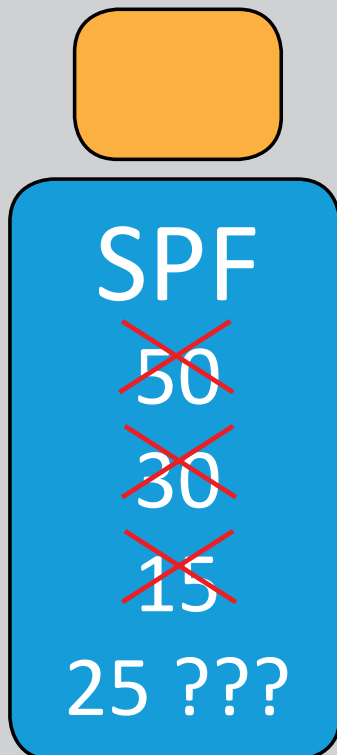


IN VITRO SUN PROTECTION EVALUATION



*Why and how?
Does it work?
How to make it reliable?*

Sun risk and basis of sun protection

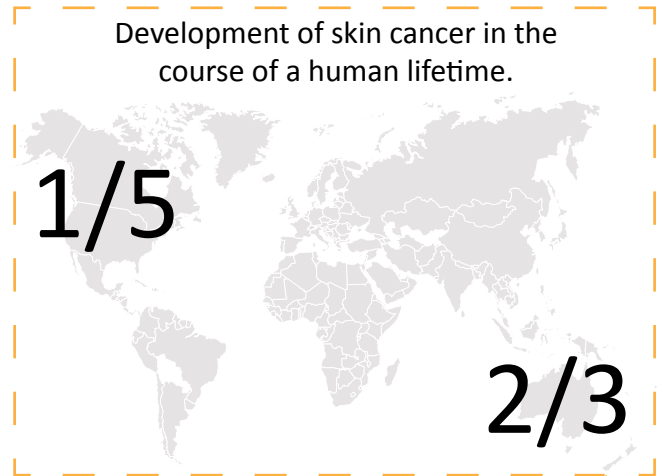
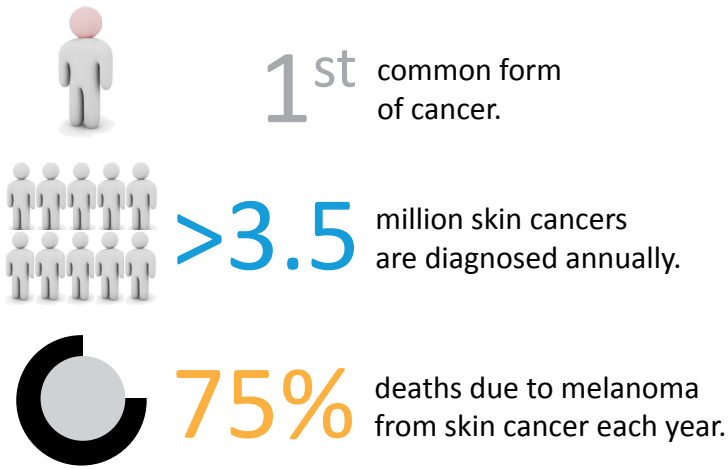
Principle of evaluation

Key parameters for reliability

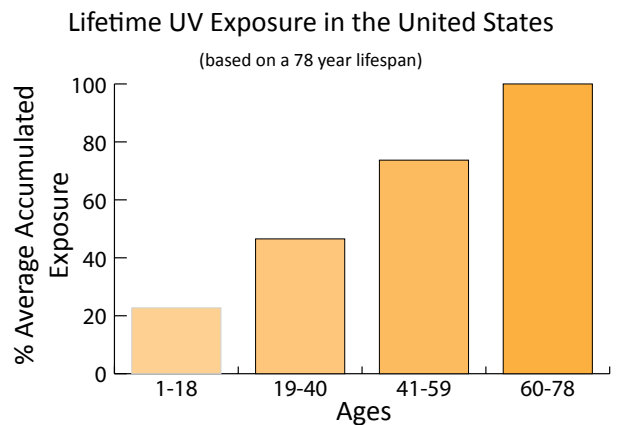
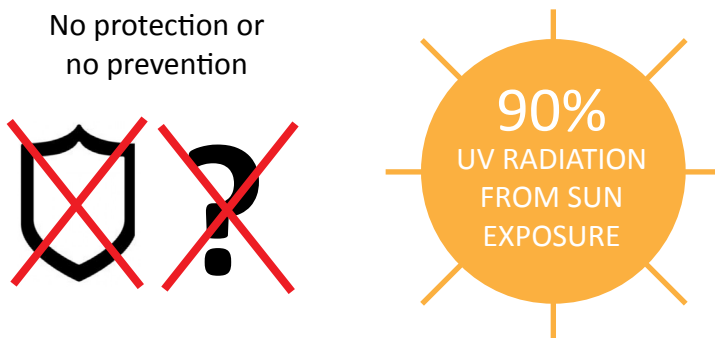
SUN RISK

[1][2][3]

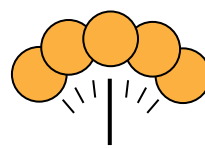
1. Key figures of skin cancer



2. Causes of skin cancer due to the sun



3. Prevention about sun risk



Avoid sun exposure between 10 am-4 pm.



Seek shade when UV rays are the most intense

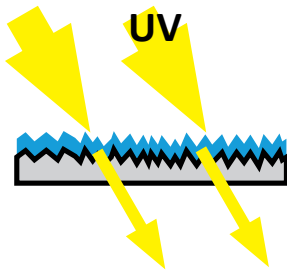
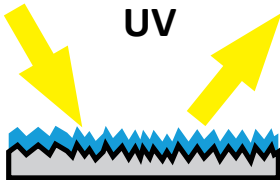


Sunbeds damage the skin and unprotected eyes and are best avoided entirely.

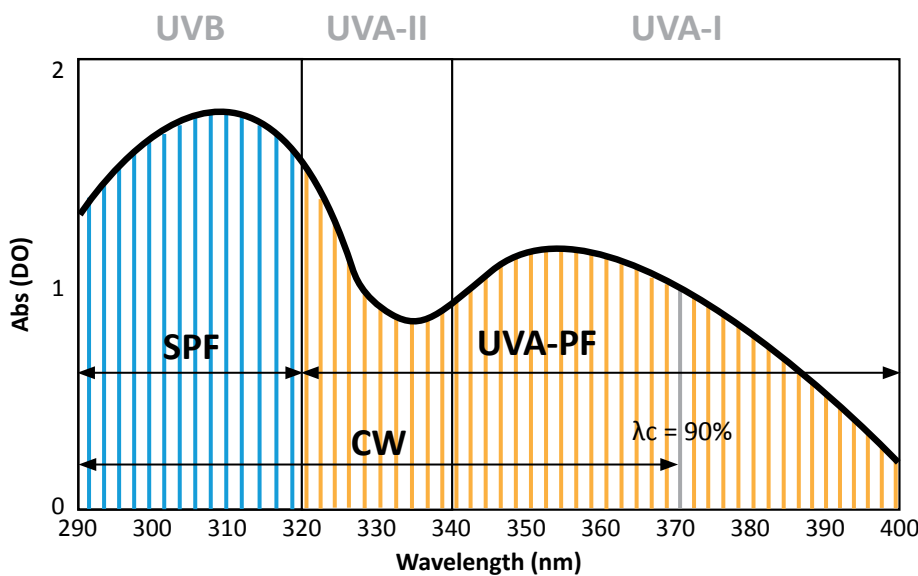
BASIS OF SUNSCREEN PROTECTION

[4][5][6]

1. Sunscreen and UV filters

Sunscreen product	Organic filter	Mineral filter
UV filters in: - Emulsion (Oil/Water; Water/Oil) - Oil - Stick - Alcoholic spray - Powder - Gel	Absorbing effect 	Scattering & Absorbing effect according to particle size 

2. UV absorbance



SPF: Sun Protection Factor (UVB protection)

UVA-PF: UVA Protection Factor (UVA protection)

CW: Critical Wavelength (UVB/UVA balance protection)

3. Solar protection assessment according to 3 indexes:

	SPF	UVA-PF (PA+, PA++, PA+++, PA++++)	CW (Broad spectrum)
Based on biological effect on human	IN VIVO standard	IN VIVO standard	-
Based on physical effect	IN VITRO method	IN VITRO standard	IN VITRO standard
Based on computer simulation	IN SILICO information	IN SILICO information	IN SILICO information

IN VIVO PRINCIPLE: BIOLOGICAL

[7][8][9]

1. Selection of human volunteers

Volunteer

PHOTOTYPE	I	II	III	IV	V	VI
SKIN TYPE	Extremely Light Skin	Extremely Light Skin	Light Skin	Olive Skin	Dark Skin	Darker Skin
BURNING LEVEL	Immediately	Often	Sometimes	Not frequently	Rarely	Rarely
UV DOSE REQUIRED	MED	MED	MED	MED	MED	MED

*MED: Minimal UV dose required for sunburn

2. Application of product

Amount

NO PRODUCT

Left & Right **BACK** of human volunteers

WITH SUNSCREEN AT 2.0 mg/cm²

~ 8 cm

~ 5 cm

3. UV Exposition

Solar Simulator

Phototype I, II & III

SPF = 15 SPF = 10 SPF = 20

4. End point determination

Reading

Several **SPOTS** at different irradiation doses.

WITH SUNSCREEN					NO PRODUCT				
100 sec	150 sec	200 sec	250 sec	300 sec	10 sec	15 sec	20 sec	25 sec	30 sec
		MED protected					MED unprotected		

5. Calculation

SPF

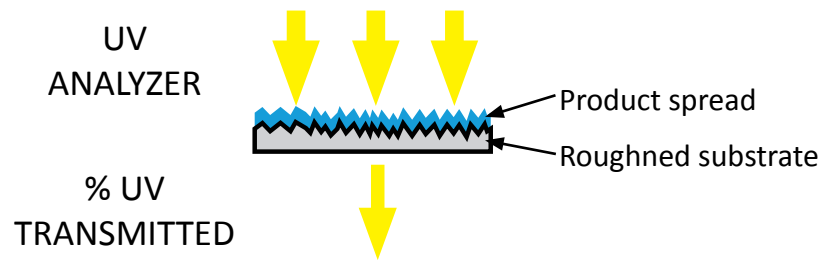
$$SPF_{in\ vivo} = \frac{MED_{protected}}{MED_{unprotected}} = 10$$

« SPF is only a relative scale of rating on the protective capabilities of products against erythema, used as a reference mark of consumer guidance. »

Marc Pissavini, Coty/Lancaster - Cosmetic Days 2012

IN VITRO PRINCIPLE: PHYSICAL

[9][10][11]

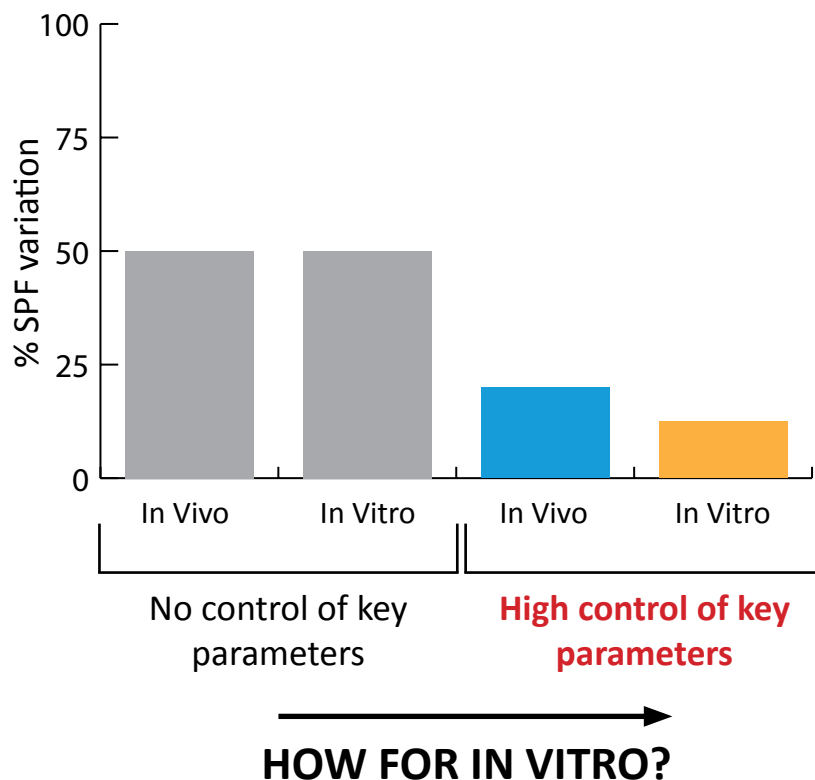


« People always think accuracy before reproducibility but without control of key parameters, we can demonstrate everything and the opposite! »

Dominique Lutz, HelioScreen - JP Marty Days 2013

RELIABILITY OF METHODS

High control of key parameters for improvement of reliability



IN VITRO KEY PARAMETER: SUBSTRATE

[12][13][14][15]



HELIOPATE with high roughness reproducibility.

HD6 - Molded PMMA plate

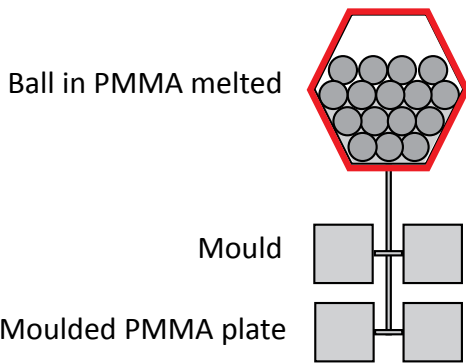
SB6 - Molded-Sandblasted PMMA plate



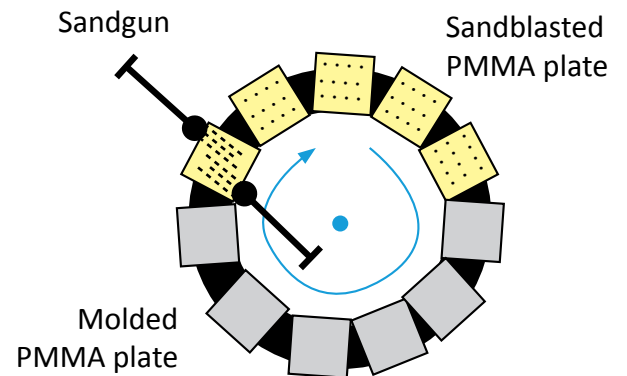
1. Process



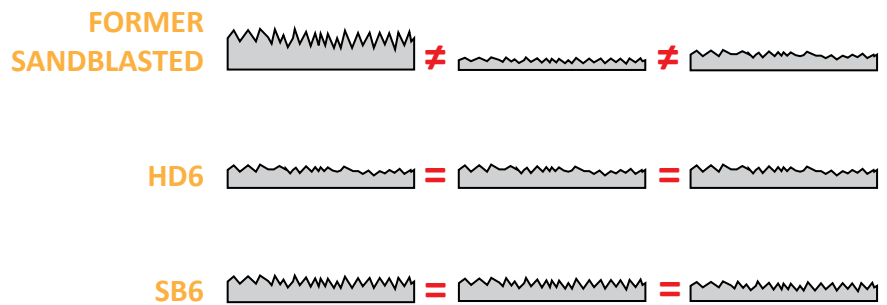
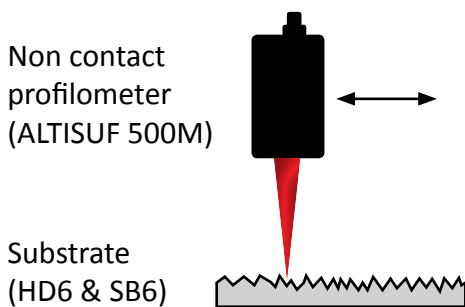
MOLDING (HD6)



MOLDED SANDBLASTING (SB6)

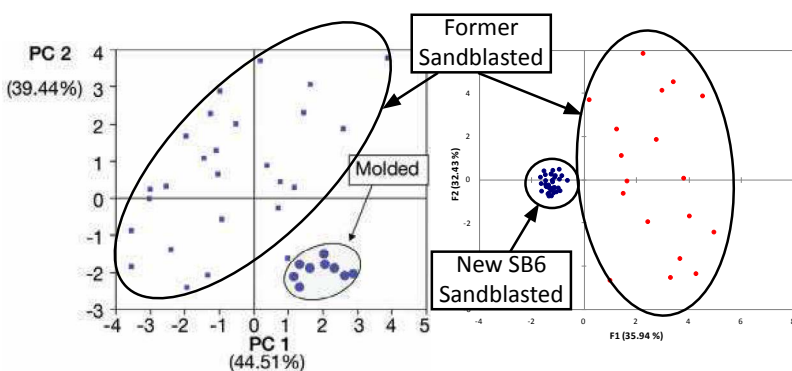


2. Roughness control

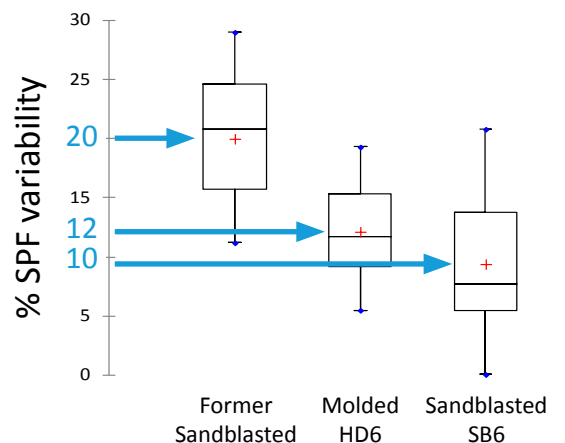


3. Advantages

Topographic reproducibility according to substrate



In Vitro SPF variation according to substrate by manual spreading for 1 operator



IN VITRO KEY PARAMETER: TEMPERATURE

[16]



HD-THERMASTER
with high temperature control
at substrate surface.



1. Process

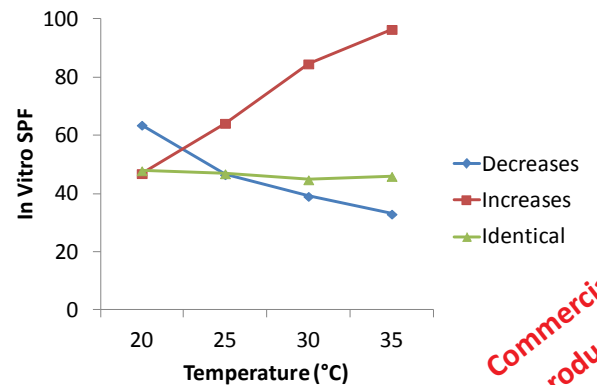
Substrate in oven is **NOT** enough

Temperature must be controlled at **SUBSTRATE SURFACE** during **WHOLE PROCESS** (product application, spreading, drying, UV exposure)

Metallic support for temperature maintain by thermal inertia

2. Advantages

Avoid In Vitro SPF difference level according to temperature at substrate surface.



IN VITRO KEY PARAMETER: PRODUCT

[17]



AUTOMATED SERYNGE
for sunscreen application.



1. Process

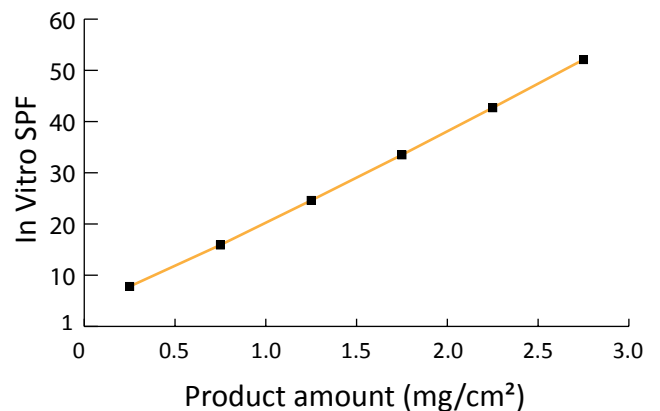
Perform equal drop over whole substrate surface in order to reach rate required.

Sunscreen amount according to substrate:

1.3 mg/cm² for Molded PMMA plate **HD6**
1.2 mg/cm² for Sandblasted PMMA plate **SB6**

2. Advantages

Avoid In Vitro SPF difference level according to product amount applied



Spreading immediately after (<30 sec)

IN VITRO KEY PARAMETER: PRESSURE

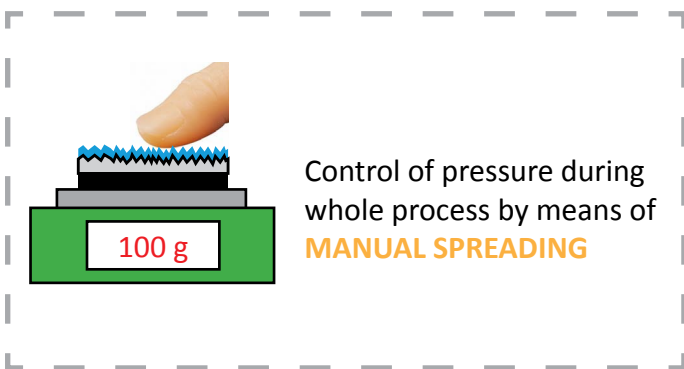
[18]



FINGER PRESSURE SENSOR
with high pressure precision detector.



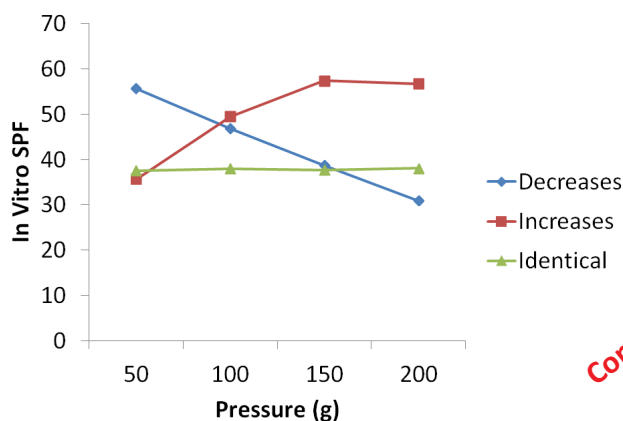
1. Process



Drying time (15-30 min)

2. Advantages

Avoid In Vitro SPF difference level according to pressure during spreading step



Commercial products

BEST WAY

IN VITRO KEY PARAMETER: SPREADING

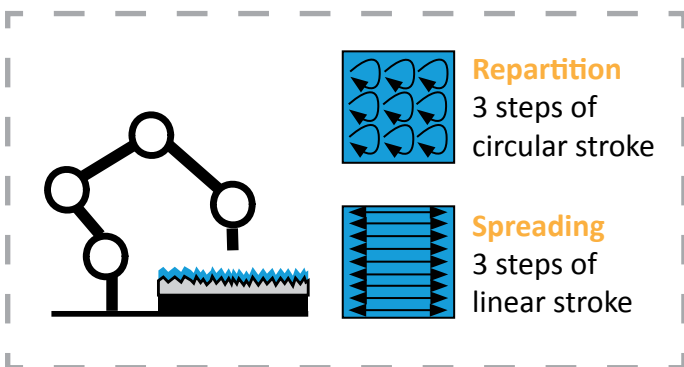
[19]



Robot HD-SPREADMASTER
with high spreading reproducibility.



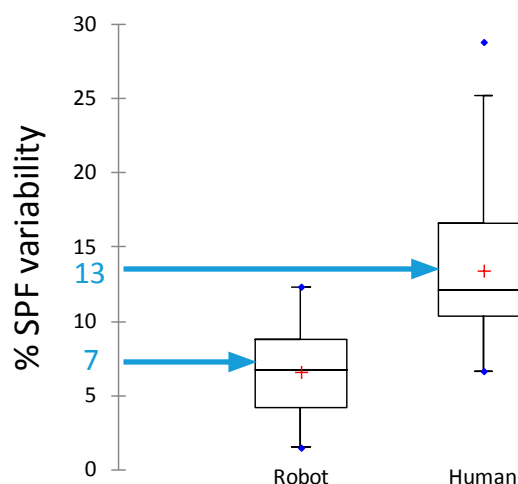
1. Process



Drying time (15-30 min)

2. Advantages

In Vitro SPF difference level between Robot and Human spreading (1 operator)



Commercial products

Tested with participation of Chanel Parfum Beauté-Pantin; Yves Rocher-Issy les Moulinaux; Clarins-Pontoise; Pierre Fabre-Castres; Sisley-Saint Ouen l'Aumône; Parfums Christian Dior-Saint-Jean-de-Braye; and L'Oréal-Chevilly-Larue.

IN VITRO KEY PARAMETER: SOLAR SIMULATOR

[20]

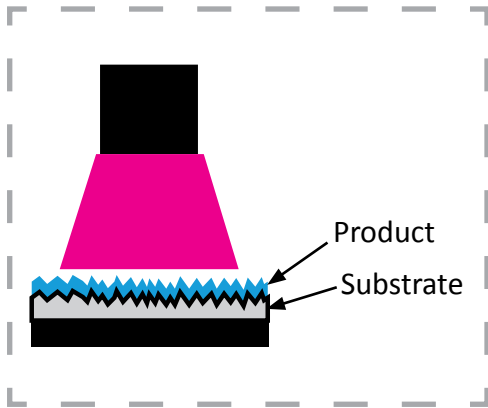


REQUIRED CONDITIONS:

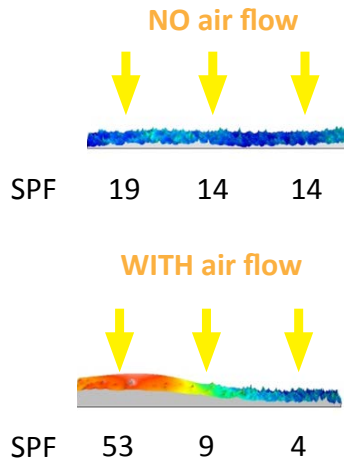
- Irradiance level (40 - 200 W/M²)
- UVA/UVB ratio (8 - 22)
- No heating ($\pm 2^\circ\text{C}$)
- No air flow
- Beam uniformity (< 10%)



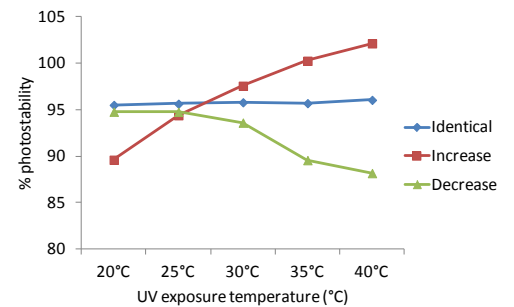
1. Process



2. Advantages

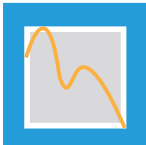


Avoid results difference according to temperature during UV exposure step



IN VITRO KEY PARAMETER: UV ANALYZER

[21]

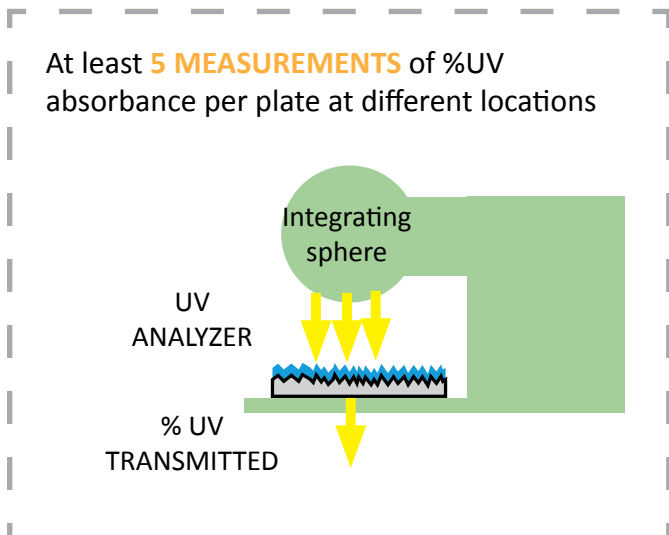


UV MEASUREMENT

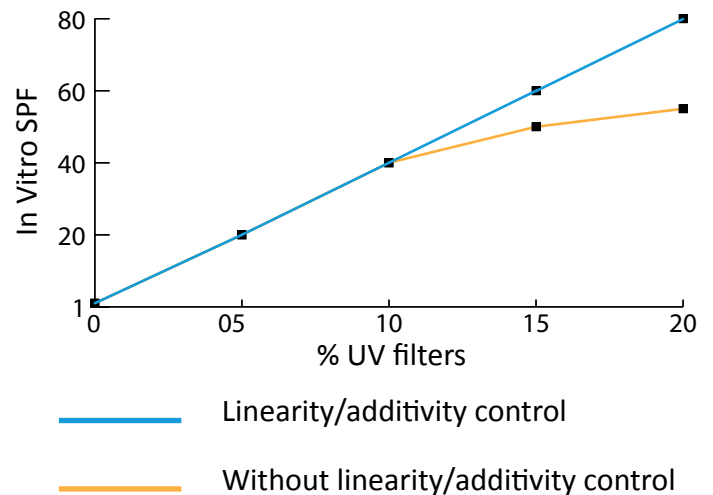
- linearity/additivity
- wavelength accuracy test
- integrating sphere
- each wavelength



1. Process



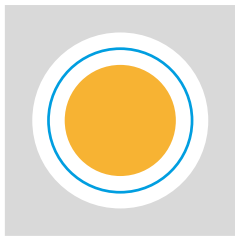
2. Advantages



This guideline opens the way for mastering the In vitro method for the evaluation of sun protection. Technical and practical problems for reproducibility and reliability can be at least solved. But these rules and conditions must be NOW understood and followed! ANY expertise or great experience could substitute principles and laws of the physic.

*The story is not over!
We are now facing the heavy task to make them accepted and applied every where and by anyone.*

Hope this guideline will have contributed to this goal...

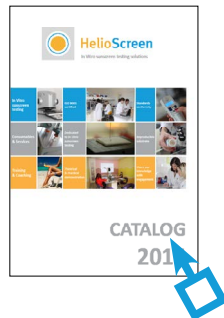


HelioScreen

In Vitro sunscreen testing solutions

Discover other documents for helping your sunscreens' development or for claiming according to market area.

Catalog



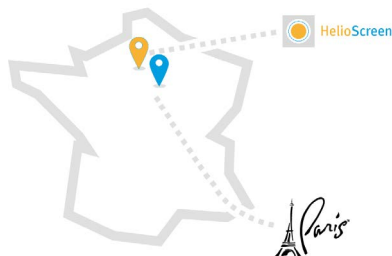
Regulations



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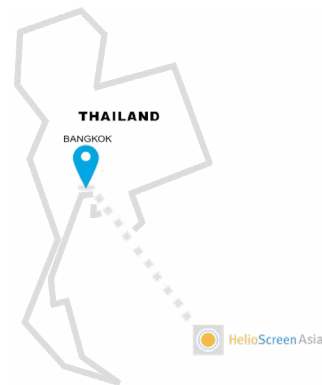
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administration@helioscreen.fr



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- [3] <http://fourpointsdermatology.com/2012/infographic-slather-on-that-sunscreen-what-you-should-know-about-skin-cancer/>
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- [17] M Pissavini et al, Determination of the in vitro SPF, Cosm & Toil 118(10) 63-72 (Oct 2003)
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- [20] S Miksa, D Lutz and C Guy, Key parameters for In Vitro UV exposure of sunscreens, Cosm & Toil 129(9) (Sep 2014)
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