

# Oxisol

Antipollution

Powerful Anti-Oxidant

Anti-aging

SPF/UV-A protection booster

IR—Protection

Photo stable



# NEW AGE REJUVENATION PANACEA

## >> POLLUTION RELATED DAMAGES IN TECHNOLOGY AND INDUSTRIAL ERA

The increased global environmental pollution along with several other factors (excessive sun-exposure, smoke, daily stress, use of junk food) leads to a greater exposure to pollutants derived from the uncontrolled industrial development and electromagnetic radiations (UV-A, UV-B rays, Infrared rays) able to cause ageing events. As result of such factors, there is a much higher risk of exposure to free radicals, highly reactive chemical species able to cause alterations of the structure of skin cells components such as proteins and DNA. Results of such interactions are damages to dermis and epidermis, and a consequent onset of the aging process consisting in the loss of skin elasticity, formation of wrinkles, skin dryness and an uncontrolled peeling of the skin surface cells.

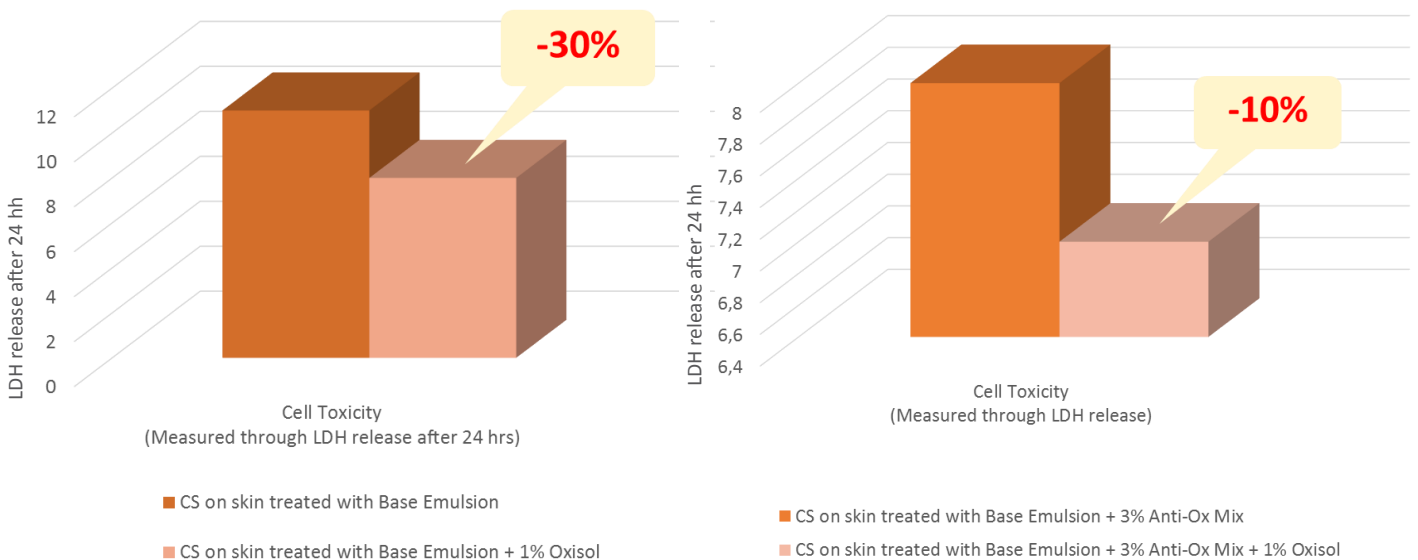
In order to avoid these damages, it is fundamental to use molecules with a powerful anti-oxidant power able to reduce the free radicals and make them harmless. It has also been demonstrated that not only UV rays, but also Infrared rays can potentially increase the cells stress conditions and boost the UV-induced damages. The approach to the prevention of such effects has been addressed to the use of strong anti-oxidants.

Oxisol is a specialty with an unmatched anti-oxidant power, far superior to other actives found on the market. Proven to be active at different levels on the above mentioned factors of risk, its activity and anti-oxidant benefit, in fact, go way beyond the action provided by traditionally used products like Resveratrol, Tocopherols, C Vitamin etc.

The astounding scavenging action of Oxisol can be exploited to formulate highly performing anti-aging creams, colored creams (Foundation, BB /CC creams etc.) with the additional benefit of help building SPF and UV-A Protection Factor. Oxisol is therefore a raw material designed to counteract all the factors of risk involved in nowadays' environmental pollution.

## ANTIPOLLUTION

Test carried out on Reconstructed Epidermal Model (RHE). The Cells were pre-treated with Chemical Smoke and a comparison of the levels of LDH on areas of the skin treated with base emulsion and base emulsion + Oxisol was done. LDH (Lactate De-Hydrogenase) is a marker of cell necrosis and apoptosis



Oxisol has been proven to reduce of 30% the level of toxicity caused by the exposure to environmental contaminants (chemical smoke), in comparison with a base cream without active ingredients.

Oxisol also works in synergy with other free radicals scavengers, boosting the reduction of pollution damages.

It does not give pro-oxidant action, neither in combination nor if used at a higher concentration of use (tested up to 3% in formula).

# FREE RADICALS SCAVENGER

UNMATCHED INTRINSIC ANTI-OXIDANT POWER <<

The intrinsic anti-oxidant power of Oxisol has been measured with 3 methods (DPPH, FRAP and PCL tests). The results underline that the intrinsic anti-oxidant power of the Oxisol is much higher than the most famous active ingredients used in the market, along with a lower reaction time, resulting in a faster action.

## PCL TEST:

Based on a reaction of a specific radical species (Superoxide) obtained through Photo-chemistry by UV-radiations, with a compound able to emit chemiluminescence. The marker used (Luminol) is a molecule that when gets oxidized from free radicals, emits a light measured through a specific tool (Photochem).

The presence of antioxidant substances inactivates the radical species inhibiting the chemiluminescence

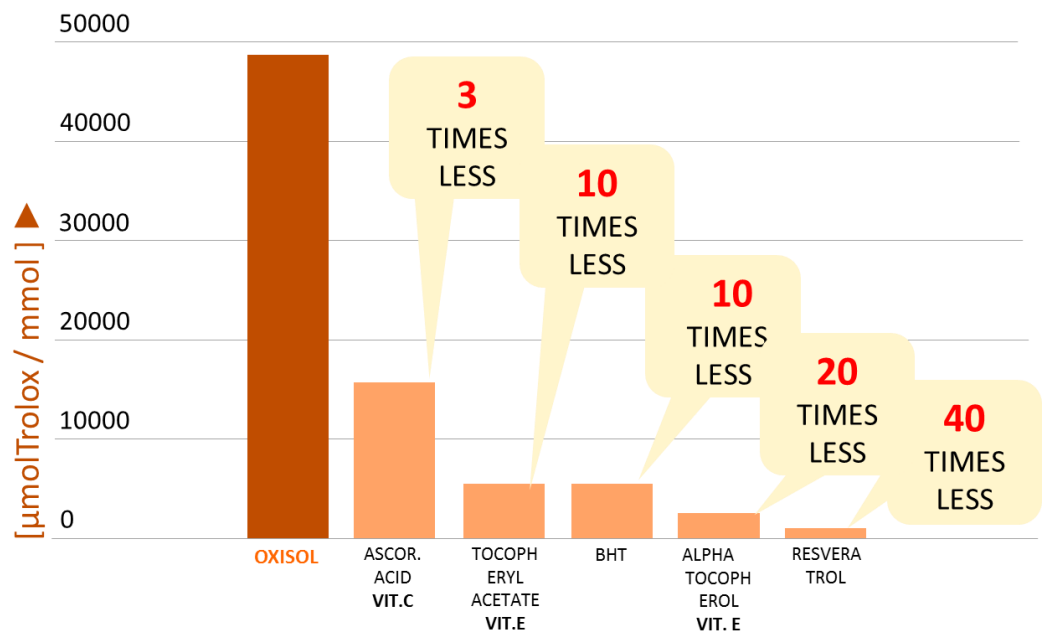
## FRAP TEST:

It measures the reducing capability of anti-oxidants toward Fe ions. It is a method based on electrons transfer, in which the Iron passes from  $Fe^{+++}$  to  $Fe^{++}$ , in presence of the TPTZ (2,4,6-Tris(2-Pyridyl)-s-Triazine) at a pH of 3.6. The ions form complexes, detectable and measurable through spectrophotometry.

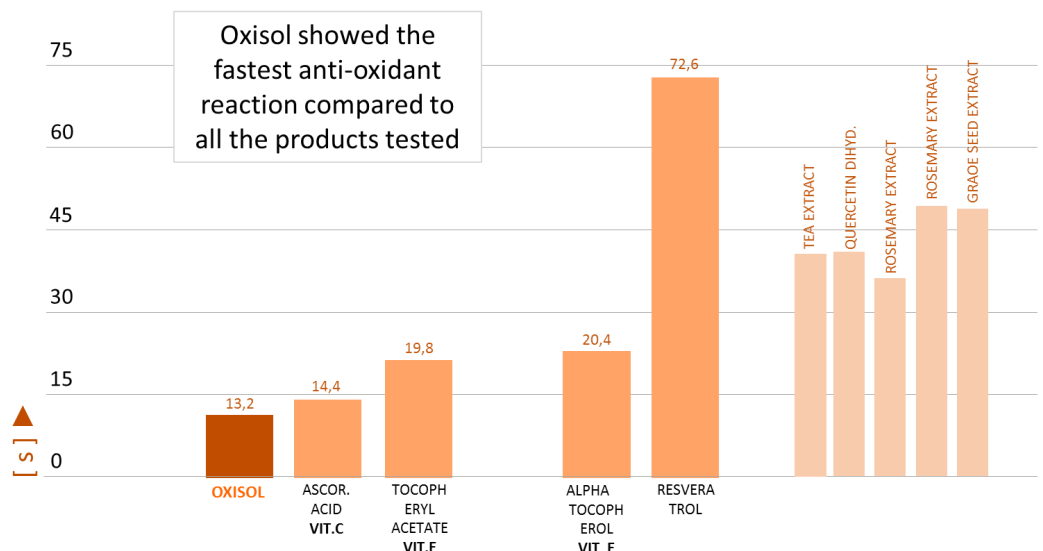
## DPPH TEST:

Test carried out with DPPH (DiPhenyl-Picril-Hydrazyl), stable cationic radical chromophor, reduced in presence of anti-oxidant compounds

In order to have a more clear idea about the astounding anti-oxidant force of Oxisol, it is sufficient to take under consideration the comparison with the most used and valuable anti-oxidants for the skin on the market, such as Ascorbic Acid, Tocopherol, Resveratrol, Tocopheryl Acetate etc., The test shows evidence of an Oxisol unmatched anti-oxidant strength.

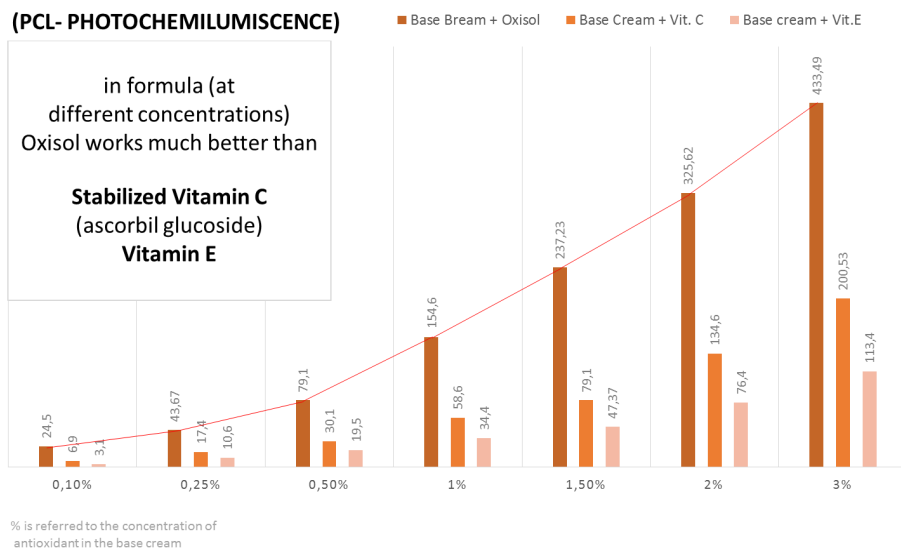


Oxisol also works with a lower reaction time, compared to most anti-oxidants on the market. This promptness allows a faster scavenging action, resulting in a more efficient prevention of the free radicals induced damages at skin level.



# IN FORMULATION ANTIOXIDANT POWER

>> COMPARED ANTIOXIDATION IN COSMETICS END PRODUCTS



Cosmetic formulations containing Oxisol at different concentrations (0.1, 0.25, 0.50, 1.00, 2.00 and 3.00 %) as only active ingredient have been evaluated in terms of anti-oxidant force. The end products have been compared both with base formulations containing the best anti-oxidants used in cosmetics (Ascorbic Acid and Tocopherols) and end-products in the market claiming a strong anti-oxidant power. Every measurement carried out shows a linear behavior, in which Oxisol shows better results than Vitamin E and Vitamin C stabilized version.

EMULSION BASE	EMULSION BASE	EMULSION BASE	ITALIAN PHARMA LEADER	EMULSION BASE	WORLDWIDE MARKET LEADER
<b>1 % OXISOL</b>	<b>1,5 % VIT.E</b>	<b>1,5 VIT.C</b>	<b>1% VIT.C</b>	<b>3 % OXISOL</b>	<b>&gt;3% VIT.C</b>
[ $\mu\text{molTrolox} / \text{mmol}$ ]	[ $\mu\text{molTrolox} / \text{mmol}$ ]	[ $\mu\text{molTrolox} / \text{mmol}$ ]	[ $\mu\text{molTrolox} / \text{mmol}$ ]	[ $\mu\text{molTrolox} / \text{mmol}$ ]	[ $\mu\text{molTrolox} / \text{mmol}$ ]
154,6	47,37	79,1	2,19	433,49	211,13
	3 TIMES LESS	2 TIMES LESS	70 TIMES LESS		2 TIMES LESS

Cosmetic formulations containing Oxisol at 1% provide an anti-oxidant power superior to the same cosmetic formulations containing 1,5% either of Vitamin C (almost 100% ) or Vitamin E (more than 2 times better, more than 200%), so best results achieved with a lower concentration of use.

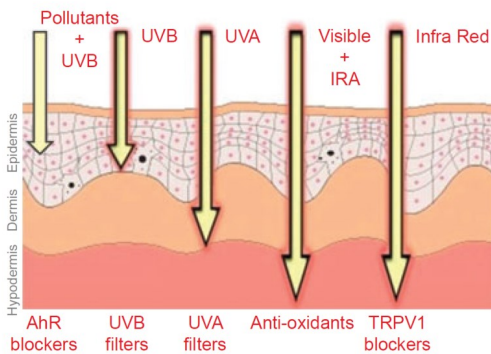
The results observed in a benchmark found in the market containing high amounts of Vitamin C show that Oxisol antioxidant action is more than 2 times stronger than the benchmark.

## >> INNOVATIVE STABILITY MECHANISM

One of the most frequent issues when formulating cosmetics with a high anti-oxidant power is keeping the effective anti-oxidant efficacy also inside the finished product; most anti-oxidants found on the market, from Ascorbic Acid to Glutathione etc. have plenty of issues from this standpoint, as their anti-oxidant action sometimes gets lost with the ingredients found in the formulation, with the exposure to the air or other factors because of the limited "availability" of their functional groups. Oxisol represents a new kind of anti-oxidant specialty, as the molecule composing it is able to keep its stability through the electronic delocalization, avoiding the loss of efficacy. Such electronic delocalization makes Oxisol able to work as a more efficient scavenger than common antioxidant actives because of a prolonged availability of its chemical groups to inactivate free radicals. The Oxisol substantial electron attraction tendency is linked to its innovative structure, composed entirely of functional groups spread along the whole molecule able to "accept" electrons.

# IR PROTECTION

Several studies suggest that one of the concurrent causes for skin ageing is the formation of free radicals caused not only by UV wavelength range, but also in the Infrared (IR) spectral range. IR rays affect mitochondrial integrity and heat receptors (activated by IR induced vibrations) mediate some of its effects. IR-A rays are able to penetrate in the dermis and contribute in terms of free radicals generation at a level around one fourth of UV, along with decreased collagen production effects and increased itching and inflammations events (mainly observed in elderly people). [1] [2] [3] [4] [5]

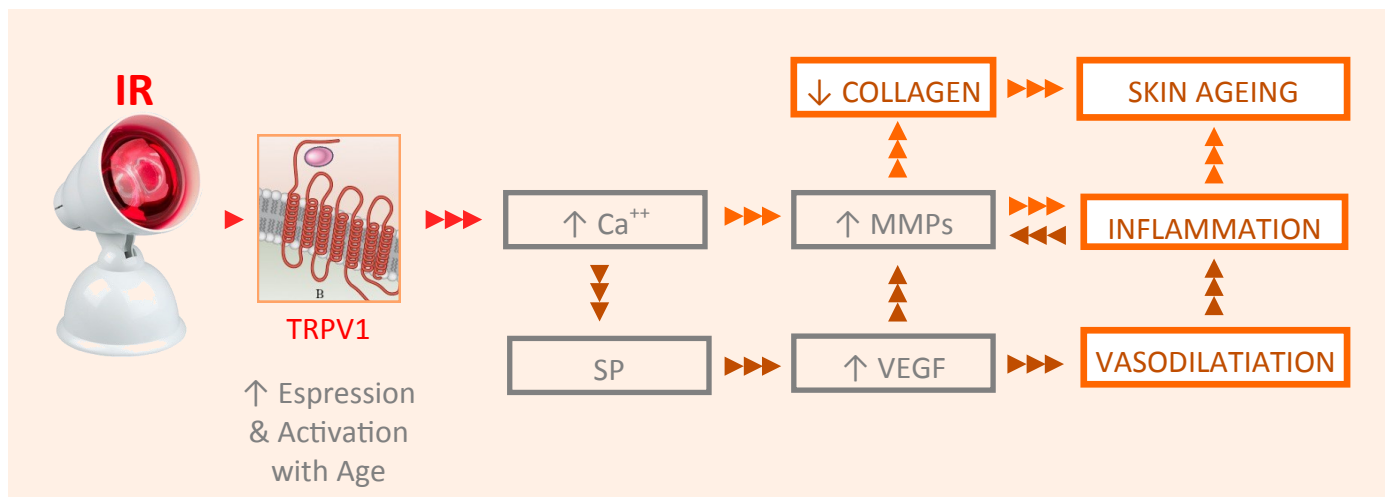


The strategy to counteract these IR damages is linked to the use of strong anti-oxidant molecules, like Oxisol of cell components like DNA and Proteins, and is highly resistant to UV exposure, so it represents a safe option.

Several tests have been carried out in order to evaluate the activity of such a specialty.

## IR-INDUCED AGEING <<

Activation of the TRPV1 ion channel by IR and heat in skin in keratinocytes, transient receptor potential vanilloid 1 (TRPV1) activation by infrared radiation (IR) and heat promotes calcium influx and induces matrix metalloproteinase-1 (MMP-1) expression, resulting in collagen degradation. On skin sensory nerve fibers, TRPV1 activation stimulates the release of substance P (SP), which mediates vasodilatation and vascular permeability, through the promotion of vascular endothelial growth factor (VEGF) secretion by mast cell [43]. Synergistic activation of TRPV1 on both skin cells favors inflammation and precipitates skin ageing. Expression of TRPV1 is increased in aged skin.



## Bibliography

- [1] Lee, Y.M., Kang, S.M. and Chung-The role of TRPV1 channel in aged human skin. *J.Dermatol. Symp. Proc.* **65**, 81-85 (2012)
- [2] Cho, S. Shin, M.H. Kim, K.Y. Seo, J.E. Lee, YM Park et al. Effects of infrared radiation and heat on human skin **14**, 15-19 (2009)
- [3] Aubdool, AA. And Brain, S.D. Neurovascular aspects of skin neurogenic inflammation. *J.Invest Dermatol. Symp. Proc.*, **15**, 33-39 (2011)
- [4] Lee YM, Kim, YK and Chung. Increased expression of TRPV1 channel in intrinsically aged and photo-aged human skin in vivo. *Exp Dermatol.* **18**, 431-436 (2009)
- [5] E.Dupont, J.Gomez and D.Bilodeau. Beyond UV radiation: a skin under challenge. *International Journal of Cosmetic Science*, 1-9 (2013)

# NEW SUNSCREEN BOOSTER

## >> A NOVEL DUALISTIC ANTI-OXIDANT SUNSCREEN BOOSTER

The use of molecules able to provide protection from free radicals and help boosting SPF and UV-A Protection Factor represent the new sunscreen formulations strategy aimed to reduce the quantity of filters included in the formulation.

## >> WHY IS IT A STABLE ANTI-OXIDANT SUNBOOSTER AND NOT A FILTER?

Oxisol (**INCI: DiHydroxyPhenyl-Benzimidazole-Carboxylic Acid**) is an innovative anti-oxidant raw material able both to counteract the formation of free radicals and to provide SPF and UV-A Protection Factor boosting.

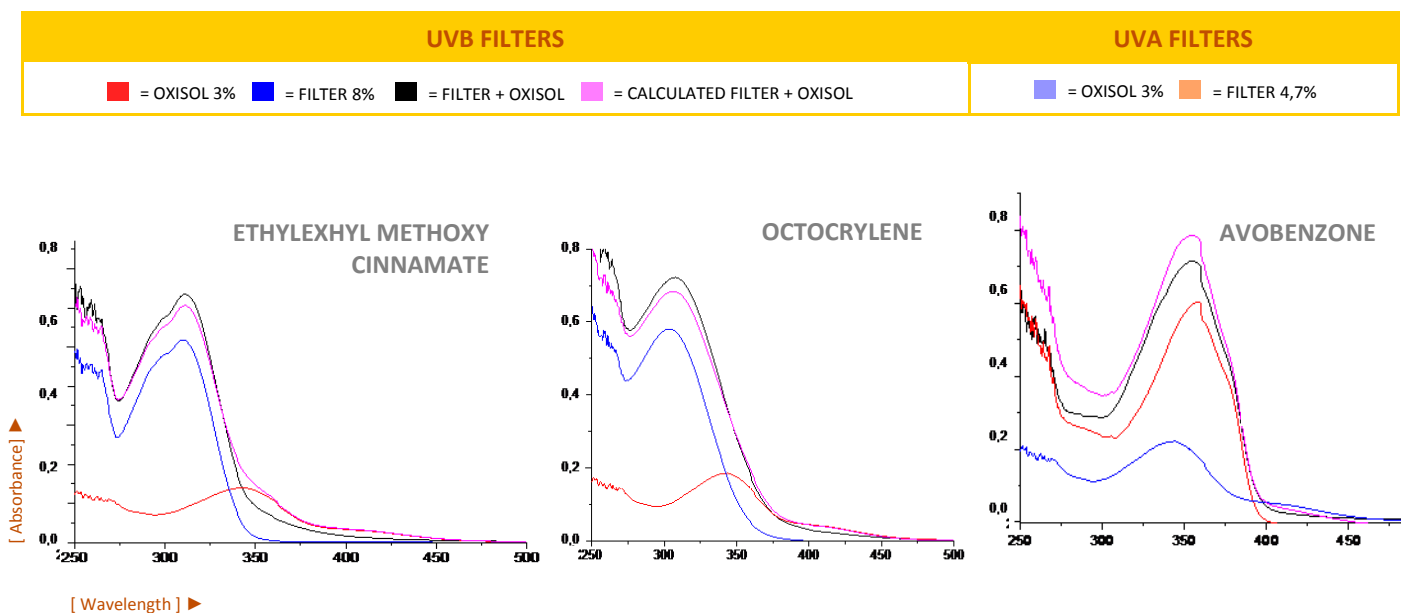
The UV boosting action of Oxisol is related to the process of energy transfer or electron transfer between the excited state of the filters and Oxisol; this event may work in the protection of filter from photo-oxidation thus improving their performances. This for the in vitro part. For the in vivo part, other mechanism of further potentiation may be involved relying on the specific physiological activity of Oxisol as scavenger of free radicals generated by UV radiation.

The following paragraph explains in detail the poor absorbance of the Oxisol as it is, but the astounding SPF and UV-A Protection increase it determines when combined with filters.

## >> OXISOL AND REGISTERED FILTER ABSORBANCE

The following graphics show the absorbance linked to the use of Oxisol as it is, sunscreen filters alone (the measurements were carried out on EthylHexylMethoxyCinnamate, Avobenzone and Octocrylene), and Oxisol in addition to the above mentioned filters.

The results suggest that in each case under analysis, the use of Oxisol improves significantly the absorbance both in the UV-A and UV-B region.



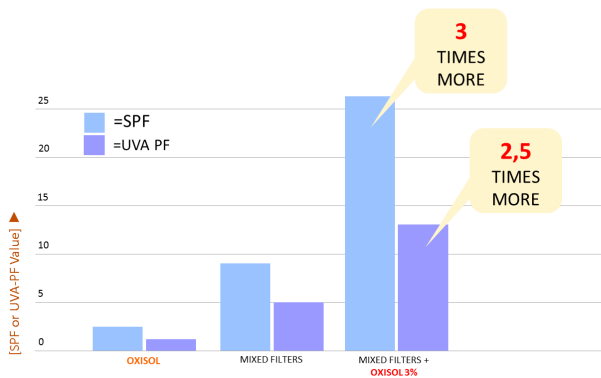
The graphics show the absorbance of Oxisol when used alone and in combination with organic filters; the result suggests that the addition of Oxisol improves significantly the absorbance of wavelengths corresponding both to UV-A and UV-B region



# SUNSCREEN TESTS

## SPF TEST & UV-A PROTECTION FACTOR in vitro <<

### INFLUENCE ON UV-A & UV-B PROTECTION [TEST 1]

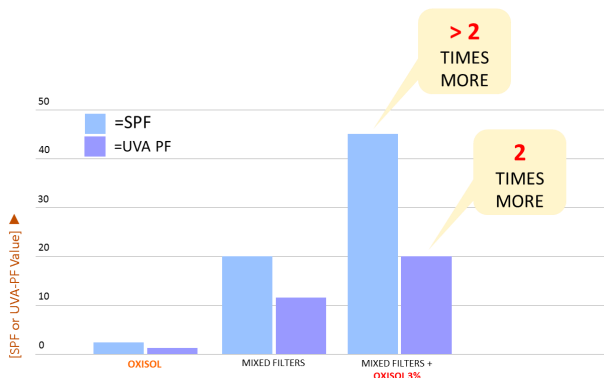


### Formulation 1

Avobenzone @ 2%  
 Octocrylene @ 4%  
 OctylMethoxyCinnamate @ 4%

has been enriched with a 3% of Oxisol .  
 Oxisol increases the SPF and UV-A Protection Factor of respectively 3 and 2.5 times.

### INFLUENCE ON UV-A & UV-B PROTECTION [TEST 2]

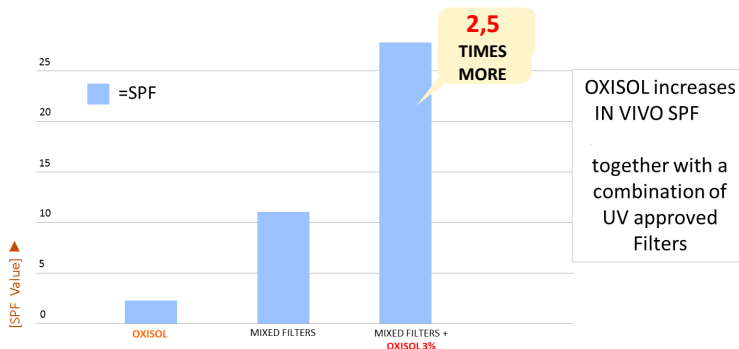


### Formulation 2

Avobenzone @4.7 %  
 Octocrylene @8.0 %,  
 Octyl Methoxy Cinnamate @8.0 %

has been enriched with a 3% of Oxisol .  
 Oxisol increases the SPF and UV-A Protection Factor of respectively of >2 and 2 times.

### INFLUENCE ON UV-B PROTECTION [TEST 3]



## SPF TEST in vivo <<

### Formulation

Avobenzone @ 2%  
 Octocrylene @ 4%  
 OctylMethoxyCinnamate @ 4%

Oxisol increases SPF the above sunscreen formulation tested in vivo

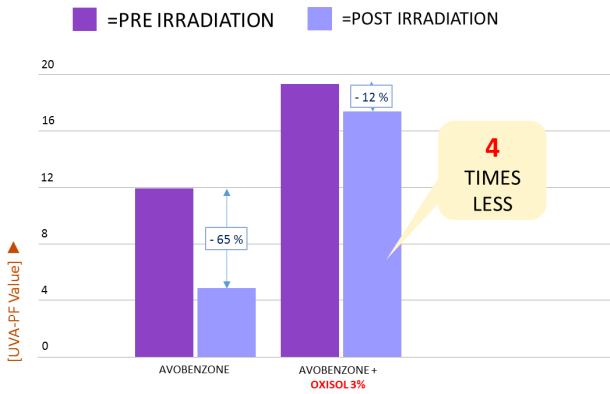
The new approach in sun protection takes under consideration not only the protection in terms of SPF and UVA-Protection Factor, but also a concurrent action on the prevention of the ageing damages related to the UV action. This new necessity, accentuated by the contextual factors of risk related to the pollution and the increased amount of environmental contaminants, brings the need of active compounds able to work in a dualistic way. Oxisol responds to such requirement through its boosting sun protection activity along with its free radical scavenging action.



# STABILITY & SAFETY

## >> PHOTOSTABILITY: UV-A PF BEFORE AND AFTER IRRADIATION

### INFLUENCE ON POST IRRADIATION UV-A STABILITY



The beside test shows the Avobenzone (the most used UV-A filter in cosmetics industry) reaction to the irradiation in terms of stability and capability to keep its action after UV exposure. The test was carried out with Avobenzone alone, and with Avobenzone combined with Oxisol.

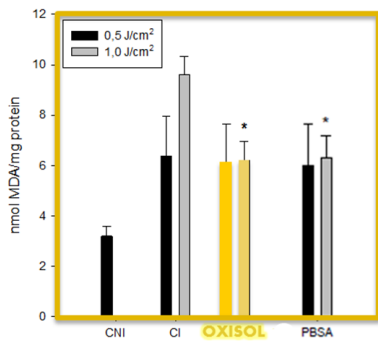
The results suggest that:

The UV-A Protection Factor is much higher when using Oxisol in association with Avobenzone, in comparison with using Avobenzone alone.

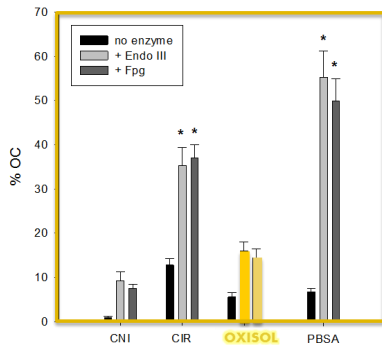
After UV exposure, the sample containing just Avobenzone lost almost all its efficiency in terms of UVA protection, whereas the presence of Oxisol avoids the loss of efficiency of the sunscreen, with a very slight decrease of activity following UV exposure

## >> SAFETY

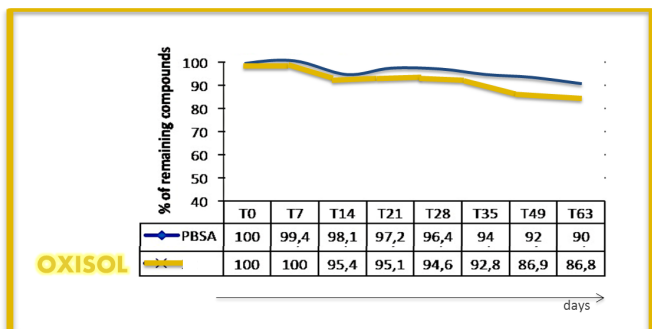
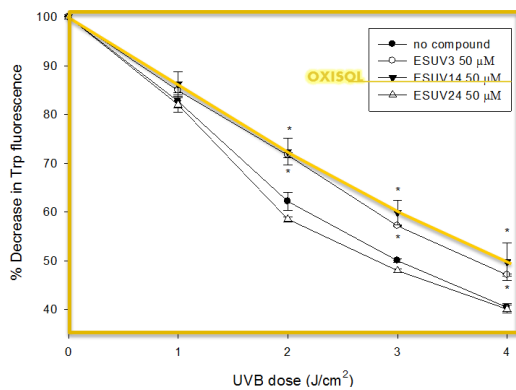
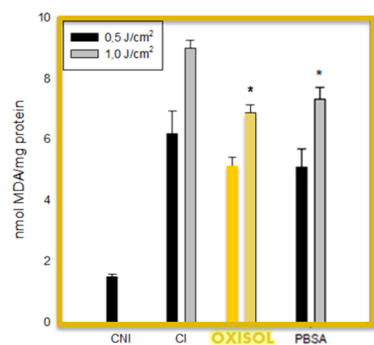
UVB photoinduced lipid peroxidation (cells)



UVB photoinduced lipid peroxidation (surnatant)



UVB photoinduced lipid peroxidation (surnatant)



Oxisol safety has been tested in several ways: as most of the existing sunscreen filters are not very stable and may have their chemical-physical structure altered by UV exposure, a long series of analysis has been carried out in order to evaluate Oxisol stability. In terms of *Photo-stability* (measurement of the residual product resulting after UV exposure), *Lipidic Peroxidation*, *Protein Photo-damage*, *DNA Photo-Cleavage*, *Physical stability*, Oxisol gave results in line or even better than PBSA, one of the safest approved UV-filters on the market. As shown in the below graphics, Oxisol has a stability profile even better than approved safe filters, in particular in terms of DNA and protein integrity. Moreover, cosmetic formulations containing the compounds were analysed by HPLC to determine the real concentration of the active molecules during accelerated ageing at 40°C = 90% in the case of the OXISOL after more than two months.



# SOLUBILIZATION

## AND TECHNOLOGICAL FEATURES <<

Oxisol is a water-soluble compound, easily melted in pre-dispersion at a pH of 8.5 - 9.5 (the best alkaline compounds that solubilize it are the aminoacids Lysine or Arginine, and generally they should be used at the same concentration of the Oxisol). The ratio of use, therefore, is:

### FOR INSTANCE

10 WATER: 1 OXISOL: 0.25 NaOH (or KOH) (pH = 9.5)

10 WATER: 1 OXISOL: 1 LYSINE (or Arginine) (pH = 8.5)

10 WATER: 1 OXISOL: 3 TEA (pH = 8.5)

Once the pre-solubilization has been carried out, it can be added to the rest of the formulation, in which Oxisol can bear the sudden change of pH and remain solubilized in the finished product

Oxisol stability is guaranteed by its innovative chemical structure taking advantage of a chemical tautomerism to keep its features and stability unaltered.

Anti-oxidants like Resveratrol require solubilization with Propylene Glycol at high temperatures, whereas most of Ascorbic Acid versions found on the market have plenty of stability issues because of the tendency to get oxidized and consequently inactivated.

Oxisol surprising UV-A boosting properties allow to include an ingredient in a sunscreen or anti-aging cream far easier to work with in comparison with Avobenzone (whose solubilizing process takes place in oily phase at high temperatures, along with a high risk of precipitation and photo-stability issues).



# RECOMMENDED APPLICATIONS

## OXISOL INTO THE COSMETIC WORLD <<

Oxisol is an innovative molecule able to overcome some of the most frequent technological and functional matters occurring when formulating sunscreens:

It is not a filter, but works even alone as a wide spectrum filter, able to provide both UV-B and UV-A covering a powerful anti-oxidant effect along with a reduction of the UV&IR-related skin ageing. It is photo-stable, so it doesn't require the addition of stabilizers as other filters do. As it is not registered as a filter, it doesn't have limits on the concentration of use and other regulatory matters. Its water-solubility combined with the UV-A/UV-B action represents a "unicum" in cosmetics industry.

- **ANTI-AGING CREAMS** : as anti-oxidant active ingredient; in association with registered filters it allows to claim both SPF and UV-A protection.
- **COLOR COSMETICS** : as anti-oxidant active and SPF/UV-A Protection co-builder in Foundation, BB, CC, DD, EE creams.
- **SUNSCREEN FILTERS** : as organic booster in several kind of formulations (sprays, milks, creams) for both UV-A and UV-B protection

## EXAMPLE OF FORMULATION >> EXTREME POLLUTION DEFENCE

INCI	%	PRODUCER
POTASSIUM OLIVOYL HYDROLYZED OAT PROTEIN, CETEARYL ALCOHOL, GLYCERYL OLEATE, GLYCERYL STEARATE, AQUA	10	<b>OLIVOIL AVENATE EMULSIFIER: KALICHEM ITALIA</b>
ETHYLHEXYL PALMITATE	9	VARIOUS
CAPRILYC CAPRYC TRIGLICERIDE	7	VARIOUS
CETYL ALCOHOL	5	VARIOUS
DIHYDROXYPHENYLBENZIMIDAZOLE CARBOXYLIC ACID	1	<b>OXISOL: KALICHEM ITALIA</b>
LYSINE	1	VARIOUS
AQUA	63.5	VARIOUS
GLYCERIN	3.5	VARIOUS

## EXAMPLE OF FORMULATION >> SPRAYABLE SUNSCREEN (SPF & UV-A)

INCI	%	PRODUCER
AQUA	32	VARIOUS
DIHYDROXYPHENYLBENZIMIDAZOLE CARBOXYLIC ACID	1,0	<b>OXISOL: KALICHEM ITALIA</b>
LYSINE	1,0	VARIOUS
MICROCRYSTALLINE CELLULOSE	3,75	VARIOUS
AQUA	37,25	VARIOUS
ETHYLEXYL METHOXYCINNAMATE, AQUA, BUTYL METHOXYDIBENZOYLMETHANE, OCTOCRYLENE, C12-15 ALKYL BENZOATE, GLYCERIN, BIS-ETHYLHEXYLOXYPHENOL METHOXYPHENYL TRIAZINE, SODIUM COCOYL AMINOACIDS, POTASSIUM OLIVOYL HYDROLYZED WHEAT PROTEIN, ALKYL POLYGLUCOSIDE	25	<b>OLISUN : KALICHEM ITALIA</b>



## WAY OF USE

	RANGE
pH of use	5,0 ÷ 8,5
Suggested concentration of use	0,1 ÷ 3,0

## TECHNICAL INFORMATION

INCI NAME and COMPOSITION	CAS#	EINECS #	RANGE %
DIHYDROXYPHENYLBENZIMIDAZOLE CARBOXYLIC ACID	-	-	100%

## PHYSICO-CHEMICAL INFORMATION

PHYSICO - CHEMICAL ANALYSIS	METHOD	LIMITS
APPEARANCE	Interno / Internal	POWDER
COLOUR	Interno / Internal	BEIGE
ODOUR	Olfactory	SLIGHT TYPICAL
pH DIRECT of an aqueous solution 10%	Interno / Internal	3 ÷ 4
TOTAL MICROBE COUNT	by inclusion Ph. Eur. 7.0	0 ÷ 100

**SHELF LIFE :** 12 months

**STORAGE CONDITIONS:** Keep the container well closed. To preserve the quality of the product, do not store close to a heat source and keep far from direct light. Keep in a dry, cool and well aired location.

# Oxisol



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