

HEXIS Anti-Microbial films PURE ZONE



construction



energy



graphics



health



racing



INTRODUCTION : definitions

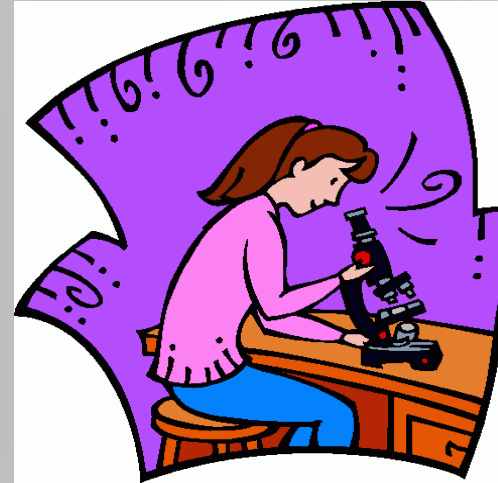


Definition: Bacteria

- It's a micro-organism (visible only with microscopes)
- A great number of bacteria exist. Most of them are harmless or helpful for human beings. But some of them are pathogenic
- Breeding by cellular division (speed depending on environment). In ideal environmental conditions, the number of bacteria (*E. coli*) can double in 20 min

Definition: classification of bacteria

1. Depending on their shape



2. Depending on the structure of the cellular wall

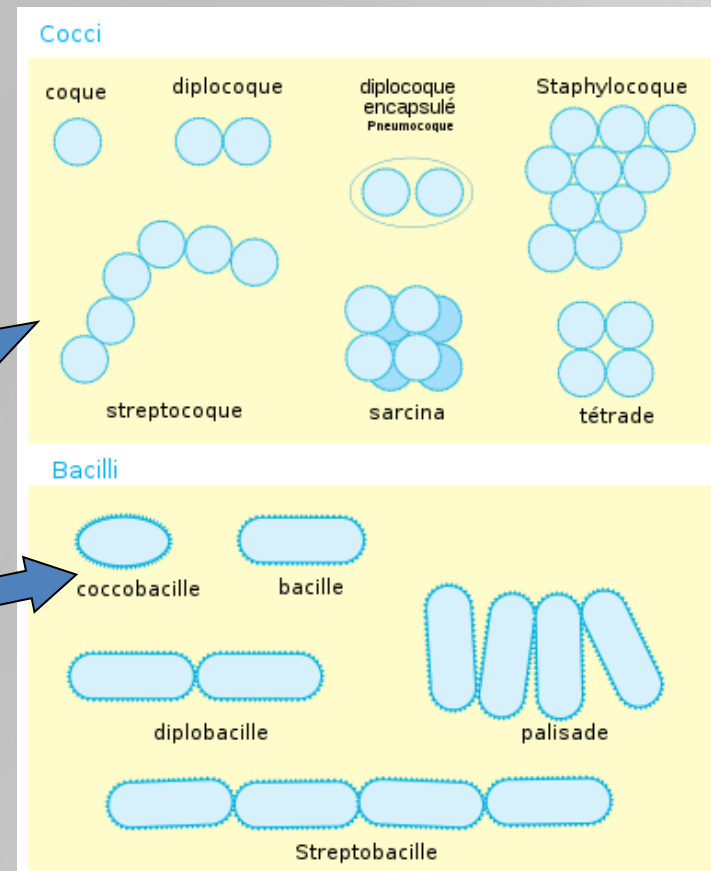


Definition: classification of bacteria

1. Depending on their shape:

Ex.: the most important are:

- *Coccus*: spherical shape
- *Bacillus*: elongated, stick shape

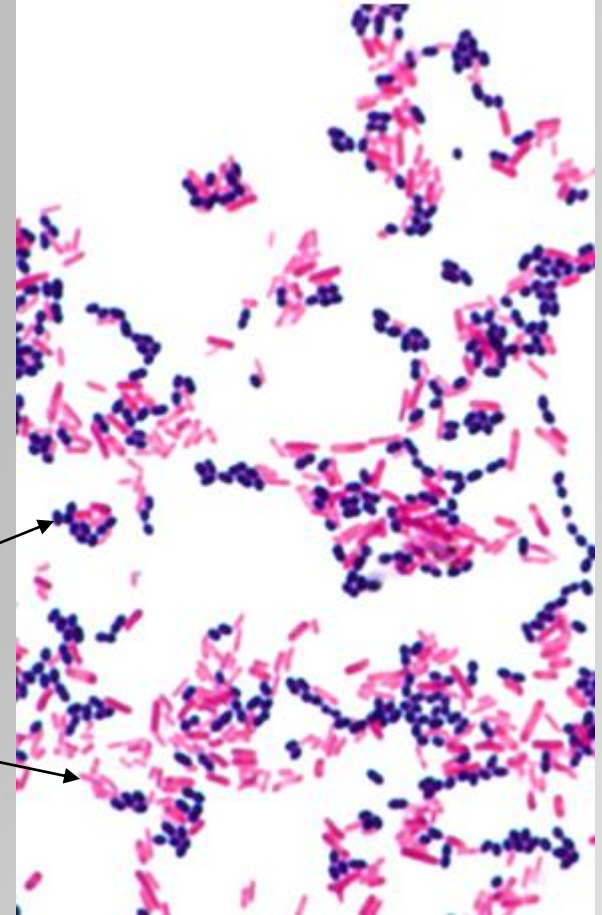


Definition: classification of bacteria

2. Depending on the structure of the cellular wall:

– Gram test: coloration test to determine cellular wall structure:

- **Gram-positive: THICK** cellular wall – purple coloration.
- **Gram-negative : THIN** cellular wall – pink coloration.



ACTIVITY OF HEXIS ANTI-MICROBIAL FILMS

Active against which bacteria?

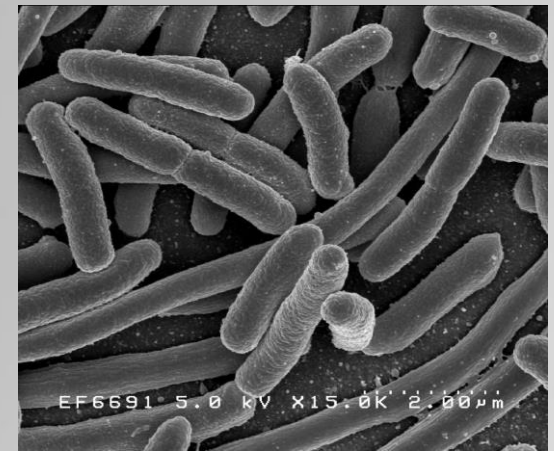


HEXIS anti-microbial films: Activity

Escherichia coli:

- **Description:** bacteria that can be present in the intestine (gram -). They represent 80 % of humans intestinal flora.
Only some strains are pathogenic.
- **Pathology:** diarrhea, urinary infection, meningitis, septicemia.
- **Contamination places:** food industry, hospital environment.

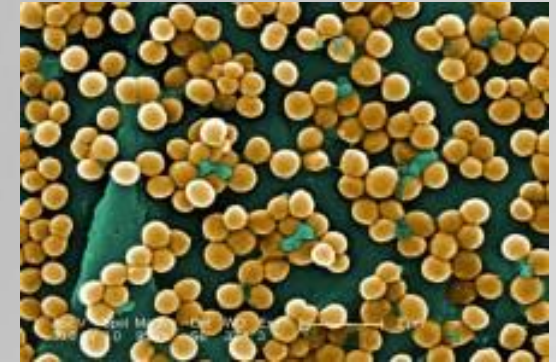
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HEXIS anti-microbial films: Activity

Staphylococcus aureus:

- **Description:** Most pathogenic bacteria of the Staphylococcus genus. (gram +).
- **Pathology:** can cause food poisoning, skin infections and septicemia.
- **Contamination places:** can be present in food industry, hospital environment.



Meticiline Resistant Staphylococcus aureus (MRSA):

- **Description:** specific strain of *S. Aureus* that developed a resistance against an antibiotic (meticiline). Ex. Of "Multi-Resistant Bacteria" (MBR).
- **Pathology:** infections and septicemia.
- **Contamination places:** Hospital environment. It is the most common Multi-Resistant Bacteria in hospitals.

HEXIS anti-microbial films: Activity

Listeria: (*Listeria monocytogenes*)

Description: gram +.

By food contamination. Can resist to some cleaning processes and survive at +4 ° C.

Pathology: Fever, meningitis, septicemia, especially for fragile people (for ex. pregnant women).

Important sequela in 40 % of the cases ; mortality in 25 % of the cases.

Contamination places: everywhere.

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HEXIS anti-microbial films: Activity

Salmonella:

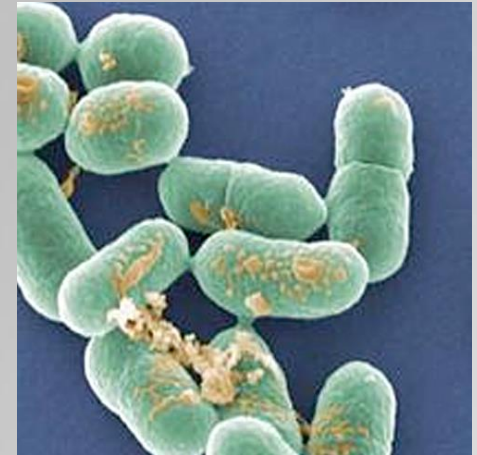
Description: gram +.

By food contamination (meat, eggs, milk...). Can resist to some cleaning processes and survive at + 4° C.

Pathology: gastroenteritis, septicemia, meningitis (especially for babies), fever.

Contamination places: can be present in food industry.

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HEXIS anti-microbial films: Activity

Pseudomonas aeruginosa:

Description: gram -.

One of the most resistant bacteria. Ability for the creation of formation of biofilm layers ((multi-)bacteria layer, that can resist to cleaning and disinfection processes).

Pathology: Ophthalmic infections, Wound infection, urinary infection. Septicemia in case of immunodepression.

Contamination places: everywhere (ground and water). Especially dangerous in hospitals.

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ACTIVITY OF HEXIS ANTI-MICROBIAL FILMS

Activity determination methods

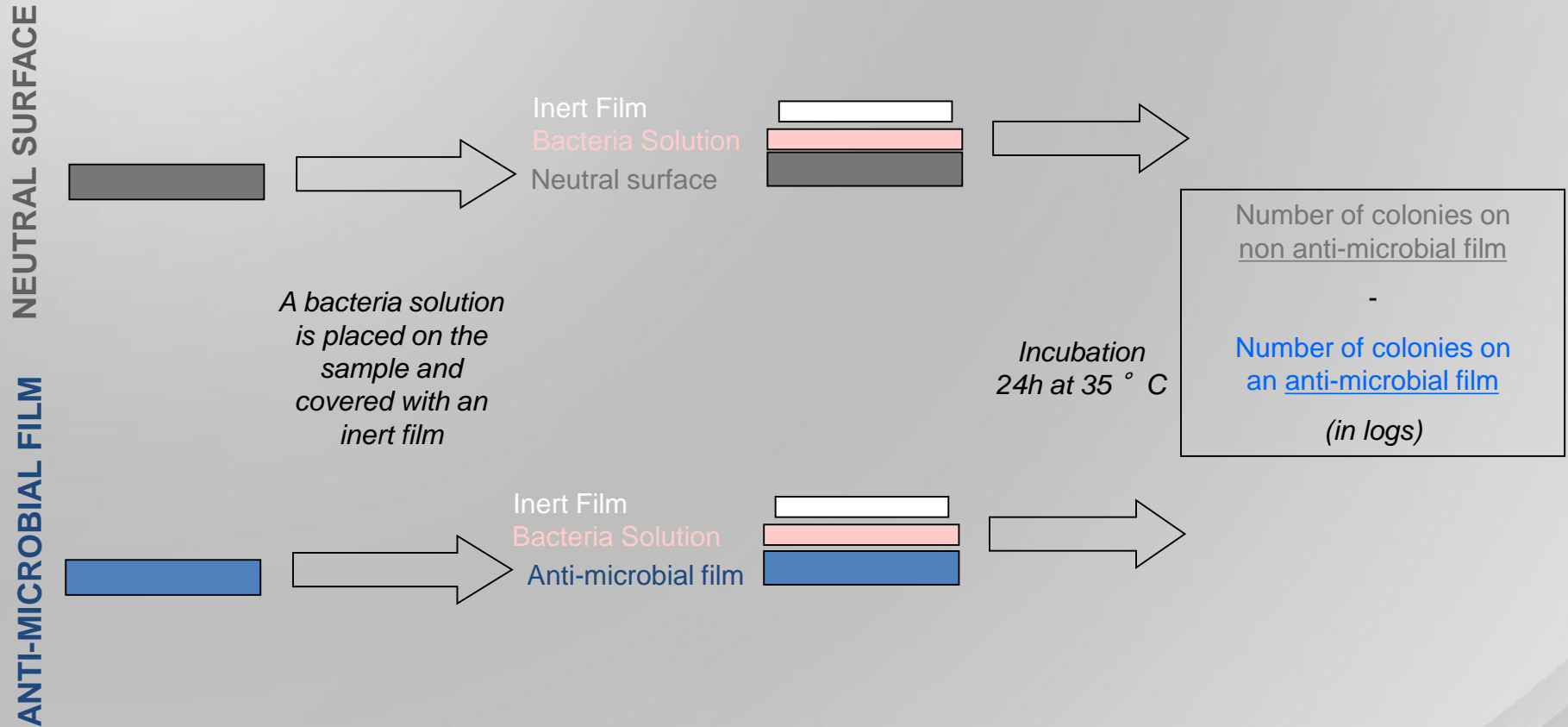


How does it work?

- **The anti-microbial molecule is included in the PVC film**
⇒ **Anti-microbial activity of HEXIS films resists to normal abrasion throughout the lifetime of the film**
- **HEXIS films have bacteriostatic properties**
⇒ **Growth and multiplication of the number of bacteria is inhibited. Existing bacteria are not killed, but their multiplication is prevented**

Activity tests

- **Test by contact (ISO 22196) :**



Activity tests

NEUTRAL SURFACE



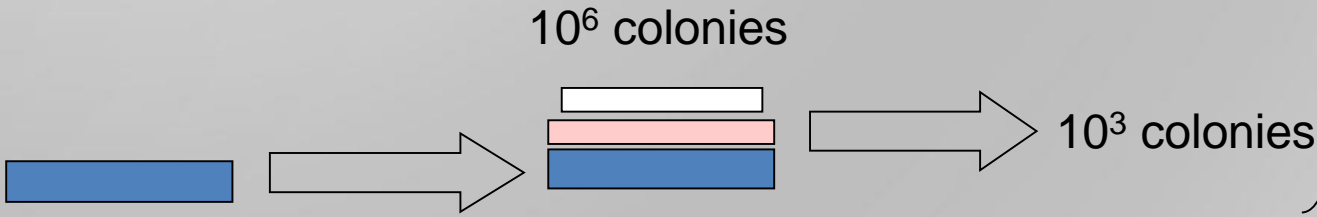
A bacteria solution is placed on the sample and covered with an inert film

Incubation
24h at 35 ° C

Difference = 10^3

Log (difference) = 3

ANTI-MICROBIAL FILM



Reduction of the number of bacteria =

$$\frac{10^6 - 10^3}{10^6} * 100 = 99,9 \%$$

- Diminution of **1 log** :
- Diminution of **2 logs** :
- Diminution of **3 logs** :
- Diminution of **4 logs** :

Reduction of **90 %** of the number of bacteria

Reduction of **99 %** of the number of bacteria

Reduction of **99,9 %** of the number of bacteria

Reduction of **99,99 %** of the number of bacteria



Activity of anti-microbial films

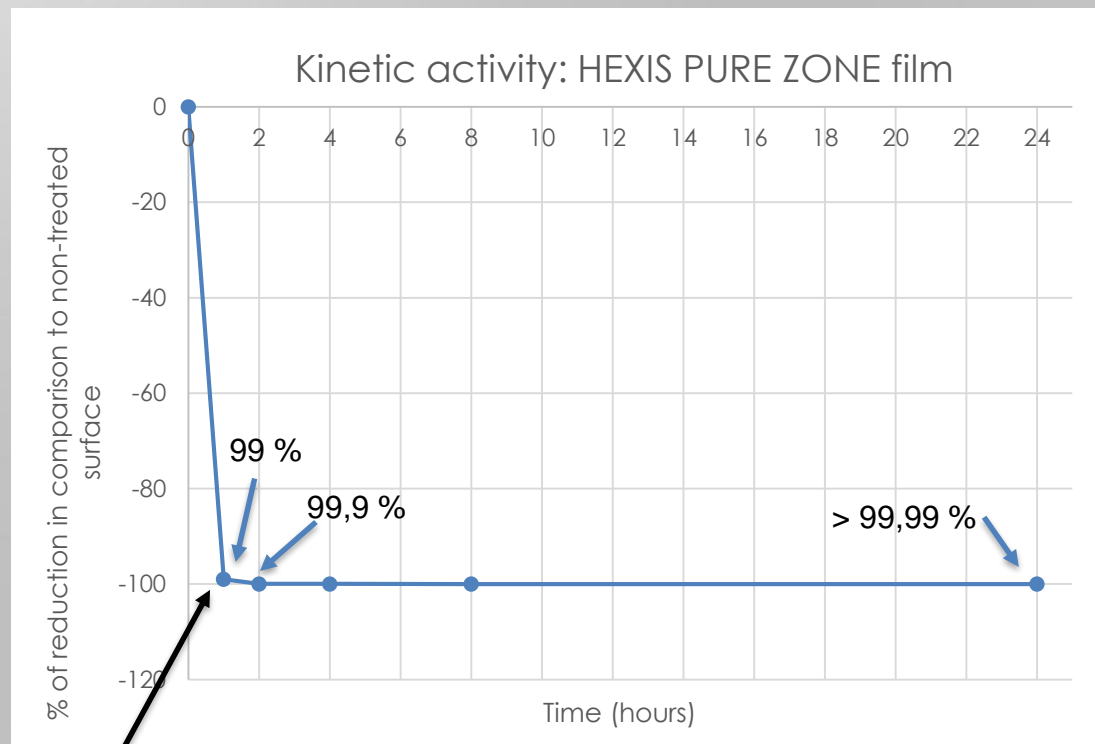
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Bacterium	Reduction <u>log</u>	Reduction <u>%</u>
<i>E. Coli</i>	> 4.5	> 99.99
<i>S. Aureus</i>	> 4.1	> 99.99
MRSA	> 3.5	> 99.99
<i>Salmonella (S. enterica)</i>	> 4.6	> 99.99
<i>Listeria (L. monocytogenes)</i>	> 4.2	> 99.99
<i>P. Aeruginosa</i>	> 5.4	> 99.999



Activity over time

- **Test by contact (ISO 22196) :**
measurement of the number of colonies, depending on contact time, made on an AM-film and on a non-AM-surface.

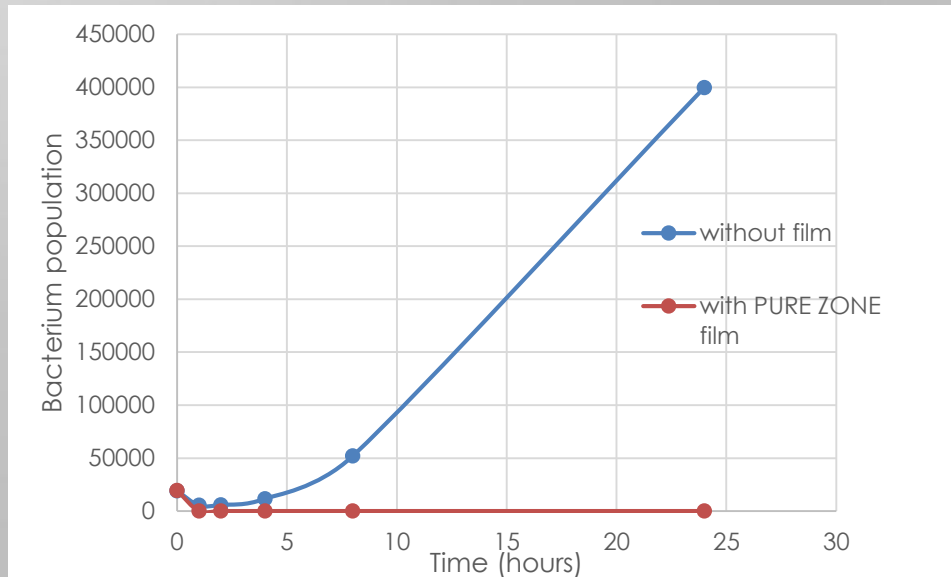


Efficient after only 1
hour of contact

Tests conducted with *Salmonella*

Comparison between a protected and a non-protected surface: benefits of PURE ZONE films

Bacterium population on a PURE ZONE – protected surface and a non-protected surface



Tests conducted with Salmonella

CLEANING



Resistance against cleaning

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The film has been cleaned 365 times with several cleaning solutions:

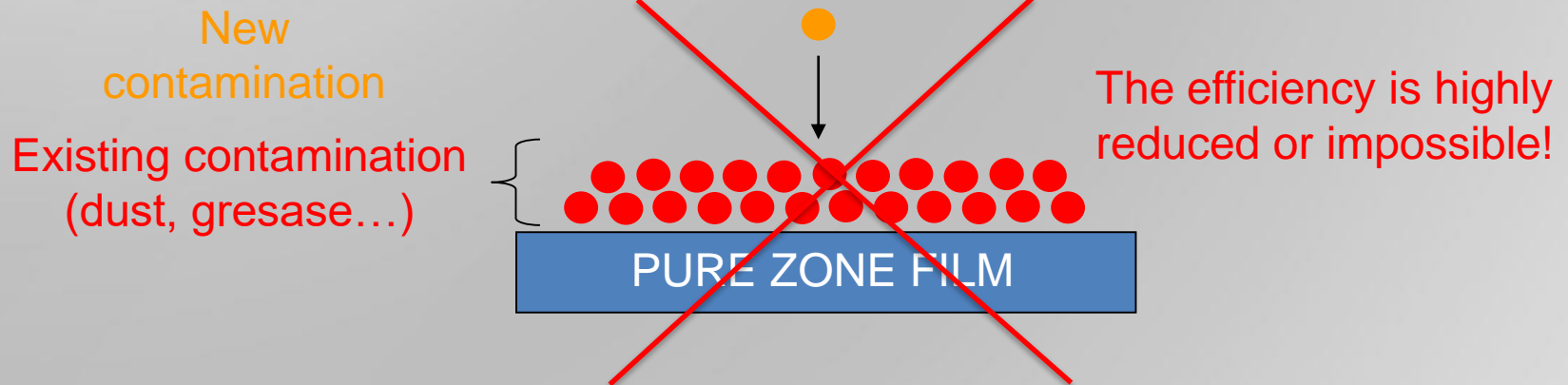
	Log Reduction Vs. non treated surface
Before cleaning	> 4,6
After 365 cleaning operations with clear water	> 4,5
After 365 cleaning operations with Ethanol (50 %)	4,1
After 365 cleaning operations with Bleach (3 %)	> 4,5
After 365 cleaning operations with ANIOSURF® (0,25 %)	> 4,2

Activity is exactly the same, before and after 365 cleaning operations using water, ethanol, bleach and ANIOSURF®.

Cleaning processes

Keep the surface clean (without dust, greasy layer etc.).

In order to be efficient, the film needs to be in contact with the bacterial contamination.



OTHER TESTS: SKIN TOLERANCE



Dermatologic tests

- Made on 15 adult volunteers (18 – 65 years old).
 - Application of a 2cm * 2cm sample, directly on skin (non-adhesive face against skin) and fixing with a plaster.
 - Removing the sample after 6 hours of contact.
 - Observation of the skin after 0 min, 30 min and 24H.
- Results:
 - ⇒ Non irritant product
 - ⇒ Safe for use on human skin

GENERAL INFORMATION



Generalities

- **PURZON060B:**

- General properties: clear cast PVC film
- Thickness: 60 µm
- Finish: gloss
- Durability : 5 years (indoor use)

⇒ can be applied on 3D surfaces

⇒ No decrease of activity through normal abrasion during the lifetime of the film