

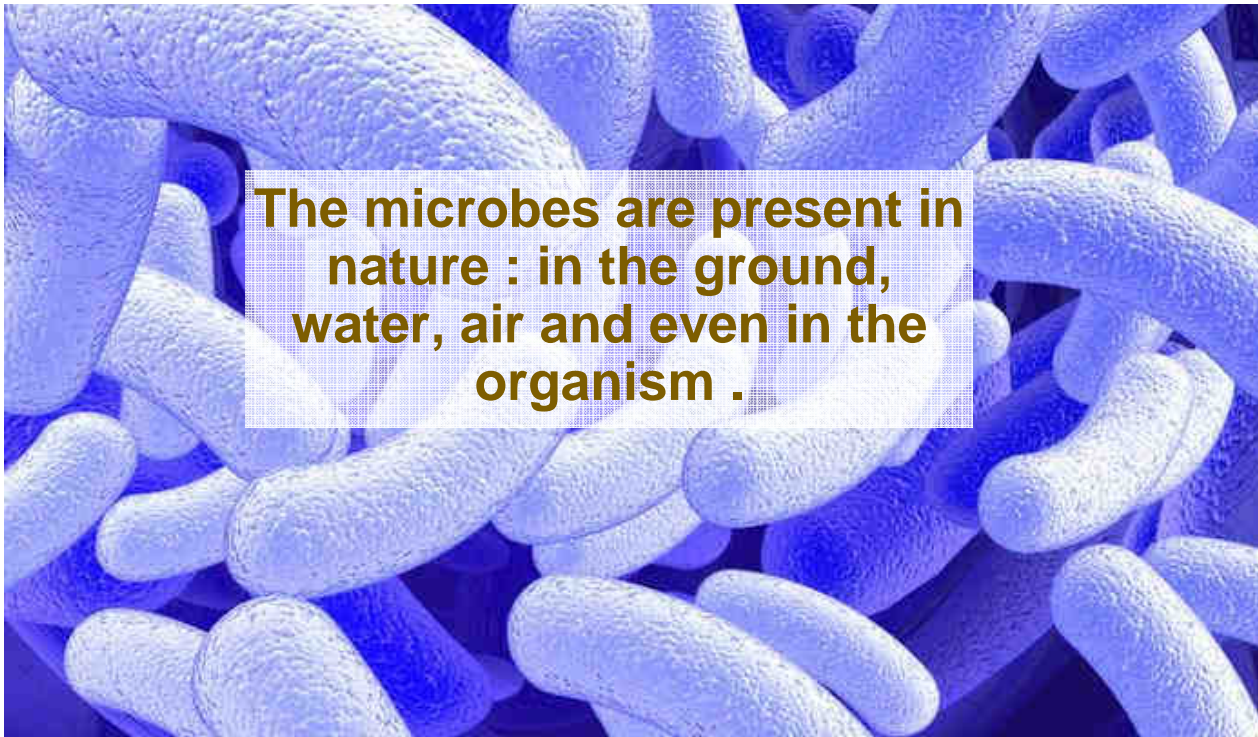
A large, artistic background image showing a microscopic view of cells. The cells are rendered in warm, glowing colors like orange, yellow, and red, with some blue and purple structures. They appear to be in motion or interacting, creating a sense of biological activity.

## The light clean disinfection



Titan *effect*®

Microbes, the infinitely small which us entour !



**The microbes are present in nature : in the ground, water, air and even in the organism .**

**Our fear with regard to the microbes comes owing to the fact that they are INVISIBLE**

There exist various types and sizes of microbes :

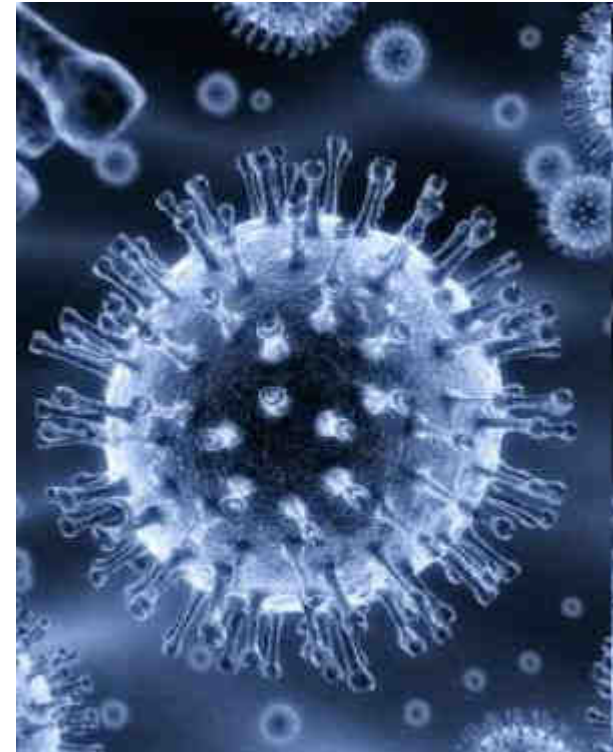
**The viruses** are the smallest microbes. Their size is measured in millionth millimeters and are visible only using one electron microscope.

**Bacteria and Microscopic fungus.** Their size is measured in thousandths of millimeters, i.e. in micron.

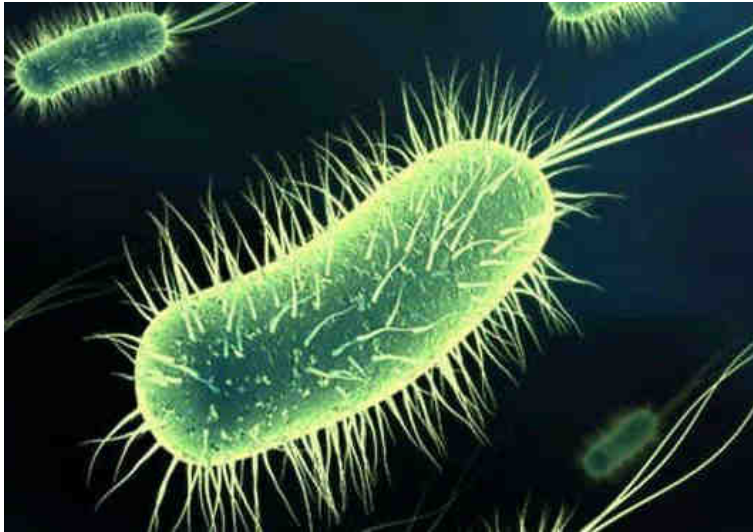
## What is a virus ?

A virus is characterized by its incapacity to only multiply by division. It needs for that to use a host cell: a virus is an obligatory intracellular parasite. It is composed of one or more molecules of nucleic acid (either of DNA, or of ARN, simple or double bit) surrounded by a protein hull, called the capsid, and, sometimes, of an envelope. It in general does not have any enzyme which can produce energy. The viruses are, generally, of very small size (compared with that of a bacterium, for example), in general lower than 250 nanometers; however, the mimivirus has a size of 400 Nm, which makes it larger than the smallest bacteria. This last has also the characteristic to have at the same time DNA and ARN.

**All the organism can be infected by viruses.**



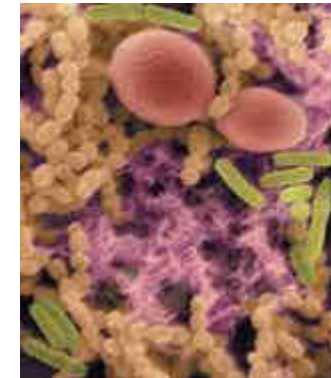
## What is a bacteria ?



The bacteria were the first living things on Earth. They are formed from a single cell. Our skin, our mouths harbor millions of bacteria, and only one gram of soil contains billions. Some bacteria are essential to life and live in harmony with us, and others trigger diseases: bacterial infections. Tetanus, for example, is a bacterial infection, like tuberculosis, scarlet fever, whooping cough, etc.. To fight against a bacterial infection is used, if necessary, antibiotics. Broadly, the antibiotics kill bacteria and allow the body to overcome infection.

## What is a Microscopic fungus?

Microscopic fungus are responsible for fungal infections called. Fungal infections are caused by yeasts or filamentous fungi. In most cases these infections are localized: skin, hair, nail, mouth, etc.. Unlike antibiotics that act at different points of bacterial, fungal act primarily at the cell membrane of fungi.



## How the microbes infect us ?

In general, those are transmitted by contact with another living being . Maybe by a direct physical contact, or by breathing the air expired by the carrier of this microbe . The ambient air is excellent “a conveyor” of the microbes.

France is one of the countries where one consumes more antibiotics . Is also one of the areas of the world where one observes the most bacteria resistant to antibiotics . The relation of cause and effect between these two phenomena seems clear, even if it is not rigorously shown . If the antibiotic treatment is, often essential, the investigations prove that in 40 % of the cases, with hospital, and in 60 % of the cases, downtown, it is contrary with the recommendations of the experts .

Logical consequence, to manage to decrease the regulations, they are the practices of a whole country, including those of the doctors, it is advisable to change, underlined the brought together specialists with Pasteur Institute . Stake is important because resistances to antibiotics are increasingly numerous and no really new family of drugs antibacterial points with horizon . Among the pneumococcal (responsible ORL and respiratory infections ), resistances to penicillin were almost non-existent in France, fifteen years ago . They touch today more half of the stocks . The hémophilus, persons in charge of many infections ORL and respiratory in the children, saw their proportion of resistance to the penicillin doubled in two years , passing from 35 % to 70 % in the Paris region . Lastly, the proportion of gilded staphylococci resistant to the méticilline is high in France , as generally in the countries of the south.

The growth of resistances poses difficult therapeutic problems with hospital , in particular in the intensive care units, where often circulate of the bacteria become multi resistant , be-with-to say resistant to several families antibiotics .



## Nosocomial infection



**An infection is known as nosocomiale or hospital, if it is absent at the time of admission of the patient in an health care institution and it develops at least 48 hours after l' admission.**

### The situation in France :

Which is the real frequency of the nosocomial infection ? To answer it, two great surveys were carried out in France in 1996 and 2001 . The most recent investigation rests on 1 533 hospitals, representing 78 % of the beds of French hospitalization . According to the results, 6,9 % of the patients present at the hospital are victims of an nosocomial infection, including 1 % acquired in another establishment . Brought back to the hospitalized population, that represents 800 000 people each year . The nosocomial infection would be directly responsible of almost 7.000 deaths .

The total proportion of these nosocomial infection place France in a situation comparable with that observed in the other European countries, where it varies between 6 and 9 % . But the percentage of stocks of gilded staphylococcal resistant to the méticilline remains in France very high (57 % in 1996, 64 % in 2001).

According to a survey of the French hospital Foundation leads in April 2004 had shown that 63 % of the people think that there are more risks related to the nosocomial infection than a few years ago . Less than one quarter (24 %) estimates that the risks decreased.

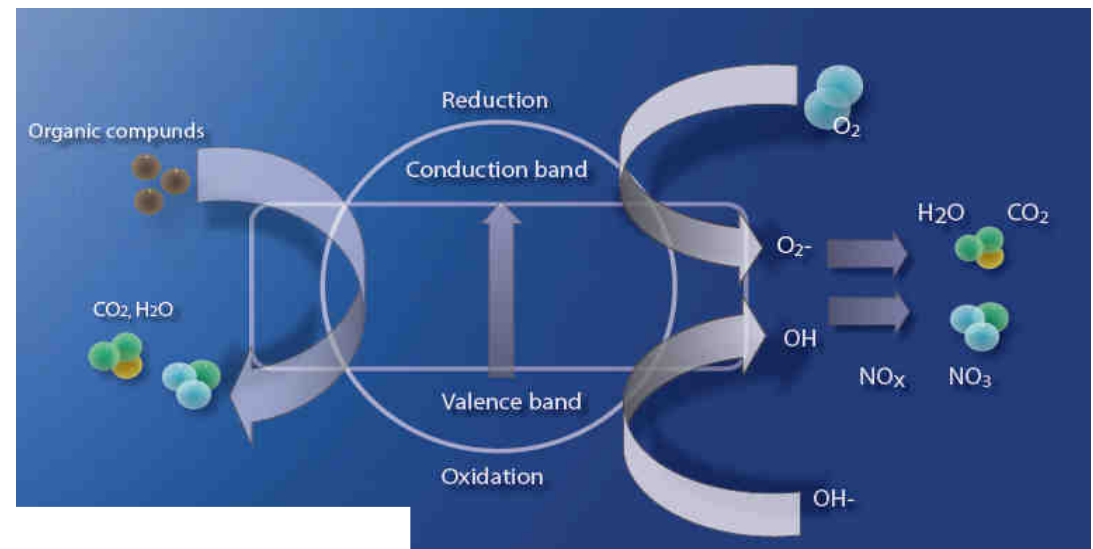
Source : Enquête national de prévalence des infections nosocomiales.



## Why Titan Effect ?

Titanium dioxide Photocatalysis is internationally recognized as one of the new sterilization materials, which can kill almost all kinds of bacteria including avian flu and SARS. It has been widely used in places of high demanding about sterilization like hospitals, institutions, schools etc. The Titan Effect Photocatalyst has strong effect on killing almost all kinds of bacteria under the irradiation of light, which can maintain very long time and thoroughly decompose bacteria, its body and the exdotoxin.

When Photocatalyst titanium dioxide (TiO<sub>2</sub>) absorbs Ultraviolet (UV) radiation from sunlight or illuminated light source (fluorescent lamps), it will produce pairs of electrons and holes. The electron of the valence band of titanium dioxide becomes excited when illuminated by light. The excess energy of this excited electron promoted the electron to the conduction band of titanium dioxide therefore creating the negative-electron (e<sup>-</sup>) and positive-hole (h<sup>+</sup>) pair. This stage is referred as the semiconductor's 'photo-excitation' state. The energy difference between the valence band and the conduction band is known as the 'Band Gap'. Wavelength of the light necessary for photo-excitation is:  $1240 \text{ (Planck's constant, } h) / 3.2 \text{ eV (band gap energy)} = 388 \text{ nm}$  The positive-hole of titanium dioxide breaks apart the water molecule to form hydrogen gas and hydroxyl radical. The negative-electron reacts with oxygen molecule to form super oxide anion. This cycle continues when light is available.





Meanwhile, Photocatalyst can wipe out the indoor allergen to reduce the incidence of respiratory diseases. Sterilization Mechanism of Titan Effect Nano Coat Titanium dioxide itself has no toxicity to microbe and cell.

At the present of light, the very strong oxidizing power of titanium dioxide can destroy bacteria's cell wall and membrane, and react with cell component, which inhibits bacteria's activity and ultimately results in the death and decomposition of bacteria.

The sterilization of TiO<sub>2</sub> Photocatalyst presents the following 2 different biochemical mechanisms:

- ✓ TiO<sub>2</sub> irradiated by light directly reacts with the cells
- ✓ Indirect sterilization reaction

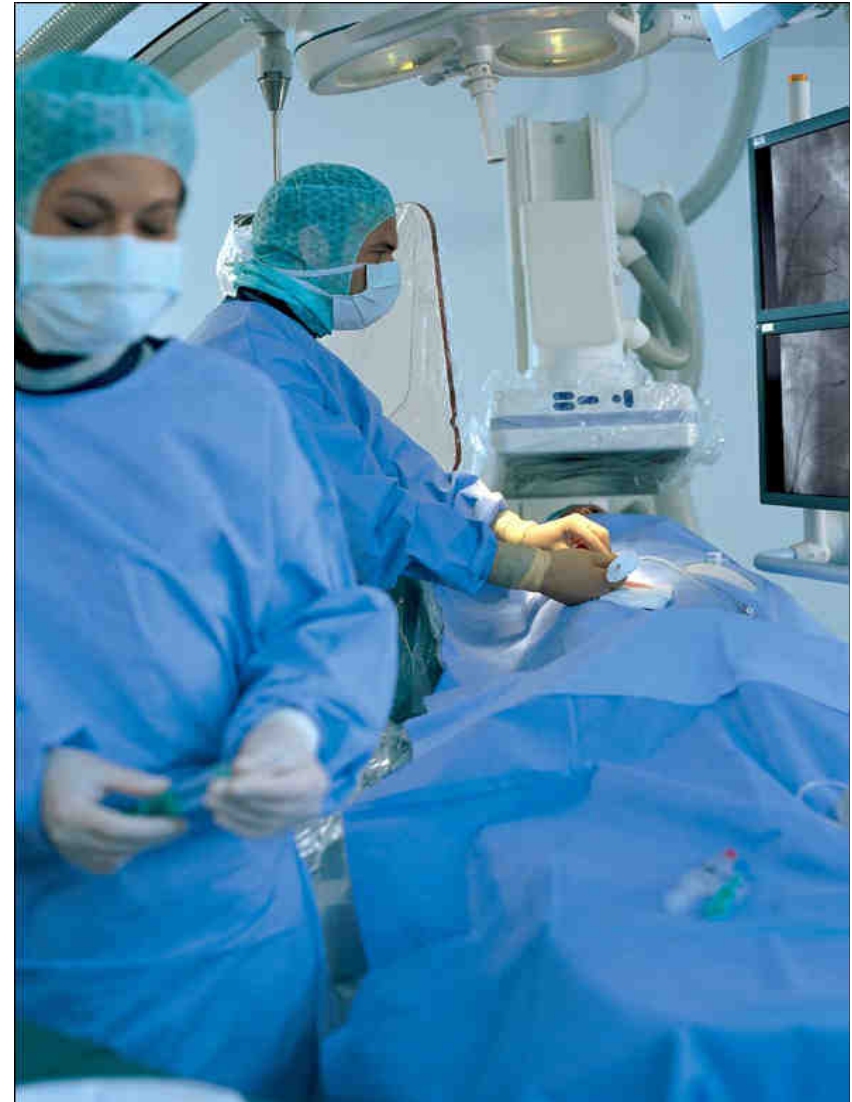
## TiO<sub>2</sub> irradiated by light directly reacts with the cells

The electron-hole can directly react with cell wall, cell membrane and cell component. In the sterilizing process of microzyme and bacilli, CoA inside cell oxidized to CoA dimer loses its activity, which causes the respiration of the cell to stop and finally results in the death. During this process, the electron shift between the killed cell and TiO<sub>2</sub> is passed by CoA. Therefore the content of CoA decreases and CoA dimer increases.



## Indirect sterilization reaction

That electron hole dissolves in water will generate active oxygen such as hydroxyl radical. The electronic structure of titanium dioxide is characterized by filled valence band (VB) and empty conduction band (CB). The band gap energy is excited and an electron is promoted from the valence band (VB) to the conduction band (CB). Then an electron-hole pair is generated (electron  $e^-$  and hole  $h^+$ ). The positive-hole of titanium dioxide breaks the water molecule apart to form hydrogen gas and hydroxyl radical. The negative-electron reacts with oxygen molecule to form super oxide anion ( $O_2^-$ ). Super oxide anion can react with water molecule further, which generates hydroxyl radical peroxide ( $\cdot OOH$ ) and hydrogen peroxide ( $H_2O_2$ ). Moreover, active hydroxyl radical can combine to form hydrogen peroxide. This cycle continues when light is available. The active hydroxyl radical, super oxide anion, peroxide hydroxyl radical and hydrogen peroxide can react with biomacromolecule such as protein enzyme and lipid, which will destroy the cell structure. They react with cell wall, membrane and its component. For example, the oxidation – reduction material is necessary in the formation of adenosine triphosphate inside the hela cell.





## Titan Effect for disinfection.

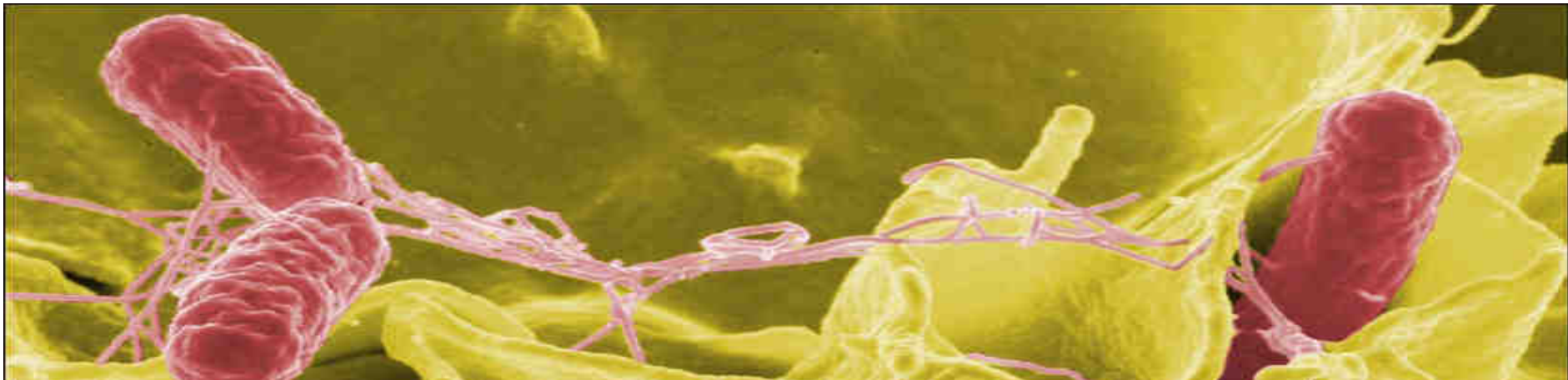
### **Objective :**

Antibacterial and antiviral treatment in public places and equipment such as the hospitals, clinics, schools, hotels, bus, subways, etc Also in the agricultural domain.

### **Solution :**

The photocatalysis Titan Effect offers a powerful effect making it possible to almost kill all kinds of bacteria and virus, including SARS, H5N1, H1N1 etc. This action is permanent and present in the long run . The treatment Titan Effect can completely break up the bacteria & virus, their body and endotoxin, and exerts a stable effect to destroy

the new variations of bacteria . Thanks to the photocatalysor, the bacteria and viruses are completely broken up. Titan Effect will not lose its effect because of the accumulation of the bacterial organizations on surface. The photocatalysor Titan Effect can eliminate the cigarette smoke and the odors related to the animals, but also the allergens interior to reduce incidence of respiratory diseases.





## Most Titan Effect.

Often, the places requiring an antibacterial treatment powerful and effective are located in interior and in places less exposed to the light.

Following this report, a specific adaptation for our anti product bacterial was developed . It is about a product profiting obviously from the characteristics from the photocatalysis, but optimized on the one hand for the interior (reaction with the artificial light) and in addition for a quasi constant action . This continuity of action is obtained thanks to the integration of nano silver particles in the product in order to clean the air of the bacteria and virus even without light . The combination of the two actions makes it possible to obtain optimal effectiveness.

### **Advantages :**

- Broad spectrum of sterilization, no choice of target (bacteria and virus).
- High performance and durable effect.
- Decomposition of the body and the endotoxin of the germs.
- Sure, no additional pollution, respectful of environment and inoffensive for man
- Eliminate the allergens and odors.
- Effectively protect from the epidemic diseases in the public places, such as hospital, schools, hotels, etc
- Excellent results and no odor is released, contrary to chlorine dioxide disinfectants .

## Tests .

### Sample 1. Anti bacterial test on Titan Effect Covplus



Irradiation with a fluorescent lamp 40W during the test

	Klesiella pneumoniae (ATCC 10031)	Inoculums Count after 24 hours (cfu/pièce)	Bactericidal rate (%)
Escherichia coli (ATCC 25922)	3.9 X 10 <sup>4</sup>	9.0 X 10 <sup>2</sup>	97.69
Staphylococcus aureus (ATCC 6538)	6.8 X 10 <sup>3</sup>	1.1 X 10 <sup>2</sup>	98.38
Pseudomonas aeruginosa (ATCC 9027)	2.8 X 10 <sup>5</sup>	84	99.97
Klesiella pneumoniae (ATCC 10031)	2.7 X 10 <sup>5</sup>	1.5 X 10 <sup>3</sup>	99.44

According to GB 15979-2002, tested carried out by GUANGDONG DETECTION CENTER OF MICROBIOLOGY

### Sample 2. Antibacterial test in dark places with Titan Effect Bacplus

	Concentration of bacterial (cfu/ml)	Concentration sample	Duration of the test	Time of contact	Surviving bacteria on sample (cfu/ml)	Surviving bacteria on control sample (cfu/ml)	Broken up rate %
Escherichia coli (ATCC 25922)		Original	1	24h	<1	1.2x10 <sup>8</sup>	>99.9
		Original	2	24h	<1	1.1x10 <sup>8</sup>	>99.9
	1.2x10 <sup>6</sup>	Original	3	24h	<1	1.1x10 <sup>8</sup>	>99.9
		Original	4	24h	<1	1.4x10 <sup>8</sup>	>99.9
		Original	5	24h	<1	1.0x10 <sup>8</sup>	>99.9

Test condition: according to GB 15981-1995, carried out by SGS, whole process under conditions without lights



### Exemple 3. Antibacterial test under lamp

	Result: Total Mould Count, ctu/plate (Sabouraud Dextrose Agar (25°C, 5 day))
Stage 1 : Connection and installation of 4 fluorescent lamps (18W plug in CFL). Hours 9:30 a.m.	19
Stage 2: 1:30 after commutation of existing lamp with 2 lamp of table	4
Stage 3: Taken with same condition 1 hour and 30 minutes after stage 2.	0

This sample test antibacterial environment of the treatment Titan Effect . The lamps are placed in a house then the bacteria in air are analyzed by CHEMICAL LABORATORY SDN BHD. Interns method test based above on Unites States Pharmacopoeia 28



## Contact :

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