuming or washing. By cleaning you reduce the number of (potential) germs on a surface. But beware! You do not kill those germs. It is therefore important to clean regularly, because otherwise the germs will reappear.

When you **disinfect or decontaminate**, you kill the bacteria on a surface. However, this only makes sense **after** you have cleaned that surface. Therefore, always wipe a surface with a cloth and soap, before disinfecting it. To this end, use an approved disinfectant. This means that it must kill 99.9 % of the test bacteria within 30 seconds. By disinfecting you reduce the growth of the number of harmful fungi, viruses and bacteria, but you do not kill them all. So, for disinfecting too, you need to repeat this several times (a day), because otherwise the harmful micro-organisms will quickly reappear.

Sterilisation is a stronger form of disinfection, which is mainly used **for cleaning medical tools** (killing effect of min. 99.9999 %).

This is called 6-log reduction, or an effectiveness of 99.9999 % in killing the pathogen or germs.



5. What are the factors involved in the survival rate of a bacterium/virus?

It depends: in the air or on a surface?

5.1 On a surface:

As a rule of thumb: half of the viruses dies within 3 days, on a surface (e.g. plastic, glass, aluminium, ...)

Through scientific research we have gained an ever better understanding of the fact that viruses, bacteria etc. survive for the longest time on absorbent materials and on stainless steel.

On stainless steel: this is logic, since this substance and anything on it (e.g. viruses) cannot oxidise - measurements have shown that viruses can survive for several weeks.

A virus can survive for up to 28 days, especially if relative humidity is low (< 30 %).

Absorbing/porous surfaces (e.g. untreated parquet, cardboard, etc.) **transmit fewer pathogens** than smooth surfaces. This is due to the fact that porous surfaces absorb the pathogens and therefore retain them for a longer time.
On contact with this type of surface, pathogens will not rub off as easily as on smooth surfaces.

On/in absorbing materials, such as parquet, cardboard, bedding, curtains, they can also hide better and as such are less exposed to the aggressive radicals in the air, being O and OH radicals.

A metal with EXTREMELY high merits in the eradication of pathogens (bacteria and viruses) is **COPPER** (Cu).
Pathogens that land on Cu will be killed in the shortest of times (a few tens of minutes), for a completely different reason: **Cu is a very good oxidant** – and therefore has very strong antimicrobial and antiviral properties! (See below).

5.3 In the air

In general, the following factors are important:

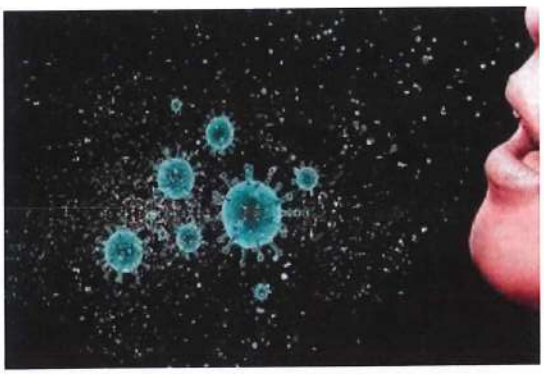
Temperature

Atmospheric humidity

Supply of fresh air (e.g. via ventilation)

Good to know: When an infected person sneezes, and thus releases viruses, aerosols are created (water droplets containing viruses).

In the case of large aerosols, these fall immediately to the ground (within 1.5 to 3 m) - the light ones can float around in the air for a long time and are therefore absorbed in the lungs through our respiration.



1° Temperature:

Low temperature promotes the survival of a virus.

Think of the virus: Influenza or flu (from the Italian: influenza di freddo or cold virus)

Reason: When temperature is low, the outside air usually becomes drier because during freezing the water droplets are "removed" from the air, e.g. by forming snow that falls down.

So, the air gets drier, the air droplets with the viruses evaporate faster and grow lighter. This allows these lighter droplets to float around more easily and for a longer time, so they survive longer and have a greater chance of being inhaled, which leads to a higher risk of contamination (see above). So, by low temperatures, and certainly with freezing temperatures, the air dries quickly, which causes the relative humidity to drop. This brings us to the next VERY IMPORTANT factor in virus control: the RELATIVE HUMIDITY!

This is a general fact, eg. with the herpes virus in horses too, the virus can travel long distances in this way, even from one stable to another much further away - partly also due to the fact that the herpes virus is a small, light virus.

2° Relative atmospheric humidity (RH):

The occurrence of pathogens or germs in the air, and therefore also in our lungs (in other words the risk of becoming ill by inhaling viruses, etc.), is very much determined by the Relative Humidity (RH) - especially with viruses.

First and foremost: the concentration of viruses that a person ingests and that remain present in the body, determines whether or not this person gets ill. If the amount of remaining viruses is small, the immune system will eliminate them.

Scientists have believed for a long time that either high OR low RH was conducive to the survival of viruses, or therefore to getting ill.

However, new insights (research by German and Indian researchers on the flu virus, SARS-cov-1, MERS, SARS-cov-2) teach us: both too low an RH (< 30 %) and too high an RH (> 80 %) are extremely conducive to the survival of these viruses.

This is because the thickness of the alveolar mucus layer in our lungs is determined by the RH in the air surrounding us.

The lower the RH, the thinner the mucus layer, making it more difficult for the cilia in that mucus layer to evacuate (which is their transport function) the mucus containing any possible viruses or bacteria (legionella).
The amount of pathogens in the lungs increases, and so does the risk of infection.

Furthermore: the danger of these small droplets, because of a low RH in a room, is that they can penetrate deeply into the lungs.

Conversely, if the RH is too high, the mucus layer is thicker, and the transport function of the cilia again cannot do its job.

This is not only true for the lungs, but also with the occurrence of sinusitis - the inside of the sinuses is surrounded with mucus membrane and cilia - with the same function of providing protection against foreign bodies and germs.

Furthermore, extreme humidity leads to mould formation and a greater risk of legionella infections.

Note: in an indoor space one needs to keep an eye on Temperature (T) as well as RH, because in this case higher T usually leads to lower RH. That way, a higher T in an indoor space has the opposite effect of a higher T in the outside air - usually far above freezing point, a higher T in the outside air will cause higher atmospheric humidity, because there is enough water present.

3. Supply of fresh air (e.g. via ventilation)

The importance of ventilation is well known, specifically the fact that good ventilation is paramount for reducing the concentration of germs.

The lower the concentration of germs e.g. viruses in the air, the smaller the risk of inhaling large amounts, and the smaller the risk of getting ill.

This can best be measured with a CO_2 meter. The more we breathe, the more CO_2 is released into the air and, with this, the concentration of viruses exhaled by an infected person.

So, keep an eye on CO_2 concentrations, **and ventilate in time**.

PS: A good ventilation is not only important to reduce the concentration in germs, but also to evacuate harmful gases, such as CO_2 itself, hydrazine, etc.

CONCLUSION:

There is not much we can do about the outside temperature, so the annual recurrence of certain viruses, e.g. the flu, especially in winter, is nearly inevitable.

Inside temperature is normally around 20° C, so this is also a factor that we have little control over in the struggle against viruses.

On the other hand: the most important factor that we do have control over, is the RELATIVE HUMIDITY as well as VENTILATION of the air, and the DISINFECTION of surfaces (for inside spaces).

Specifically:

a) **Ideally, to prevent viral infections, humidity should be between 40 and 60 %** - there is little chance that the RH will be too high (above 80%).

b) **Ventilation systems without extra humidifiers will most of the time cause the air to be too dry.**
Therefore, it is usually far more important to have a humidity meter checking the indoor air, than a CO_2 meter.
Most ventilation systems dry the air: fresh cold air is drawn in from the outside, then heated, which dries out the air, providing an excellent environment for viruses.
If you do not have ventilation: DO NOT WORRY, just provide natural ventilation by regularly opening the windows, especially after busy meetings with a lot of people.
Because ventilation tends to be very expensive, both in purchase/installation and in consumption (heating).

c) **Disinfection of surfaces deserves our special attention, especially those surfaces touched by many people, door handles, toilet seats, etc., to which not only viruses can stick, but also all other micro-organisms.**

What to do with: the presence of porous objects, such as paper, cardboard but especially parquet floor (can lower the RH considerably by absorbing water vapour from the air).

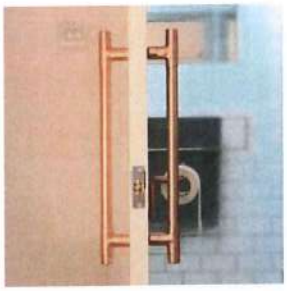
Solution: Our CRM.Fog offers the PERFECT SOLUTION for this (see below).

5.2 What's so special about Cu? Also called "Killing Copper".

More and more people fall victim to bacteria that are resistant to all known antibiotics. Hospital infections in particular are becoming more and more common, but there is a method that is very simple, effective and efficient. Use as many copper objects as possible, as our ancestors did, especially for those objects you frequently have to touch, like door handles etc.

Even in ancient times, people knew its excellent antibacterial properties in medication and disinfection.





Both bacteria - also those resistant to antibiotics - and especially viruses are killed quickly in contact with Cu on door handles, taps, light switches and other surfaces (those surfaces that are touched by lots of people).

Lab tests have shown that copper kills up to 10 million MRSA-bacteria (hospital bacteria) per m^2 in no more than 90 minutes!

So, let us cover plastic objects with a layer of copper, and we will achieve the same effect! Copper alloys also are very effective, the more copper, the better.

Reasons for this: Copper ions (as a precious metal) change the permeability of the membrane of viruses, **again through oxidation**, and then penetrate them.

One drawback, though: some people are allergic to copper.

Since the structure of the influenza and Ebola virus is very similar to that of Covid-19, these are also quickly killed with Cu (viruses with envelope - see below).

Antivirale werking van Koper op COVID-19, een informatieve samenvatting.

Prof. Dr. Patrick Lievens

Koper kan vele infectueuze virussen doden, zoals bronchitis virus, poliovirus, human immunodeficiency virus type 1(HIV-1) en andere omhulde of niet omhulde, enkel- of dubbel-gewikkeld DNA en RNA virussen, waaronder het coronavirus COVID-19.
Door elektrolyse van koperelektroden worden koperionen in het zwembadwater opgelost wat resulteert in een sterke antivirale werking inclusief het COVID-19.
De synergetische werking van Koper en Chloor maakt het mogelijk om met lage chloorconcentraties een hoge ontsmettingsgraad tegen o.a. dit type virussen te bereiken.

1. Antivirale werking van Koper:

Koper heeft een krachtige antivirale werking:

- Koperionen veranderen de permeabiliteit van het membraan. Ze dringen daarna binnen in het virus.

- Koper heeft een vrij elektron in zijn buitenste schil van elektronen dat gemakkelijk deelneemt aan oxidatiereductiereacties (waardoor het metaal trouwens ook een goede geleider is).
  Via deze redoxreacties (reductie van Cu^{2+} naar Cu^{1+}) is het in staat om vrije radicalen ('moleculaire zuurstofgranaat') te vormen. Deze reageren met de lipiden in het celmembraan waardoor dit verder beschadigd wordt. Bovendien kunnen deze radicalen het RNA in het virus beschadigen.
  Zilver en goud hebben dat vrije elektron niet, zij zijn dus minder reactief.

- Koperionen interfereren met de werking van proteïnen door de structuur te veranderen of de werking ervan te inhiberen door te binden met actieve plaatsen.
  Coronavirussen danken hun naam aan de eiwitten (proteïnen) die als een kroon op hun mantel zitten. Om een menselijke cel te infecteren, gebruiken coronavirussen deze spike-eiwitten.
  Zeker bij deze categorie van virussen verwachten we extra effecten omdat koper de essentiële metalen in de structuur van die proteïnen verdringt en vervangt, waardoor de rol van die proteïnen uitgeschakeld wordt en waardoor dus de capaciteit om te binden met humane receptoren verloren gaat.

2. Studies met Koper in combinatie met Chloor in zwembadwater

Er werden studies uitgevoerd waarbij koperionisatie gecombineerd werd met een verlaagde chloorconcentratie in zwembaden, waaruit bleek dat er een synergie is tussen koper en chloor waardoor de efficiëntie van het chloor verhoogt.

3. Koper in oppervlakken

Het nieuwe coronavirus is zeer gevoelig voor koperen oppervlakken. Op alle onderzochte oppervlakken, Teflon, PVC, keramiek, glas, siliconenrubber en roestvrij staal, was het virus nog na meerdere dagen actief. Op oppervlakken die bestonden uit koper of uit legeringen bestaande uit minstens 60 procent koper, werd het virus binnen enkele minuten geïnactiveerd .

Prof. Dr. PATRICK LIEVENS
vrijdag 26 juni 2020

Referenties : op aanvraag

B. What is nebulising and how to proceed with it. Advantages and disadvantages

1. Disinfecting/decontaminating/sterilising through nebulising.

How do we best proceed to "mix" those bacteria, viruses, etc. with the H_2O_2 in order to kill them, in other words to achieve **disinfection**?

As everyone knows, a room where an Ebola patient has been nursed must be thoroughly disinfected before it can be released for future use.

Manual disinfection of the room is not a viable option, because of the risk to the staff. Moreover, manual cleaning does not guarantee that all contaminated surfaces can actually be reached.
A thorough disinfection can only be achieved with the use of a disinfectant in the form of a gas or vapour.

Besides nebulising with for instance H_2O_2, there are other methods with the less secure UV-machines, Ozone machines, etc. (see below).

The preferred method uses hydrogen peroxide in vapour form - to achieve this we need to dissolve the hydrogen peroxide in water, and then evaporate it into small droplets, in other words: **to nebulise, fog or fogger it**.
The machine used for this, is a **nebuliser or fogger**.

The effect of hydrogen peroxide is mainly based on the **oxidation** of the pathogen or disease-causing micro-organism.

With the necessary precautions, the substance can be safely used. One can find numerous methods described and assessed as very effective in the international literature.

The effectiveness with regard to the different pathogens differs slightly, but hydrogen peroxide is a broad-spectrum disinfectant for all micro-organisms, including bacteria, viruses, fungi, yeasts and spores, in other words it is a virucide, bactericide and fungicide.

Is a fogger a medical device?

"No, only products that are specifically intended for the disinfection of medical devices are considered to be medical devices and may be CE marked under the medical device regulations. Products that are intended to be used as multi-purpose hard surface disinfectants/cleansers and/or general environmental disinfectants are not considered to come within the remit of the medical device regulations. There is no provision under the medical device regulations for disinfectants labelled primarily for use with medical devices with subsidiary claims for multi-purpose use, therefore such products should be marked separately under the different sets of legislation." In some parts of the EU, it is not necessary to market separately, the assumption being that the user recognises that the CE rating applies only to the medical device.

In other words: the fogger is not a medical device and thus not subject to that specific regulation.

2. What's special about a device that disinfects by nebulising with water vapour and silver ions (Ag+ ions)?

Wet nebulisers based on Ag+ have existed long before the Covid period. These nebulise wet water vapour with Ag+ ions in it, but what's so special about that?

This kind of humidifier already allows disinfection **to a limited extent** - moreover, this works only **very locally around the evaporator**, since this emits a wet vapour (see below).

After the Covid-19 outbreak there has been recent scientific research that showed the reason of the exceptional "disinfection properties of the air" of this method.

Surprising trick: Silver(ions) disrupt the way certain bacteria move (the flagella as whip-like engines that the bacteria use to move) and causes them to die from lack of food – this trick has been used for a long time but has only just recently obtained a scientific explanation.
These flagella get stuck - their movement slows down and often changes direction.

Ag+ was used as an antibacterial layer on the International Space Station (ISS).

Furthermore: not all bacteria have flagella - but on both bacteria and viruses, Ag can also hit the cell wall of these micro-organisms as a bomb, damaging and penetrating it, causing them to explode, as it were.
Especially when H_2O_2 is nebulised with Ag ions, the Ag ions coat themselves with a layer of H_2O_2, so that they hit the micro-organisms like a bomb.

3. What are the factors affecting the effectiveness of disinfection/sterilisation with a nebuliser?

These are important factors:

1° Temperature and pH
This is less important, due to the fact that we use stabilised H_2O_2.

2° The biocide itself
With stabilised H_2O_2 we achieve the highest killing rate.

3° The nebuliser/fogger used
With our CRM.Fog with super small aerosol and its pressure gradient we achieve the highest standard for killing pathogens (see below).

4° The nature of the surface
Plays a crucial part with regards to the survival time (see pt A.5) of a virus/bacterium as well as with killing it through nebulisation.

If porous surfaces, e.g. untreated parquet, cardboard, etc., are present in a room, we will have to fog more intensively, because the nebulised biocide is quickly and strongly absorbed by those surfaces, so that the remaining concentration in the air and therefore also on the other surfaces decreases sharply.

Solution:
Increase the fogging time - with up to 35 % (see measurements below).

4. Advantages and disadvantages of combining the use of a biocide with nebulisation

Nebulisation is always done with a biocide that has an oxidising effect, e.g. H_2O_2 (very strong oxidiser).

The only drawback: Since it can have an irritating effect on the eyes, upper airways and mucous membranes, it is not recommended to nebulise (fog or fogger) in the presence of humans or animals!

Advantages of nebulisation with H_2O_2:

a) **No bio-accumulation** - no absorption of the biocide by the product - ECOCERT CERTIFIED or BIODEGRADABLE;
b) **No residue formation** - finally H_2O_2 turns into $H_2O + O_2$;
c) **Non-toxic;**
d) **Non-carcinogenic;**
e) **Non-corrosive in dry nebulising;**
f) Furthermore: always a better means of eradicating pests in horticulture as an alternative to chemical pesticides, because the insects **cannot build up resistance** to hydrogen peroxide – successful against spider mites, aphids and dark-winged fungus gnat larvae.

What then is the "harmful effect" of H2O2 comparable to?

With looking in the bright sunlight for a while: the longer and more intense the exposure, the more harmful, as there is the irritation of the eyes, upper respiratory tract, and mucous membranes. Contact with hydrogen peroxide will make the skin turn pale and at high concentrations it can cause painful blisters and burns.
To be clear: the CRM.Fog uses only a low concentration of 6 tot 12.5 % of H_2O_2, which is approved by the FPS Public Health (FOD Volksgezondheid).

Note: The corrosiveness obtained in the process water for horticulture by adding H_2O_2 depends on the amount of dissolved oxygen that is produced. Oxygen is corrosive to ferrous metals.
Copper parts, such as electrodes, can also act as a catalyst and be attacked by hydrogen peroxide vapour, when using **wet** nebulisation (see below), but not with dry nebulisation as with the CRM.Fog!

5. Why is a nebuliser superior in killing micro-organisms to air purifiers based on e.g. UV or Ozone?

In addition to nebulisers, there are also devices based on Ozone and UV radiation.

All these techniques also use oxidation.
So they are effective in itself, but since these may not radiate DIRECTLY on the air or surfaces (among others, they are carcinogenic), the active element must be used INDIRECTLY, i.e. enclosed in a device.

This only allows to suck in the air in a room.

So, **this type of device only allows disinfection of the air, not the surfaces!**

A nebuliser allows disinfection of the air as well as all surfaces.

As a result of the Covid-19 outbreak, it has very recently been scientifically established that many infections, both of viruses and bacteria, happen through the surfaces that people touch frequently, especially many different persons, e.g. in meeting rooms in companies.
Sources of contamination are therefore: door handles, shopping carts, toilets, conference tables, ATMs, chairs and tables, bed linen, etc.

Since the ambient air is sucked into the device to be disinfected by such a biocide (UV or Ozone), it suffers from the following **disadvantages compared to a nebuliser**:

a) **Much less effective in the fight against pathogens:** This device can NOT be used to disinfect surfaces, as the airflow is not strong enough to suck in the bacteria, and certainly not the viruses (a few 0.1 microns in size).
b) The substances used are toxic and carcinogenic – so they are not approved by the FPS Public Health.
c) Much shorter reaction time of such a UV device compared to that of a nebuliser, which is usually 1 hour or longer. Consequently, such a device kills less pathogens - **again: lower effectiveness.**

Hospitals are switching more and more to DIRECT UVc sources for sterilisation, but these are very expensive.

Ionisation devices are also being used, with the advantage that these are not toxic or carcinogenic, but they can also only be used to disinfect the air.

C. Different types of nebulisers and the CRM.Fog

1. How the CRM.Fog works

Not all nebulising devices with H_2O_2 are equally effective.
There are different methods, and a good dispersion in the air differs greatly depending on the method used.

The CRM.Fog, the fogger developed by the CRM Group in Waregem, has **3 special properties,** making its effectiveness one of the highest of all known foggers.

They are:

a) The biocide is **stabilised** H_2O_2
b) The use of **super-dry** mist
c) The **pressure** with which the vapour is being nebulised.

The effectiveness of our fogger is determined by:

a) The fact that we do not simply use hydrogen peroxide, but **STABILISED hydrogen peroxide - stabilised with silver ions (Ag+) - in short: Ag + H_2O_2.**

Advantages of STABILISED hydrogen peroxide:

H_2O_2 is a very powerful oxidation agent, however in order to use it as a disinfectant, higher concentrations of H_2O_2 are required, or a **catalyst,** such as Ag+.
At lower T, around 20° C, standard hydrogen peroxide has a very low activity of 1 – 5 %, while Ag-stabilised H_2O_2 has a 99 to 99.99999 % activity rate against bacteria, fungi, and viruses. At a lower pH (under 5.5) hydrogen peroxide is very effective, up to 99.99999 % (with a pH of 4.4), however with a higher pH (above 4.5) its effectiveness drops to 1-9 %.
Ag+ stabilised H_2O_2 is 99.99999 % effective with a pH of 4.4 to 6.1!

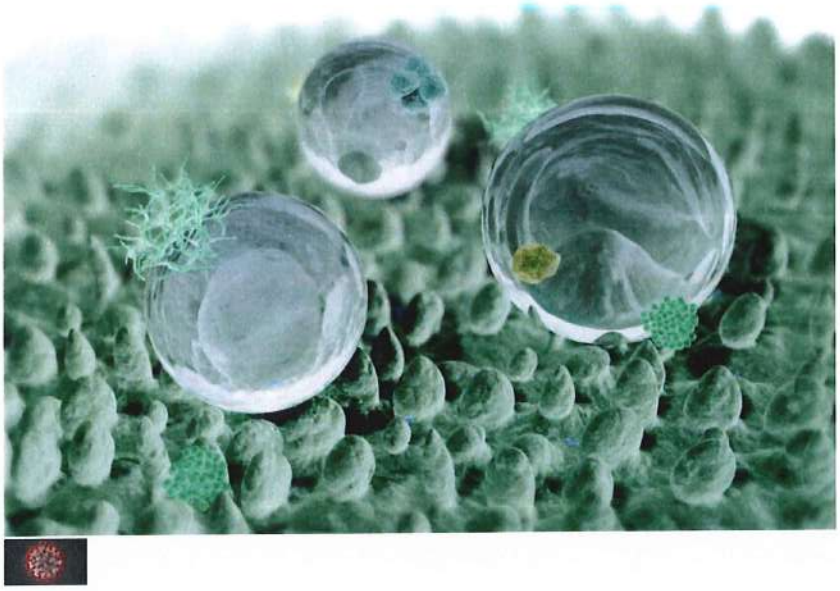
For this reason, Ag+ H_2O_2 is recognised as an effective disinfectant against Covid-19, and other versions of the coronavirus, other viruses such as MERS, SARS, bacteria such as legionella, MRSA (hospital bacteria), fungi, even algae, etc.
So, thanks to the unique formula with Colloidal Silver, H_2O_2 is made stable and effective as a disinfectant against all possible pathogenic micro-organisms.

Without a stabiliser, H_2O_2 quickly disintegrates into H_2O and O_2 (spontaneous redox reaction), thus losing its disinfecting capabilities.

To sum it up: the advantages of Ag+ stabilised H_2O_2 ($Ag + H_2O_2$) as opposed to standard H_2O_2:

i. Much more **effective** with normal T and pH (resp. about 20° C and 6.1) - factor 100.
ii. **Stabilises** H_2O_2, in other words: during storage, "no" natural decomposition into H_2O en O_2 (therefore: long shelf life without loss of effectiveness).
iii. In the presence of minerals such as Ca, Mg or Cl and at neutral pH, standard hydrogen peroxide is ineffective (up to 1 %), while $Ag + H_2O_2$ retains its full effect.

b) **With the super-dry mist** that is nebulised, the droplet size of the aerosol (*) is only 5 microns – this is super small compared to the aerosol produced with wet fog.
To put this size into perspective: a Corona virus has a size of about 0.1 to 0.3 microns (**) - in other words: such a super small droplet is still tens of times larger than a virus.



c) **The pressure with which the vapour is nebulised creates a pressure gradient** that ensures the vapour is pushed into the smallest crevices and corners and thus ensures disinfection in the entire space that is being nebulised.

(*) What's an aerosol?

An aerosol is a small droplet in the air.
It can be produced by a spray can, or a fogger, but unfortunately, we also produce aerosols ourselves when we cough or sneeze, and if we're ill, it will contain viruses.

When nebulising a disinfectant, small droplets are released that mix with the air and float around in the air, i.e. an aerosol. The smaller these are, the better the nebula behaves as a physical gas, and thus the further it can spread (by natural diffusion) or fill the entire space when propelled by a fogger (homogeneous distribution in all areas of the room).

The size of these aerosols also determines how deep they can penetrate the lungs, larger droplets do not reach beyond the trachea and bronchi (these are the alveoli in the upper respiratory tract).

(**) How is such a small aerosol generated in a nebuliser?

For the nebulisation of dissolved medicines, the medical world quite often uses **ultrasonic nebulisation**. This involves the use of an electronically generated high-frequency vibration in a crystal (piezo-electric crystal), which sets the liquid in motion allowing very small droplets to escape from the surface of the liquid and to remain suspended above the liquid surface as a mist. An airflow then carries it along into the patient's inhaled air.

The CRM.Fog nebulises with the help of the **venturi-effect**.

2. EVERY specific advantage of the CRM.Fog.

There is both (Super) DRY and WET nebulisation.

CRM.Fog uses super dry nebulisation with stabilised H_2O_2 as a biocide, and these are the specific advantages:

ALL advantages are a consequence of a) a super small droplet (aerosol) and b) a hefty pressure gradient due to the thrust of the fogger and c) the use of stabilised H_2O_2 (see pt B.6 supra).

The droplet size is about 5 microns, compared to the Covid-19 virus: 0.1 to 0.3 microns.

SPECIFICALLY:

1. **Homogeneous distribution of the biocide over ALL surfaces, both at the bottom, top and all crevices in the surface – so very effective for all surfaces.**
   So, it reaches zones that other techniques cannot affect.

2. **There is not even the smallest puddle of water on any surface.**

3. **Homogeneous and rapid diffusion in the air as the nebulised solution behaves almost like a gas due to the super small droplet and due to the thrust of the motor of the pump, together with the venturi effect – so very effective in the air.**

4. **No corrosion of electrical appliances since we do not generate a wet environment.**

5. **No pre-treatment – nothing to tape, not even the doors. This is because the water droplets are so light that they do not quickly sink to the ground and leave the room like a mist through the cracks of the doors.**

6. **Safe - the droplets are so small that they do not interrupt the light beam of a smoke detector – so the fire detection does not need to be switched off during nebulisation**
   .

7. **No manual assistance required before foggering. Therefore, the CRM.Fog can be programmed fully automatically to fogger at night.**

8. **No post-treatment required - e.g.: wiping everything dry, removing tape, etc.**

9. **Fogger time is limited because the biocide in very small droplets can do its job much more effectively.**

10. **Requires the least amount of liquid, which means it has the lowest running cost – Rule of thumb: 100 ml for 100 m^3.**

11. **The total fogger cycle = Pre-treatment + fogger time + reaction time + limited post-treatment – the room can be cleared for use very quickly.**

12. Since most rooms are quite dry, and therefore an ideal habitat for the pathogen, the CRM.Fog can also be used as a humidifier with pure water – especially in places where there are many absorbent objects, e.g. untreated parquet – multifunctional.

13. The CRM.Fog can also be used to quickly enter a room that smells nice by mixing essential oils in the liquid – multifunctional.

14. Not only pathogens such as bacteria, viruses, fungi, yeasts can be killed, but also eg fruit fly, scabies, mites, certain mosquito eggs, etc. - multifunctional.

ALL ADVANTAGES of the CRM.Fog in a nutshell:

√ **Safe!**

√ **Quick clearing of the room!**

√ **Very effective!**

√ **Considerable gain of time!**

√ **Multifunctional!**

√ **Very low running cost!**

3. Efficient and regular nebulising with the CRM.Fog results in effective disinfection.

3.1 GENERAL:

Nebulising is allowed only when there are no people/animals present in the room, because of the oxidising effects (irritation of the eyes, upper respiratory tract, lymphatic system).

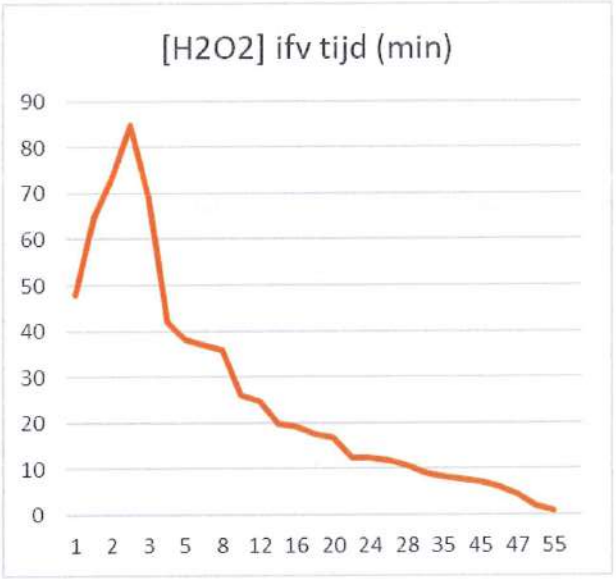
The fogger process looks like this:

Fogger time = The time during which the fogger effectively runs (e.g. 5 minutes at night).
Immediately followed by: reaction time (i.e. time during which the biocide takes effect, during which no one is allowed to enter the room, eg 45 min) – the room may be released at a concentration of H_2O_2 of max. 1 ppm (the so-called MAC value).
The fogger cycle: Fogger time + reaction time

THE key question: How safe am I between two fogger cycles?

Answ: Once the room is released after a fogging operation, you may be exposed to pathogens again, because once the H_2O_2 is "dispelled", the disinfecting effect is gone, the H_2O_2 is finally reduced to water and oxygen without further side effects.

See below: an example of a disinfection cycle (based on the concentration in H_2O_2 as a function of time).



The fogger cycle is: 2.5 min. (fogger time) + 53 min. (reaction time) = 55 min.
In other words: the room was disinfected for 55 minutes!

3.2 Your safety is largely determined by the fogger frequency.

Effectiveness of the fogger is determined by how strongly the device effectively KILLS the micro-organisms.

In addition to the previous point, the question is: what is the chance that I will still be infected if I install the CRM.Fog?

The evolution of the INFECTION CHANCE looks like this with foggering:

a) With efficient disinfection, such as with the CRM.Fog, the pathogens are **almost all killed with each fogger cycle** – so no accumulation of the pathogens on a surface.
"Efficient" here means correct fogger time, correct positioning of the fogger in the room.

THUS: Immediately after the room is cleared for use, it is very nearly 100 % disinfected.

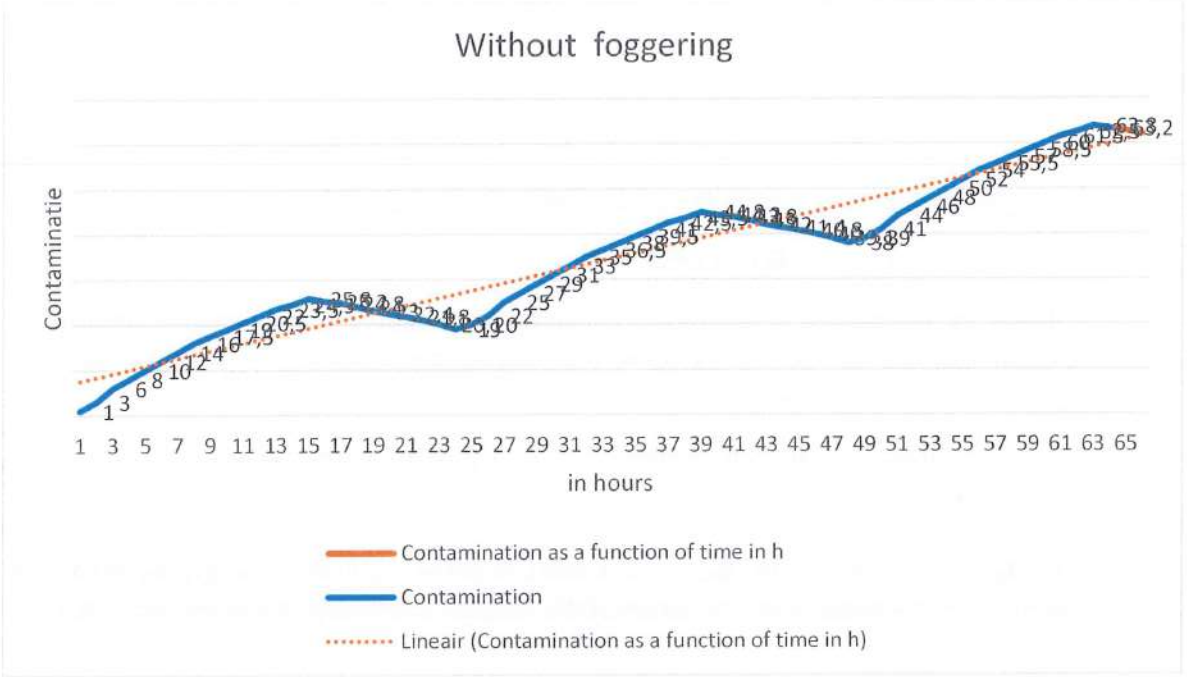
b) After the room is released, pathogens can again start to accumulate, especially on surfaces. If the room is frequently ventilated, the air will not really be a problem.

THUS: the contamination risk slowly increases again if people are present who, for example, carry a virus.

However, we can STRONGLY reduce the chance of infection/contamination by foggering more regularly because the concentration of pathogens determines the chance of infection (the more viruses or bacteria in the air or on a surface, the greater the risk of infection).

The following graphs show the evolution of contamination on surfaces depending on fogger frequency:

- No foggering (image 1)
- Foggering once every 24h (e.g. at night) - (image 2)
- Foggering multiple times during a day (e.g. at noon and at night) - (image 3)


Without foggering
Contaminatie
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65
in hours
Contamination as a function of time in h
Contamination
Lineair (Contamination as a function of time in h)


foggering 1 x a day
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71


foggering 2 x a day
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71

Conclusion - The effectiveness of the CRM.Fog can be increased:

1° Foggering drastically reduces the accumulation of pathogens.

This is very important for **ALL spaces!**

2° Foggering several times a day reduces not only the accumulation, but also the average concentration of pathogens (i.e. a lot more lows in the graph) - compared to foggering 1x, the concentration is on average half as high when foggering happens 2x a day.

This is **very important for a longer stay** in a room, **e.g. in an office at work.**

Please note: the concentration of the biocide as a measure of the risk of infection as presented here is not absolute, as it also depends on the nature of the surfaces and relative humidity (see pt A.3 supra).

4. Which micro-organisms are the most difficult to kill (both in the air and on surfaces)?

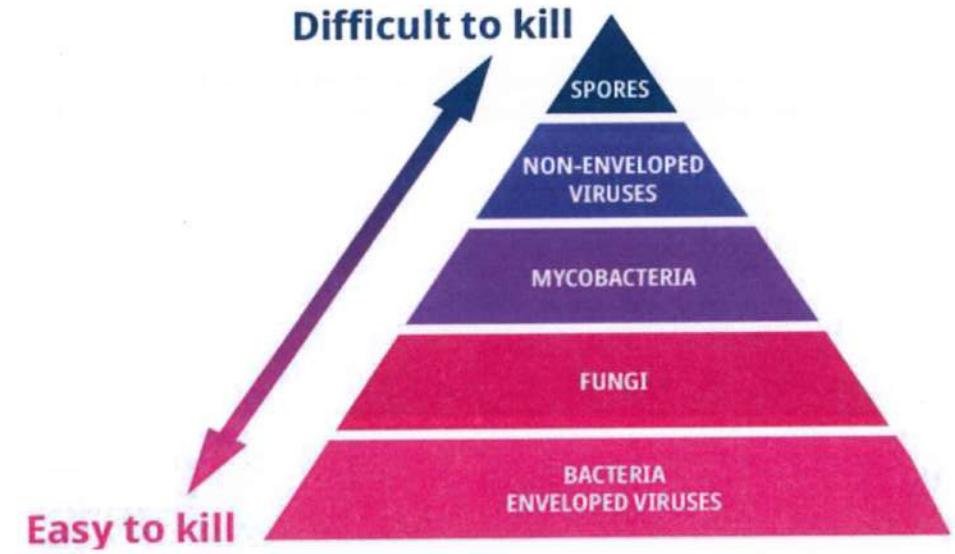
4.1 General

Super-dry nebulisation of stabilised H_2O_2can kill bacteria and even resistant spores with spectacular effect (with a log reduction of 6!) – the latter even offers the possibility, with the patented method of the dosing system IC-4TM, to easily, quickly and efficiently combat the hospital bacteria MRSA (see the sources in the appendix).

MRSA and other staphylococci have grown resistant to antibiotics, so treatment with stabilised hydrogen peroxide is virtually the only way to kill these.

The question that arises immediately: are all pathogens equally easy to kill?

The answer is clear: NO - see graph below:



Pathogen groups

4.2 About Covid-19 and other related Corona viruses:

It belongs to the bottom group of "enveloped viruses", like all Coronaviruses, such as MERS, SARS. HIV (aids virus) too, is an enveloped virus.
Therefore, these can easily be killed with an oxidising substance.

The envelope of Covid-19 consists of a **very fragile** lipid membrane - which makes it easy to kill with a strong oxidiser, such as stabilised H_2O_2!

D. Effectiveness of the CRM.Fog - Lab tests

1. Lab tests with a device similar to the CMR.Fog.

1.1 Reference to tests by the CTGB regarding the nebulisation of H_2O_2

Before we proceed to measurements with our own CRM.FOG, we would like to refer here to tests with H_2O_2 with the same concentration and with a dry nebuliser (i.e. Alpha-Bac 12F), cfr the CRM.Fog.

We are quoting literally from the paper:

The file contains a semi-practical test in which 100 g/l hydrogen peroxide (a slightly lower concentration than Alpha-Bac 12F) is nebulised using nebulisation equipment (a fogger) in a closed space, under the conditions as described in the WG/GA and in the protocol. Tests were carried out with small plastic or stainless-steel plates and pieces of cloth, contaminated with micro-organisms, and then dried. These plates are placed in the area that is being disinfected. They are also placed in hard-to-reach places, such as in an open cupboard and in a corner behind the fogger. After disinfection, the number of surviving micro-organisms is determined. This is a quantitative measurement. For verification, comparable plates are placed in a room next to the disinfected room.

Efectiveness test results are summarised in Table 1. The study also tested fungi, viruses and mycobacteria. The effectiveness against these organisms was very variable (depending on the test surface and the location in the room). Because the effectiveness against these organisms is not claimed in the WG/GA, these data are not taken into account.

Table 1. Results of a test in which hydrogen peroxide is nebulised in a test room at 25° C.

Test organism	Nebulisation time in min.	H_2O_2 in the air (ppm)	Average log reduction compared to control*
Pseudomonas auruginosa	60	100-120	7
Enterococcus faecium	60	100-120	7,8
Proteus mirabilis	60	100-120	7,9
Staphylococcus aureus	60	100-120	7,6
Candida albicans	60	100-120	6,1
Bacillus cereus spores	60	100-120	7,4

* averages of plates and cloth on different spots in the test room.

1.2 Conclusion effectiveness

When used in accordance with the Statutory Instructions for Use and the Operation Instructions, the agent Alpha-Bac 12F is sufficiently effective for room disinfection in the vapour phase against bacteria (excluding mycobacteria), bacterial spores and yeasts on surfaces in rooms intended for the accommodation of people.

Efectiveness test results are summarised in Table 1. The study also tested fungi, viruses and mycobacteria.

2. The tests with our fogger, CRM.Fog:

The measurements relate to a field test in which stabilised hydrogen peroxide is nebulised using the CRM.Fog in an enclosed space, under normal conditions of Temperature and Pressure (22°C and 1 atm), at a neutral pH of 7.

The tests were performed with the Dräger Pointgard 2000 with an H_2O_2 -sensor, measurements up to 300 ppm (parts per million – i.e. the concentration in which a biocide is expressed) are possible.

The measuring device is positioned in "the shadow" of the fogger, so that there is no direct nebulisation towards the measuring device.

2.1 Measurements

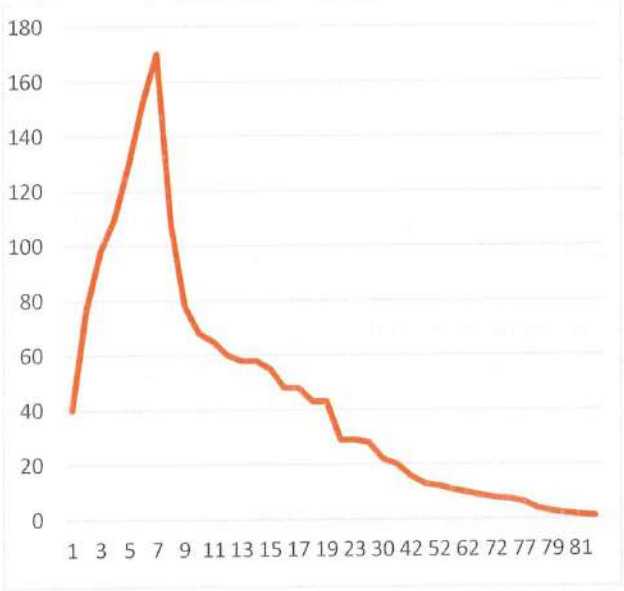
4 measurements were conducted:

a) **The first:**
   a. The Liquid: 12.5 % with Ag+ stabilised H_2O_2 in water.
   b. Closed, dry space of 100 m^3.
   c. Fogger time: 7 min, - with a nebulisation of 200 ml of liquid (consumption).
   d. Atmospheric humidity: 39 %.
   e. No absorbing substances, like carpet or cardboard present in the room.
   f. No ventilation - in order to guarantee the maximum reaction time for the hydrogen peroxide vapour.
   g. With an active smoke detector (fire alarm active).
   h. Reaction time: 70 min.
   i. Windows opened after reaction time until measurements showed 0.9 ppm.
   j. Total fogger cycle until 0.9 ppm: 1h20'.

Results:

The concentration of H_2O_2 reached a peak value of 170 ppm, and this via a strong LINEAR course.
The same values were measured everywhere in the room, albeit with some delay of up to 2 to 3 minutes.
No wet spots were found.
The fire alarm was not triggered.

The results can be found in the graph below:



		Peak H2O2
Fogger time:	7'	170 PEAK
Reaction time :	**70'**	6
Windows open :	6'	0,9

Conclusion:

Considering:

1° With regard to the above-mentioned bacteria in the study by CTGB:

Nebulisation time in this case is longer than 60' + the concentration of H_2O_2 in the air (ppm) is higher than the maximum value of CTGB (170 in stead of 120), and a log reduction of 6 to 8 was achieved.
Consequently, it is safe to conclude that we definitely obtained a 6-log reduction for those bacteria in this test with the CRM.Fog.
Considering the fact that most viruses, especially the enveloped viruses such as Covid-19, are easier to kill than the above-mentioned bacteria, our test is definitely achieving a 6-log reduction for all viruses.

Since 6-log reduction equals sterilisation, we can conclude that this space was certainly sterilised by means of our CRM.Fog, especially with regard to most fungi, bacteria and the most well-known viruses.

2° With regard to 3-log reduction with the CRM.Fog, in other words: in businesses as catering, companies, non-medical contact professions.

For such applications a 3-log reduction or a **99.9 % kill** is sufficient, or a concentration of 85 ppm peak with a long reaction time (about 1 hour) is certainly sufficient. Hence the next, second test.

Too high log-reduction can be harmful to people and the environment, which is why we do not exaggerate if this is not required. See some scientific literature on this subject (***).

b) The second:

a. The Liquid: 12.5 % with Ag+ stabilised H_2O_2 in water.
b. Closed, dry space of 100 m^3.
c. Fogger time: 2.5 min. With a nebulisation of 100 ml of liquid (the suction of liquid does not proceed in a linear way and is stronger in the beginning than at the end)
d. Atmospheric humidity: 38 %.
e. No absorbing substances, like carpet or cardboard present in the room.
f. No ventilation - in order to guarantee the maximum reaction time for the hydrogen peroxide vapour.
g. With an active smoke detector.
h. Reaction time: 55 min.
i. Windows opened after reaction time until measurements showed 0.9 ppm.
j. Total fogger cycle until 0.9 ppm: 1h00'.

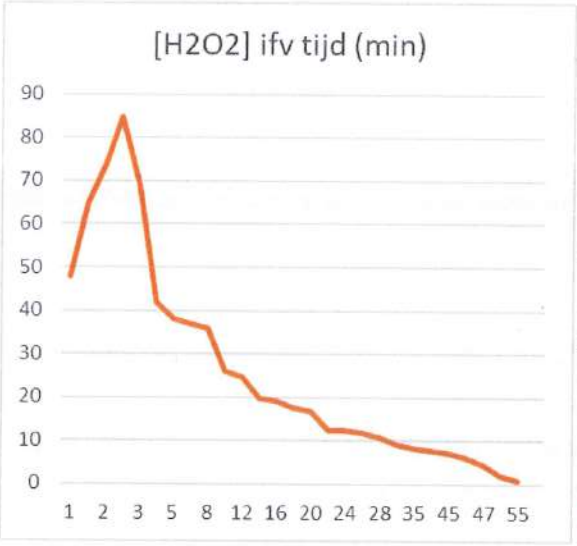
Results:

The concentration of H_2O_2 reached a peak value of 86 ppm, and this via a strong LINEAR course. The same values were measured everywhere in the room, albeit with some delay of up to 2 to 3 minutes.

No wet spots were discovered.

The fire alarm was not triggered.

The results can be found in the graph below:



		Peak H2O2
Fogger time:	2,5'	86 PEAK
Reaction time:	**52'**	6
Windows open:	6'	0,9
Total fogger cycle 55 to 60'		
This is 20 min shorter !!!!!!		

c) **The third:**

a. The Liquid: 12.5 % with Ag+ stabilised H_2O_2 in water.
b. Closed, dry space of 100 m^3
c. Fogger time: 2.5 min - with a nebulisation of 100 ml of liquid (the suction of liquid does not proceed in a linear way and is stronger in the beginning than at the end)
d. WITH strong absorbent substance, untreated parquet floor.
e. No ventilation - in order to guarantee the maximum reaction time for the hydrogen peroxide vapour.
f. With an active smoke detector.
g. Reaction time: 55 min.
h. Windows opened after reaction time until measurements showed 0.9 ppm.
i. Total fogger cycle until 0.9 ppm: 1h00'.

Results:

The concentration of H_2O_2 reached a **peak value of 56 ppm**, and this via a strong LINEAR course.

The same values were measured everywhere in the room, albeit with some delay of up to 2 to 3 minutes.

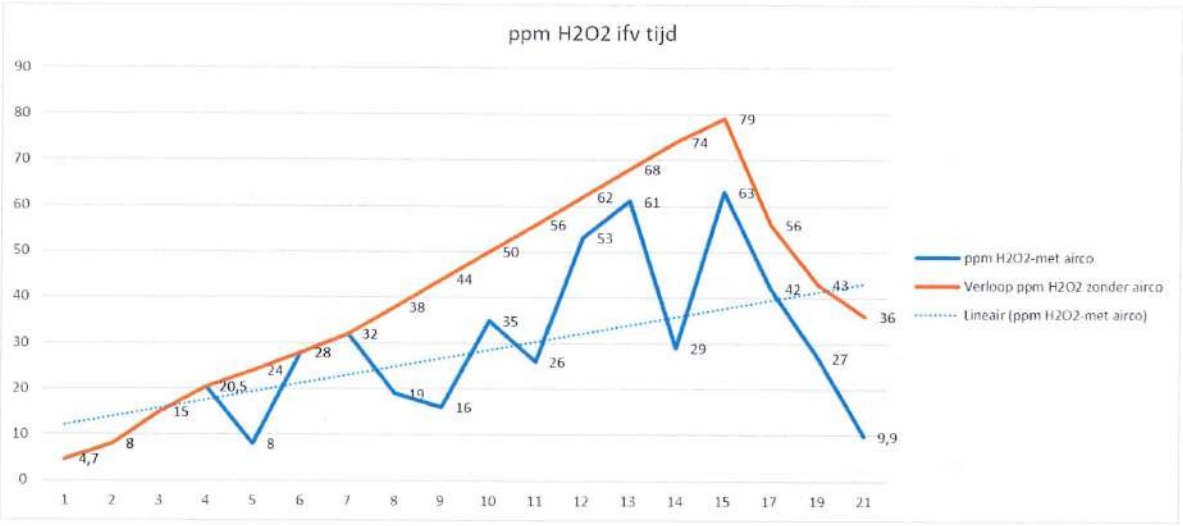
No wet spots were discovered.

The fire alarm was not triggered.

Which shows that the presence of highly absorbent surfaces can have a huge effect on the fogger time needed to reach the disinfection requirements, in this case 35%!!

d) **The fourth:**

a. The Liquid: 12.5 % with Ag+ stabilised H_2O_2 in water.
b. Closed, dry space of 100 m^3
c. Fogger time: 2.5 min - with a nebulisation of 100 ml of liquid (the suction of liquid does not proceed in a linear way and is stronger in the beginning than at the end).
d. **WITH a ventilation system - very gently powered, the airflow can hardly be felt.**
e. With an active smoke detector.
f. Reaction time: 55 min.
g. Windows opened after reaction time until measurements showed 0.9 ppm.
h. Total fogger cycle until 0.9 ppm: 1h00'.



Measurements were stopped after 20 min, since there was no point in continuing after that time (see conclusions below).

Results:

1° The blue line:

Represents the actual measurement results - very erratic because of the active ventilation - the biocide (H2O2) is effectively whimsically being blown and sucked away.

Consequences:

a) A curve with lots of ups and downs!
b) Foggering in these circumstances does not allow to reach the normal peak of app. 80 ppm.
c) After effective foggering (after 15 min), the line immediately drops to 9.9 ppm - this is because the biocide is sucked out and nothing is added any longer.

2° The orange line:

This is the evolution of the biocide concentration in the air **if the ventilation were not active** - all other parameters unchanged.

Now the line does not immediately drop to almost 0 (i.e. 9.9) but shows a much slower drop and it would linger much longer - which is very important for the effectiveness of the biocide.

We achieve peak value of 80 ppm, which is sufficient for a 3-log reduction of 99.9 % of micro-organisms (viruses such as Covid-19, bacteria such as legionella and others such as salmonella etc.)

VERY important conclusion:

ALWAYS CUT OFF VENTILATION while foggering -
otherwise, foggering will NOT be effective.

2.2 The final conclusion about our tests

These tests have conclusively demonstrated that the fogger cycle of our CRM.fog always follows the same course, making it reproducible and reliable.
That is, provided that a number of conditions are met, such as deactivating the ventilation system during foggering itself, adjusting fogger time to the nature of the environment, positioning the fogger in the room so as to take maximum advantage of the pressure gradient of the fogger.

The super-dry mist of the CRM.Fog effectively ensures that with the use of a little amount of liquid, high concentrations of biocide can be spread, concentrations that are necessary for disinfection or sterilisation, without endangering humans or animals. This is achieved in an extremely simple way: just a push on a button, or not even that, when setting the weekly or monthly program.

If you have higher demands or want to increase your peace of mind, simply increase the fogger time by a few minutes, at virtually no extra cost.

This way, we can decontaminate all spaces in an extremely safe and effective manner (the micro-organisms are actually killed with a 6-log reduction) with the necessary peace of mind, without any loss of time.

And all this without the deployment of expensive resources or investments such as ventilation systems.

In addition, we can also use our CRM.Fog to kill other pests such as fruit flies, scabies, mites, etc.

3. The GENERAL CONCLUSION about our CRM.Fog solution:

It is clear that, taking simple measures, such as regularly ventilating our indoor spaces by opening the windows every now and then - especially after busy meetings - and certainly keeping the humidity up, have always been important for people's health. In addition to that, the Covid period has been a wake-up call, and we need to do more for our health by warding off all the possible invisible dangers constituted by micro-organisms.

This is a permanent situation, as many virologists and other top scientists predict that Covid-19 is only the beginning.

Should we then continue to focus on fear of contamination by disinfecting our hands every few hours or every time we enter a room, with dehydrating and environmentally unfriendly substances such as alcohols? Should we then permanently wear mouth masks, even in restaurants, and should we then continue to avoid meeting other people as much as possible by organizing online meetings for all situations??

The answer is clear: NO!

Let us go back to ancestral times by permanently humidifying our indoor spaces, not by placing bowls of water on the radiator or stove, but with some more modern humidifiers. But also by returning to the use of substances with antibacterial and antiviral properties (e.g. Cu - copper), especially for surfaces that are touched intensely and frequently by so many people, such as door handles, shopping carts, water taps, etc.

These measures alone will not be sufficient, since there are more and more people seeking intensive contact, both privately and at work.
People meet and spread viruses and bacteria, that settle on all kinds of surfaces... pathogens that resist for hours, days, weeks.

Surely, we cannot be expected to bring a disinfecting spray to each and every conversation?

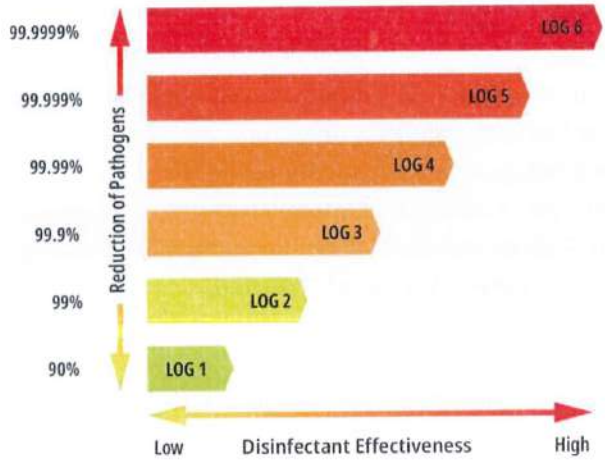
That is why CRM searched for a solution to return to "normal" life, in which we introduce 2 things:

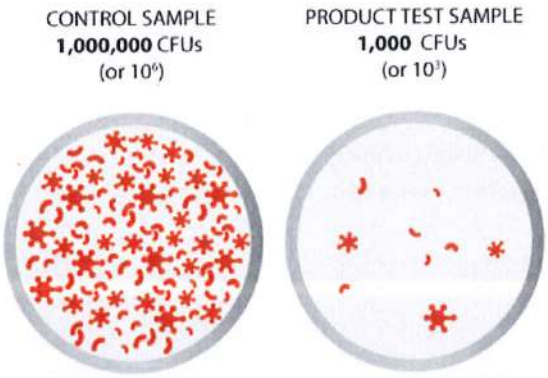
a) **Our CRM.Fog, which we can use as central heating in terms of ease of use. Once set up, we no longer have to worry about it, except for the occasional refill of the liquid.**
   The CRM.Fog can be set to run automatically and every few hours it will spread the extremely safe biocide, being stabilised hydrogen peroxide.
   Depending on the purpose and the amount of people passing by, the frequence can be set so that micro-organisms are killed in time.
b) **The use of Cu-strips that kan be applied to every possible surface.**

This is the way to quickly return to normal life, where we can without fear go back to a cafe or restaurant, go to work or travel ... but where we are much more considerate towards the environment and climate.

(***) Reducing the number of pathogens in the healthcare environment is reliant on efficient cleaning protocols together with the use of effective products. 'Log Reduction' is an industry standard term which conveys how effective a product is at reducing pathogens.

Often, products that are used for high level disinfection can be hazardous for the user and the environment.





4. Sources:

a) Rijksinstituut voor Volksgezondheid en Milieu (National Institute for Public Health and the Environment - NL) – Ministerie van Volksgezondheid, Welzijn en Sport (Ministry of Health, Welfare and Sports - B)
b) TNO laboratory set-ups using different concentrations of stabilised hydrogen peroxide to kill micro-organisms on metal, carpet, wallpaper, laminate, etc.
c) Endurocide.com
d) Bio Technics Ltd, Gourdon, Aberdeenshire Scotland
e) Studies of the CTGB (College voor de toelating van gewasbeschermingsmiddelen en biociden - Board for the Authorisation of Plant Protection Products and Biocides - NL) and RVIM (Centre for Infectious Disease Control – Wageningen University - NL)
f) Prof Dr P.M.J. Terpstra – Consumer Technology Knowledge Centre (CTKC)
g) American research by the National Institute of Allergy and Infectious Diseases, Princeton University, University of California, Los Angeles and the Centers for Disease Control and Prevention, Atlanta, published in the New England Journal of Medicine.
h) AMC I. Desinfectie en desinfectantia. Richtlijn 1998 (Amsterdam University Medical Centres I. Disinfection and Disinfectants - Guideline 1998).
i) W.I.P. Reiniging en desinfectie van ruimten, meubilair en voorwerpen. Richtlijn nr 6A 1993 (Task Force Infection Prevention - Cleaning and disinfection of rooms, furniture and objects - Guideline nbr 6A 1993).
j) APIC. Cleaning, disinfection and sterilization. Infection Control and Applied Epidemiology Principles and Practice 1996; Section E.
k) Holton J, Nye P, McDonald V. Efficacy of selected disinfectants against Mycobacteria and Cryptosporidia. J Hosp Infect 1994; 27:105-15.
l) NNI-normcie. Richtlijnen steriliseren en steriliteit. (Royal Netherlands Standardization Institute. Guidelines Sterilisation and Sterility) 1991; ;(B2200(1991))
m) Werkgroep Infectie Preventie (Task Force Infection Prevention) p/a Leiden University Medical Center - Leiden NL.
n) National Institute of Allergy and infectious diseases – Princeton University and university of California and Los Angeles
o) NRC Handelsblad
p) From Laboratory Research to a Clinical Trial: Copper Alloy Surfaces kill bacteria reduce hospital – acquired infections
q) Antivirale werking van Koper op Covid-19 (Antiviral effects of Copper on Covid-19), by Prof Dr Patrick Lievens
r) University of Sheffield UK – Dr Jim Thomas
s) Hogeschool Rotterdam (Rotterdam Academy)