RESET

Interreg Europe

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T.I.E Spa

New professional antibacterial and self-cleaning insect screening

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ABOUT T.I.E. Spa

In operation since 1996 in Tuscany – a region with ancient traditions of weaving – T.I.E. (Tessitura Industriale Europea), supplies markets throughout Europe and all over the world with an insect screen product of highest quality and reliability, made of fiberglass with PVC coating.

ABOUT T.I.E. Spa

In recent years, we have begun the production of coated yarn, both to control the production cycle from its earliest phase, and to satisfy particular market needs.

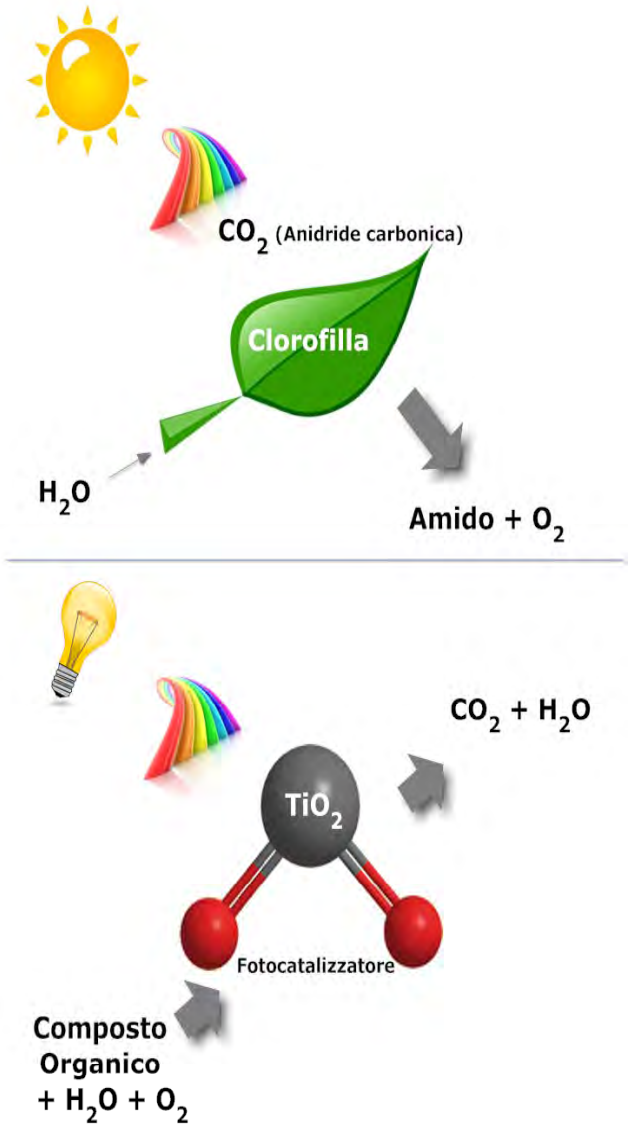
The company has equipped itself with a laboratory to support the development of its production facilities and to have total control of the components and the finished product.


T.I.E.
sunox
fiberglass mesh
SUNOX è un marchio registrato da
NEXT
TECHNOLOGY

Photocatalysis

✓ Photocatalysis is defined as "*The acceleration of the speed of a photoreaction due to the presence of a catalyst"*. A catalyst neither changes nor is consumed by a chemical reaction.

✓ This definition includes photosensitization, process in wich a molecular species undergoes a photochemical alteration as a consequence of an initial absortion of a light energy by another molecular species, called **photocatalyst**.



PCO
Photocatalytic oxidation

Definitions

"***Photocatalytic oxidation (PCO) is a recently developed air and surface cleaning technology that has the unique capacity to destroy both microorganisms and microbial volatile organic compounds (MVOCs)***"

Fonte: Kowalski, W. (2006) "*Aerobiological Engineering Handbook: Airborne Disease and Control Technologies*", McGraw Hill Handbooks, pag.295

"***PCO is a process in which surfaces coated with titanium dioxide (TiO_2) become chemically reactive to organic compounds when exposed to ultraviolet or visible light***"

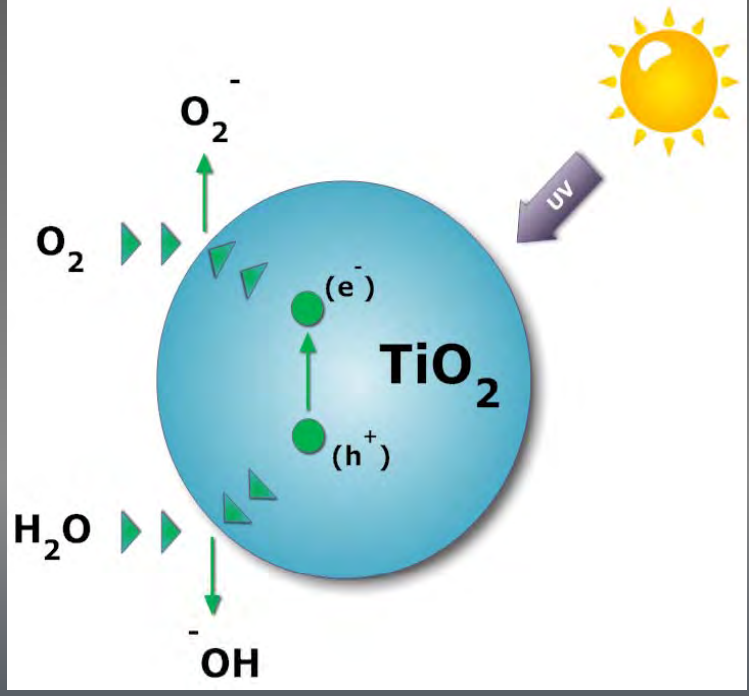
Fonte: Lyons, C. (1995). "Photocatalytic oxidation, an effective and cost competitive process for destroying volatile organic chemical pollutants is now being commercialized." Mater Technol 10(11–12): 236–238.

Titanium bioxide in «action»

The Ultraviolet Radiation (UV) coming from the sun or or from an artificial source of light (fluorescent lamps)

Absorption of radiation by TiO_2

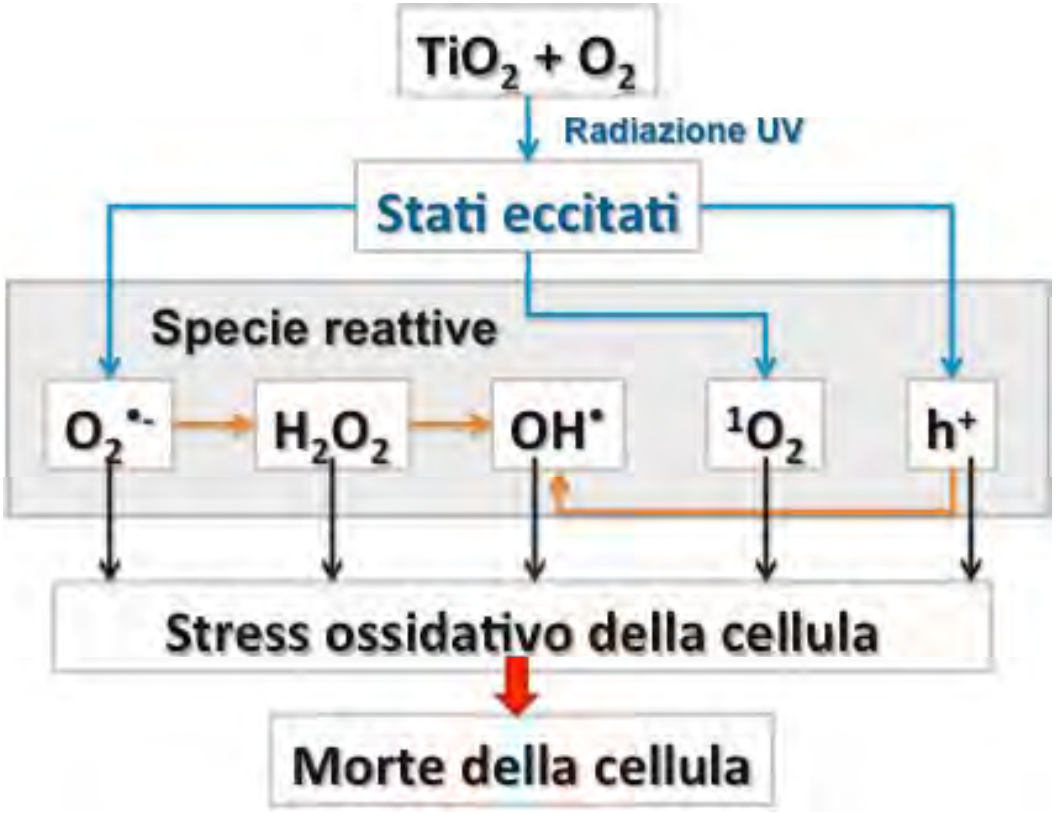
electron-positive hole couple formation



Titanium dioxide produce **Reactive Oxygen Species (ROS)**, which react with organic substances, producing non-toxic inorganic substances.

Reactive Oxygen Species

The bactericidal effect due to the phototcatalitic action of TiO_2 is releated at the formation of Reactive Oxygen Specied (ROS), such as $O_2^{-\bullet}$, H_2O_2 and $HO\bullet$,. generated by the TiO_2-light synergistic system.



Reactive Oxygen Species

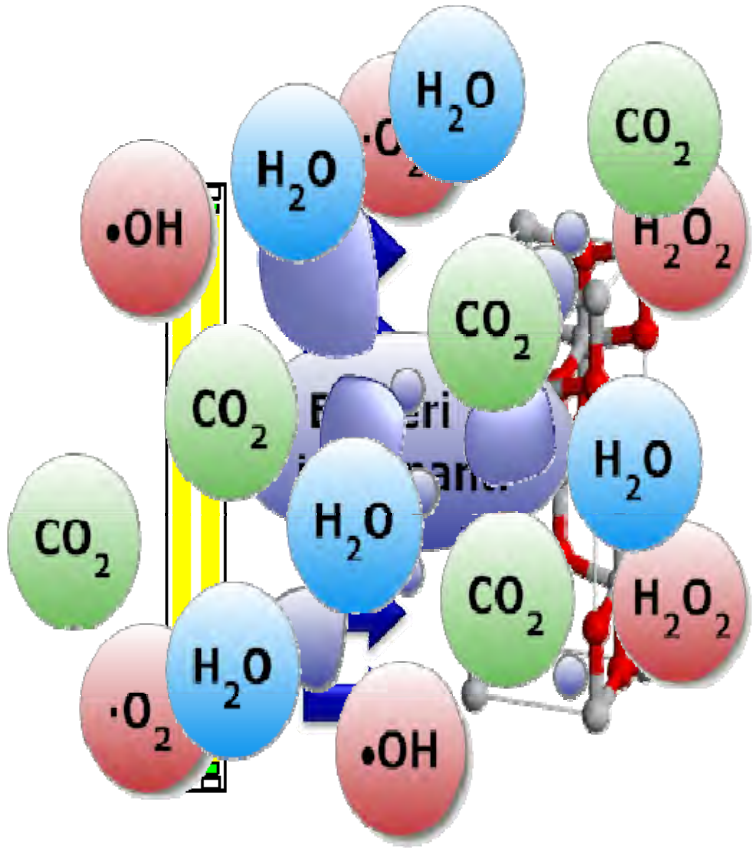
Hydroxyl radicals, having an extremely short duration (10^{-9} s), must be generate near the membrane to be able to oxide some components.

The extremely short life time and the fact that they must be produced near the surface, make them **harmless to people**.

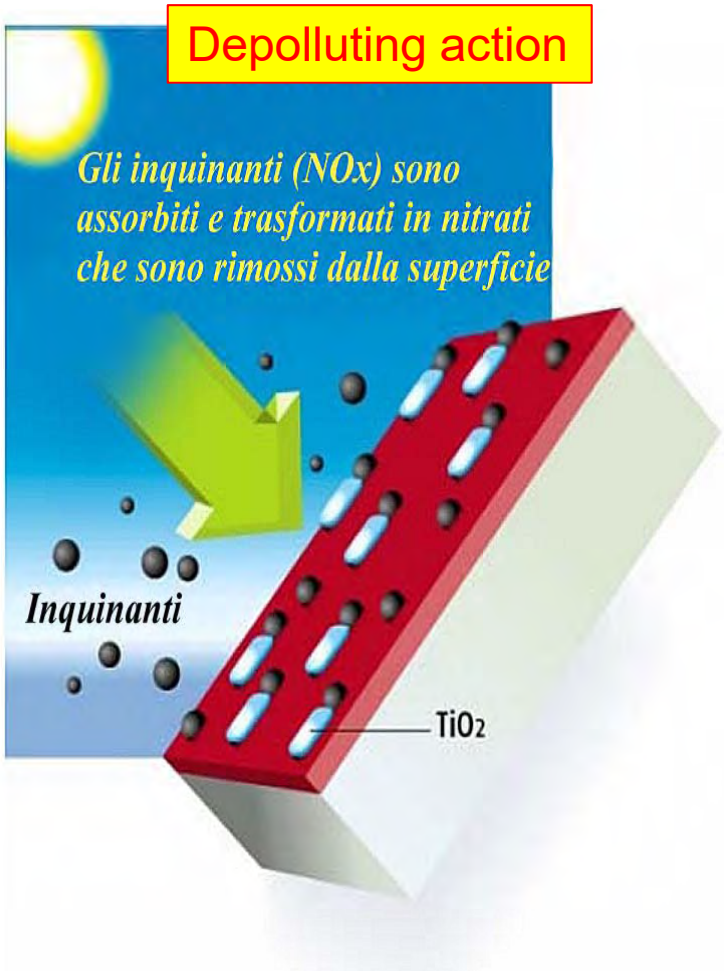
Relative power of chemical oxidants (*Fonte*: U.S. Environmental Protection Agency)		
Compound	Oxidation potentials (volts)	Relative oxidation power (Cl_2 = 1.0)
Hydroxyl radical	2.8	2.1
Sulfate radical	2.6	1.9
Ozone	2.1	1.5
Hydrogen peroxide	1.8	1.3
Permanganate	1.7	1.2
Chlorine dioxide	1.5	1.1
Chlorine	1.4	1.0
Oxygen	1.2	0.90
Bromine	1.1	0.80
Iodine	0.76	0.54

Photocaltytic oxidation

And depolluting effect



Effect of photocatalysis



Under the action of UV rays, the particles of TiO_2 transform organic compounds, odors and BACTERIA, close to its surface in water and carbon dioxide.

Comparison with other disinfection methods

	HEPA Filter	Electrostatic	Ozone	UV	Ionizer	Photocatalyst
Molds	Mediocre	Buono	Buono	Buono	Mediocre	Eccellente
Bacteria	Mediocre	Mediocre	Buono	Buono	Mediocre	Eccellente
Mites	Mediocre	Mediocre	Mediocre	Buono	Mediocre	Eccellente
Gas	Mediocre	Mediocre	Buono	Buono	Mediocre	Eccellente
Odors	Mediocre	Buono	Buono	Buono	Buono	Eccellente
Smoke	Buono	Buono	Buono	Mediocre	Eccellente	Buono
VOC	Mediocre	Mediocre	Buono	Buono	Mediocre	Eccellente

Riferimento: Keith Ho, "Development of Advanced Catalytic Oxidation Technology for Air Pollution Control", in Knowledge Transfer Conference, Hong Kong 8-9 Novembre 2010

SUNOX® technology
The antibacterical grid

It uses nanometric TiO_2 water based dispersion. It allows to fix the nanoparticles, in a stable way, on the surface of textile substrates and not, during the production phase. It preserves the substrates from the degradative photocatalitic action. It has an almost zero environmental impact.

The nanostructured photocatalytic surface, by light action (natural, fluorescent, LED UVA), constantly contrasts the growth of bacteria and virus commonly present on the surface.

Microbiological analysis

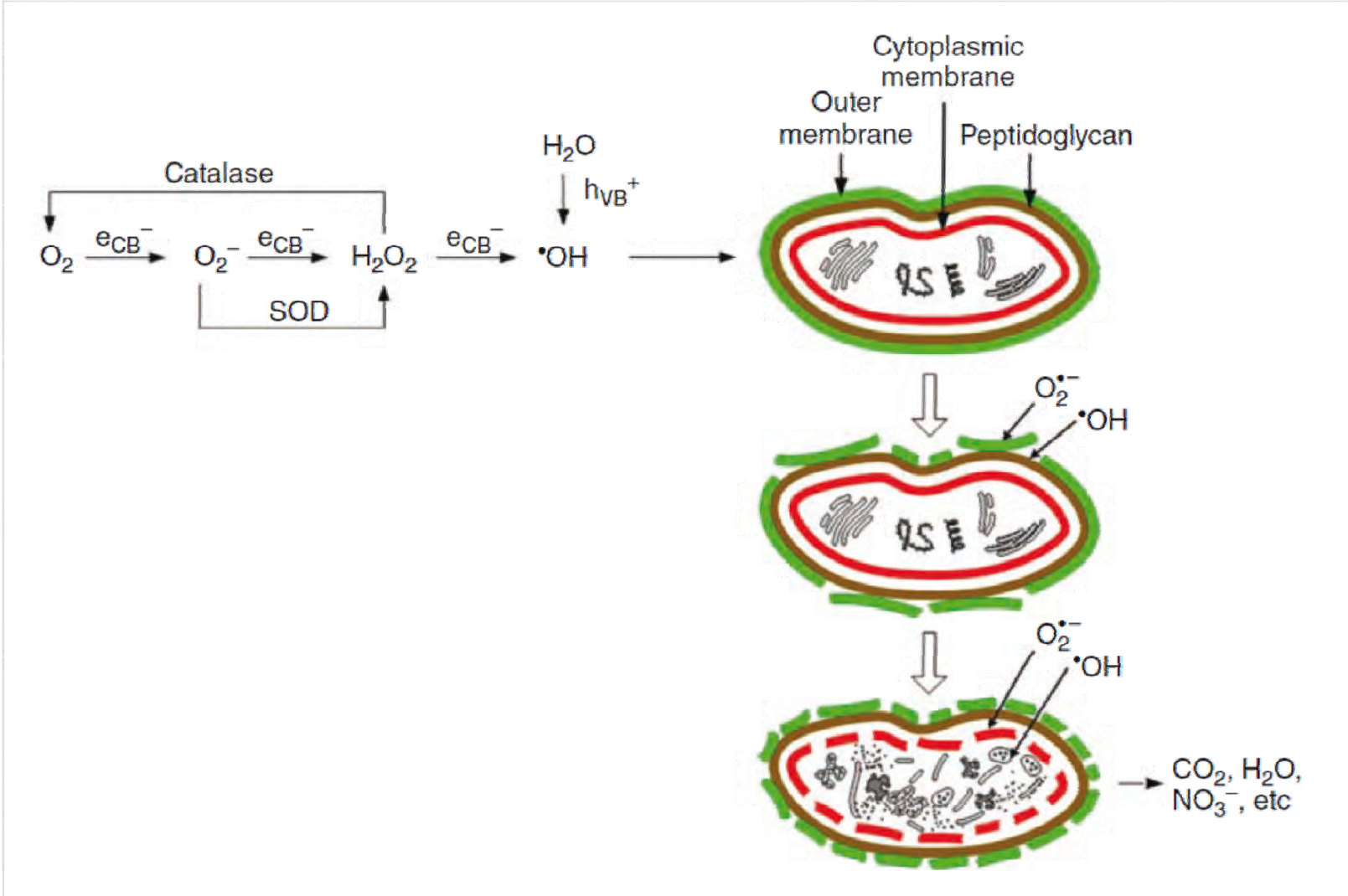
The antibacterial activity determination was performed in accordance to the norm ISO 27447:2009 (film adhesion method).

This test method is generally applicable at photocatalytic materials made to generate an antibacterial effect.

This method has been subject to some operational modifications to be adapted to the configuration (wide mesh network) with respect to the polymeric film. We ipotize to accredit the new methodologies by the end of February

Photocatalytic inactivation of E. coli

(Stochel, G et al., 2009, Bioinorganic Photochemistry, Ed. Wiley, pag.339)



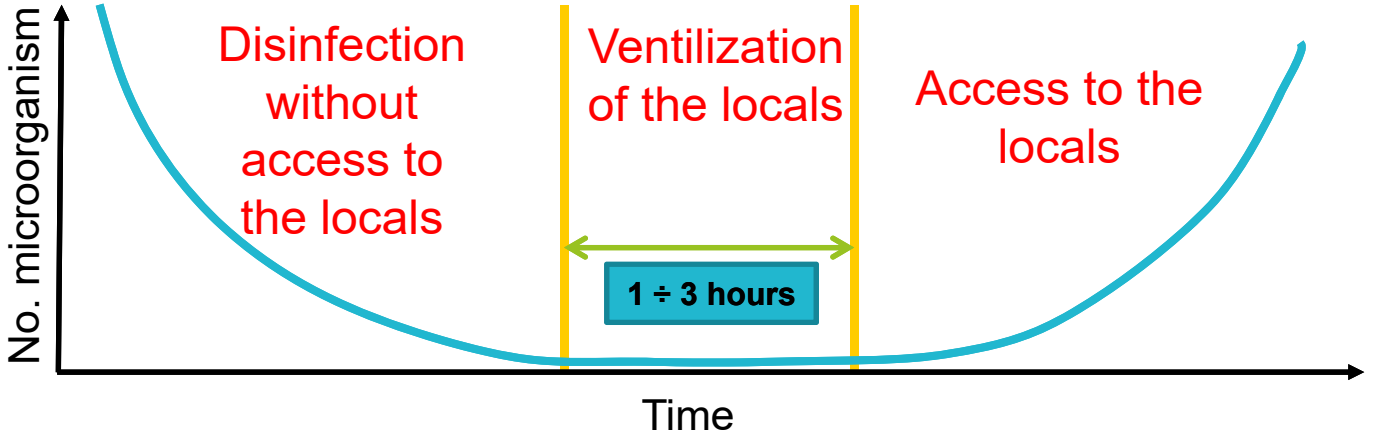
Sampling by: **Client**

Parameter - Note *Method - Note*	U.M.	Result Note	LoQ
Determination of photocatalytic antibacterial activity (DR) *ISO 27447:2009 Film adhesion method*		**> 3,4** Reduction > of 99.960%	0,1
RI - Photocatalytic antibacterial activity after UV		**> 3,4**	0,1
Size of test specimens (H x L)	mm	**40x40**	
Thickness of test specimens	mm	**1,0**	
Conditioning			
Type of polymer used for the cover film		**Polypropylene**	
Size of the cover film (H x L)	mm	**30x30**	
Intensity UV radiation	mW/cm£	**0,25**	
Exposition time	Hours	**8**	
Gram-negative strain		**E.coli - ATCC 25922**	
Number of bacteria available in the inoculum	n°	**300000**	
Volume of test inoculum	ml	**0,3**	
A - Count bacteria recovered from the specimens NOT treated time = 0	UFC	**300000**	0
Cd - Count bacteria recovered from treated specimens kept to DARK	UFC	**190000**	0

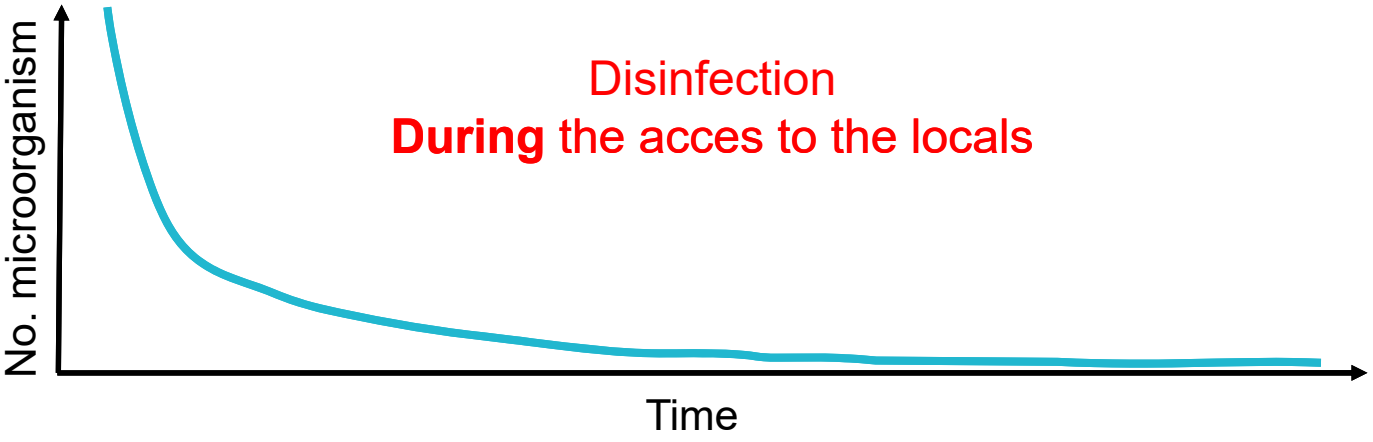
Parameter - Note *Method - Note*	U.M.	Result Note	LoQ
CI - Count bacteria recovered from the specimens treated after UV	UFC	9	0
Bd- Count bacteria recovered from the specimens NOT treated kept to DARK	UFC	**170000**	0
BI - Count bacteria recovered from the specimens NOT treated after UV	UFC	**21000**	0

Activity continues over the time

Traditional system

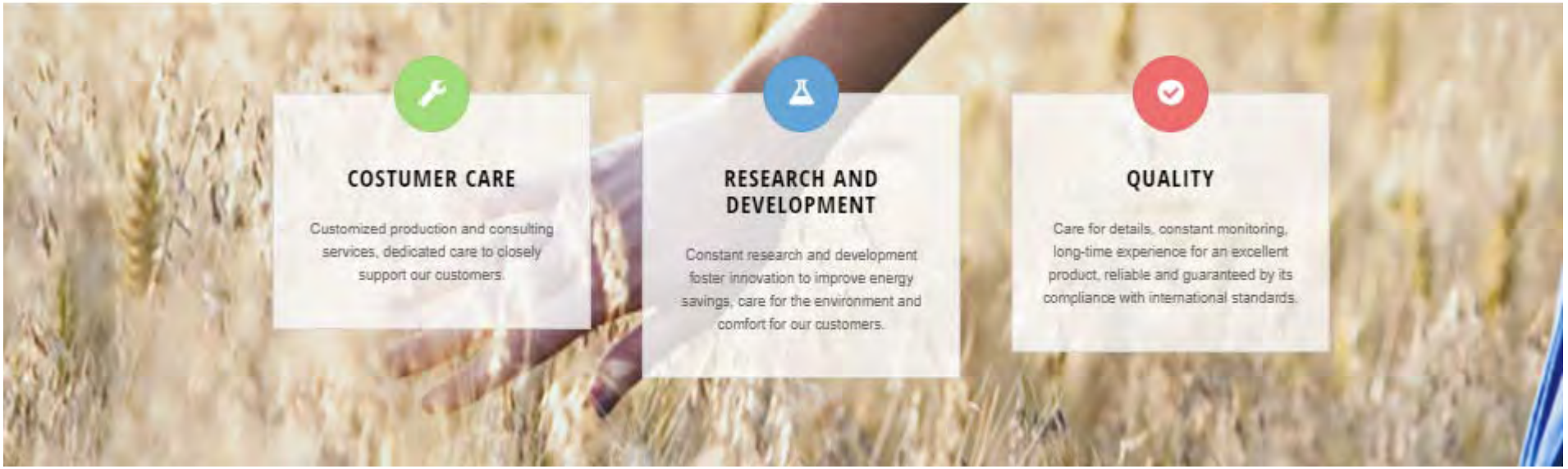


sunox



T.I.E. - EUROPEAN INDUSTRIAL WEAVING

Tradition, experience, innovation and research for the reliability of time proven quality.



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Thank you!

Questions welcome

Project smedia