eurofins | Cosmetics & Personal Care

EUROFINS DERMATEST PTY LTD

SUNSCREEN TESTING

CAPSIG - MARCH 2026

CRAIG DENNYSON

AS/NZS 2604:2021

TGA Regulated

- **SPF (Sun Protection Factor): ISO 24444:2019**
  - ***In Vitro* UVAPF: ISO 24443:2021**
- **Water Resistance (up to 4 hours): ISO 16217:2020**

Sun Protection Factor

What are we actually measuring?

Erythema – Very mild sunburn

Skin Type I: Always burns, never tans
(10 – 15 mins in midsummer sun)
Skin Type II: Burns easily, tans minimally
(15 – 20 mins in midsummer sun)
Skin Type III: Burns sometimes, tans gradually
(20 – 25 mins in midsummer sun)

Sun Protection Factor

MED: Minimal Erythemal Dose

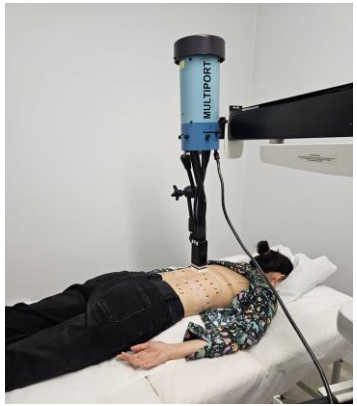
UV dose required to form a perceptible unambiguous erythema on unprotected skin = MEDu

UV dose required to form a perceptible unambiguous erythema on protected skin (with sunscreen) = MEDp

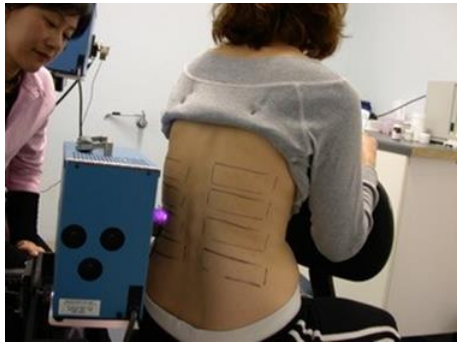
SPF = MEDp / MEDu

Solar Simulation

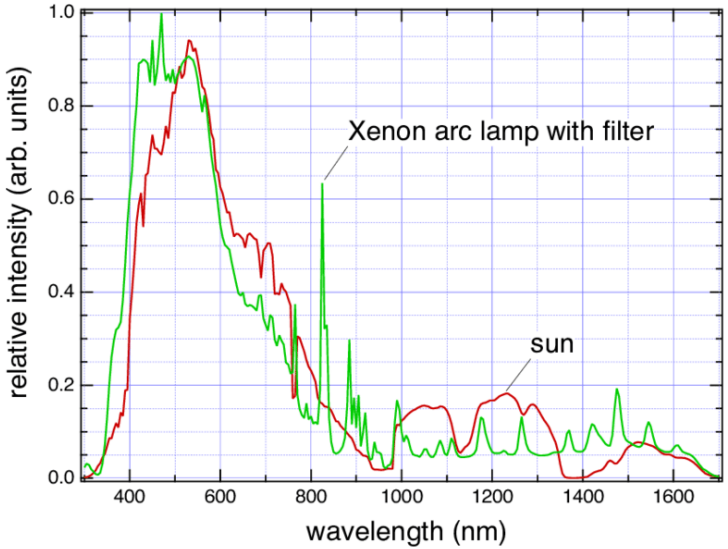
Multiport



Single Port



Trying to replicate what happens outside under laboratory conditions



IR filtered out → Cold Light

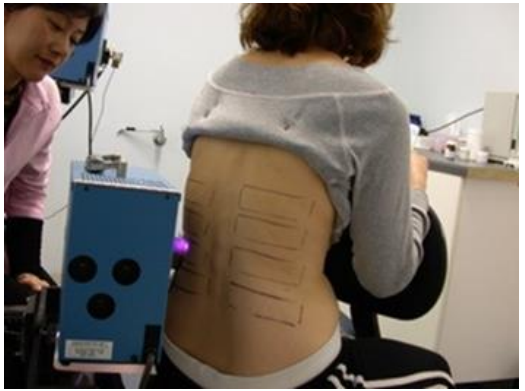
Sun Protection Factor

Application @ 2mg/cm²

Exposure

Multiport

Single Port



Reading Results: 20 ± 4hr post exposure

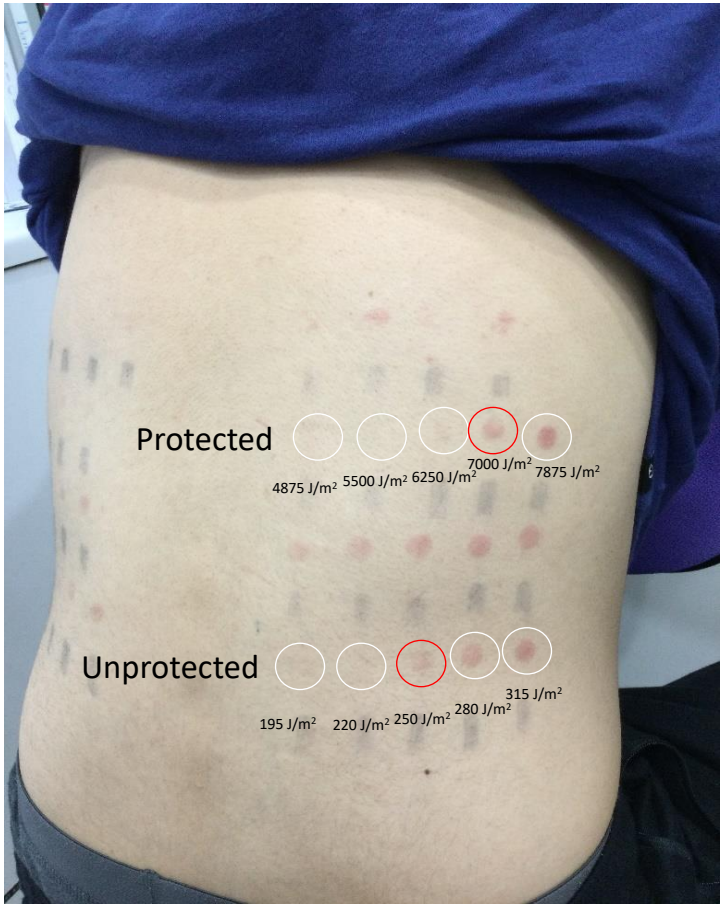
Erythema Grading

0: No erythema present

0,5: Ambiguous erythema, and/or no clear border, and/or not filling more than 50 % of the exposure subsite

1,0: Perceptible unambiguous erythema with defined borders filling more than 50 % of the exposure subsite

2,0: Moderate to intense erythema



MEDu = 250 J/m²

MEDp = 7000 J/m²

SPF = 7000 / 250 = 28

Reading Results: 20 ± 4hr post exposure

Erythema Grading

0: No erythema present

0,5: Ambiguous erythema, and/or no clear border, and/or not filling more than 50 % of the exposure subsite

1,0: Perceptible unambiguous erythema with defined borders filling more than 50 % of the exposure subsite

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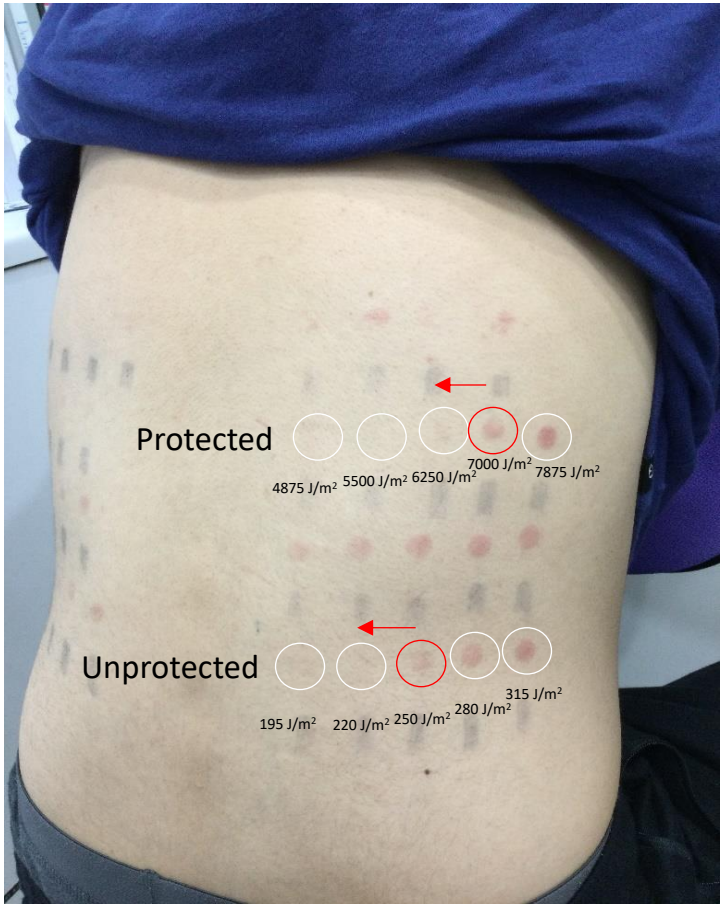


Different Skin Types

MEDu = 220 J/m²

MEDp = 6250 J/m²

SPF = 6250 / 220 = 28

Where Do We Start??

“Nominated SPF” – Where do we anchor for the first test subject?

A client’s nominated SPF should have no impact on the final SPF result!

Nominated SPF

1) Test subject safety first!
2) Valid results asap

Sunscreens with Organic Filters

- UV filter concentrations (online simulators)
- Volatile content & viscosity (lotions, balms, sprays)

Mineral Sunscreens

- *In Vitro* screening - Spectrophotometer

1st Subject Anchor – Organic Filters

Global Expertise, Personal Touch

SUNSCREEN OPTIMIZER™

Clear all | Clear Table | View tutorial video

Global	Target SPF 60	1
Add filter		
PARSOL EHS (5.0%)		5
PARSOL HMS (0.0%)		10
PARSOL 340 (10.0%)		8
PARSOL 1789 (3.0%)		4
Add parameter		
Total (%)		27.0
SPF		26.2
SPF Rating (EU)		25
UVA-PF/SPF (EU)		0.59
CW (ISO)		380
UVA-PF in vitro		15.4
UVA-PF in vivo		16.1

BASF We create chemistry | Care Creations™

FILTER

Region* All filters

Application amount 2 mg/cm²

Show INCI-Name

* Please select the relevant region for your calculation

BROAD-SPECTRUM / UVA I FILTERS

INCI-Name

- Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine (Tinosorb® S)
- Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine aq, active amount (Tinosorb® S Lite Aqua)
- **Butyl Methoxydibenzoylmethane**

Version

FILTER SELECTION

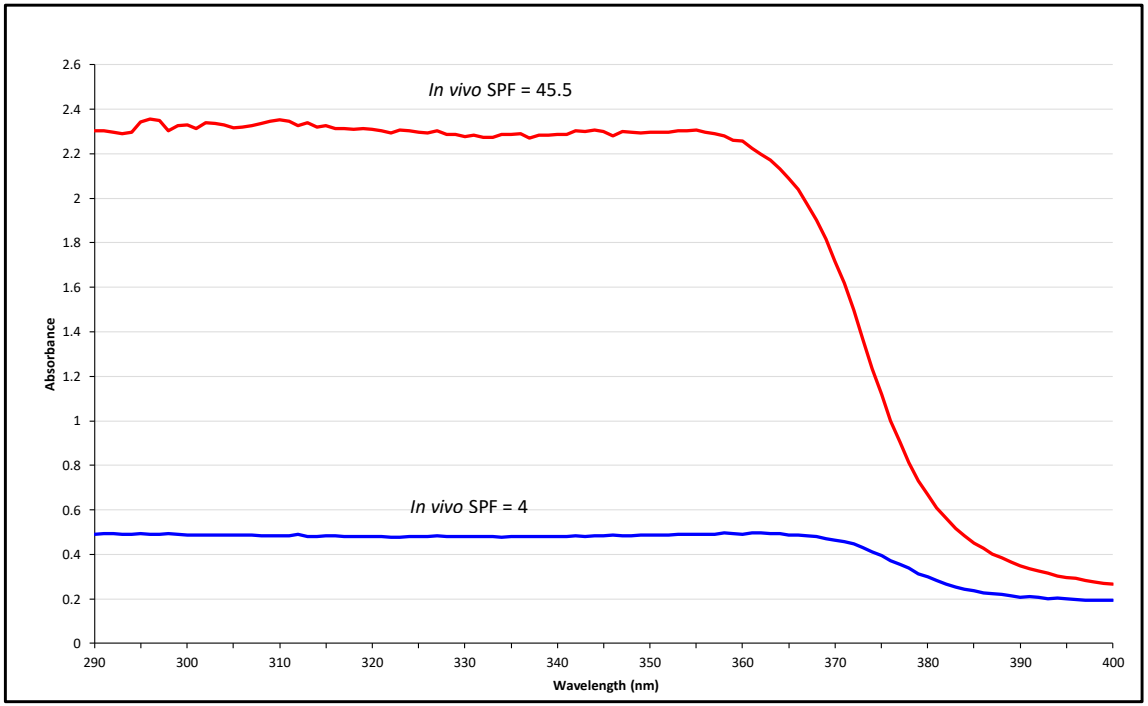
	Max.	
BMDBM	10%	4
EHS	10%	5
HMS	15%	10
OCR	10%	8
Total:		27.00%

SPF (SUN PROTECTION FACTOR)

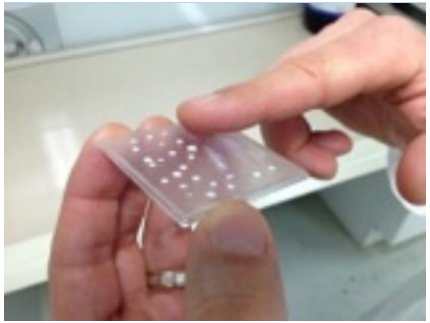
SPF:	24.1
Rating:	20
Filter Efficiency:	0.89

1st Subject Anchor – Mineral Filters

Mineral Sunscreen SPF Estimation



Two formulas, both containing 22.5% zinc oxide

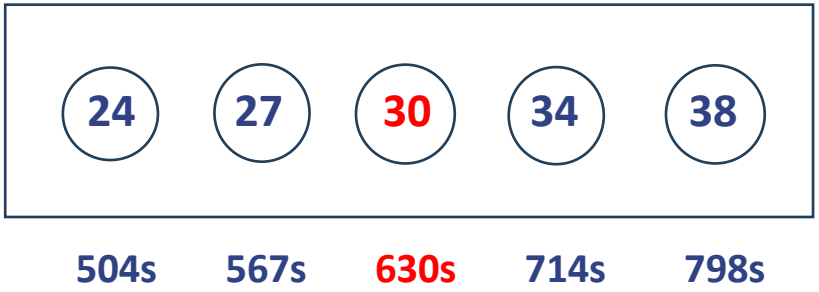


1st Subject Anchor

Incremental UV Exposure Doses

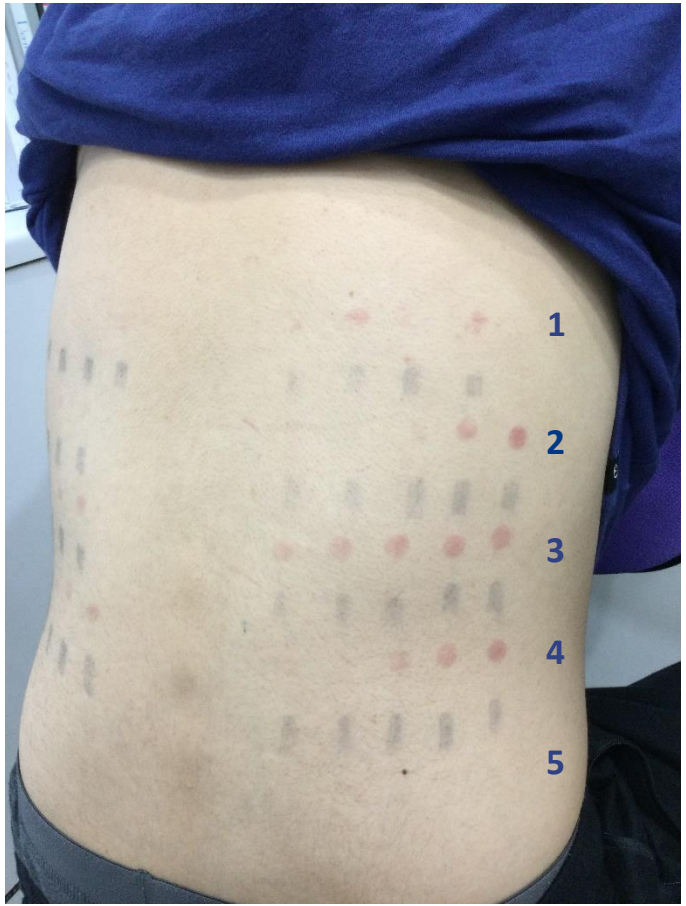
Anchoring @ SPF30

- 12%: 24 / 27 / 30 / 34 / 38
- 15%: 23 / 26 / 30 / 35 / 40
- 20%: 21 / 25 / 30 / 36 / 43
- 25%: 19 / 24 / 30 / 38 / 47



MEDu = 21 seconds

Reading SPF Results



Assuming same product applied to all 5 test areas.*

*** For demonstration purposes. Not normal practice!**

12%: 24 / 27 / 30 / 34 / 38

1. Invalid – Erythema randomly absent
2. Result at 4th exposure site (34)
3. Invalid – All sites show erythema (<24)
4. Result at 3rd exposure site (30)
5. Invalid – No sites show erythema (>38)

Range Finding / Preliminary Study

Global Expertise, Personal Touch

If we anchored too high

Preliminary Report

Test Protocol :	AS/NZS 2604:2021 / ISO 24444:2019	**Eurofins Sample No.**	
Product Description :		**Client :**	
Batch/Formula No.		**Report Date :**	22 January 2025
Test Conditions :	Static	**Contact :**	

The first test subject SPF anchor was set at : 50

	TEST	SIM				TEST SUBJECTS														
Subject	**Exposure**	**Single Port**	**Multi Port**	**Sim EE (highest)**		**Subject**		**MEDu**		**MEDp**		**SPFi**	**Rej ?**	**P2 Reference Standard**			**High SPF Reference Standard**			
No.	Date	No.	No.	MED/hr	W/m² eff	Code	ITA°	Secs	J/m² eff	Secs	J/m² eff		Y / N	Secs	J/m² eff	SPF	p#	Secs	J/m² eff	SPF
1	15/1/26	4		176	10.3	93532	47	21	215	462	4740	22.0	No	330	3386	15.7				
2	16/1/26	7		195	11.4	93867	34	20	227	367	4172	18.3	No	300	3411	15.0	P8	1806	20532	90.3
3	16/1/26	4		175	10.2	93765	44	22	224	394	4020	17.9	No	330	3367	15.0				
4																				
5																				
									Test Product Avg. SPF			**19.4**				**15.2**			**90.3**

Invalid Results : Range finding or out of range results

	TEST	SIM				TEST SUBJECTS														
Subject	**Exposure**	**Single Port**	**Multi Port**	**Sim EE (highest)**		**Subject**		**MEDu**		**MEDp**		**SPFi**	**Rej ?**	**P2 Reference Standard**			**High SPF Reference Standard**			
No.	Date		No.	MED/hr	W/m² eff	Code	ITA°	Secs	J/m² eff	Secs	J/m² eff		Y / N	Secs	J/m² eff	SPF	p#	Secs	J/m² eff	SPF
1	12/1/26	7		195	11.4	93082	54	17	193	590	6707	< 34.7	Yes	255	2899	15.0				
2	14/1/26	4		180	10.5	93549	40	22	231	535	5614	< 24.3	Yes	330	3463	15.0				
3																				
4																				
5																				

Details for Application Method : Applied from syringe and spread with fingercot

Preliminary Result : The indicative SPF when tested to the protocol specifications was **19**

*** This report should not be interpreted as indicating full compliance with the test protocol.**
Protocol specific formatted reports will be provided upon completion of the full study.

Data Rejection Reasons

1	MEDp all spots show erythema
2	MEDp all spots show erythema
3	
4	
5	

Range Finding / Preliminary Study

Global Expertise, Personal Touch

If we anchored too low

Preliminary Report

Test Protocol :	AS/NZS 2604:2021 / ISO 24444:2019	**Eurofins Sample No.**	
Product Description :		**Client :**	
Batch/Formula No.		**Report Date :**	10 December 2025
Test Conditions :	Static	**Contact :**	

The first test subject SPF anchor was set at : 35

	TEST	SIM				TEST SUBJECTS														
Subject	**Exposure**	**Single Port**	**Multi Port**	**Sim EE (highest)**		**Subject**		**MEDu**		**MEDp**		**SPFi**	**Rej ?**	**P2 Reference Standard**			**High SPF Reference Standard**			
No.	Date	No.	No.	MED/hr	W/m² eff	Code	ITA°	Secs	J/m² eff	Secs	J/m² eff		Y / N	Secs	J/m² eff	SPF	p#	Secs	J/m² eff	SPF
1	27/11/25	4		184	10.7	93747	53	18	193	1084	11628	60.2	No	302	3240	16.7				
2	2/12/25	4		185	10.8	93808	42	22	237	1331	14356	60.5	No	330	3559	15.0				
3	3/12/25	9		195	11.4	93542	50	16	182	1165	13244	72.8	No	240	2728	15.0				
4	5/12/25	7		200	11.7	93542	47	19	222	1330	15508	70.0	No	285	3323	15.0	P8	1532	17863	80.6
5																				
									Test Product Avg. SPF			**65.8**				**15.4**			**80.6**

Invalid Results : Range finding or out of range results

	TEST	SIM				TEST SUBJECTS														
Subject	**Exposure**	**Single Port**	**Multi Port**	**Sim EE (highest)**		**Subject**		**MEDu**		**MEDp**		**SPFi**	**Rej ?**	**P2 Reference Standard**			**High SPF Reference Standard**			
No.	Date		No.	MED/hr	W/m² eff	Code	ITA°	Secs	J/m² eff	Secs	J/m² eff		Y / N	Secs	J/m² eff	SPF	p#	Secs	J/m² eff	SPF
1	26/11/25	7		205	12.0	93486	36	22	263	924	11043	> 42.0	Yes	330	3944	15.0				
2	27/11/25	4		184	10.7	93747	53	18	193	968	10384	> 53.8	Yes	302	3240	16.8				
3																				
4																				
5																				

Details for Application Method : Applied from syringe and spread with fingercot

Preliminary Result : The indicative SPF when tested to the protocol specifications was **65**

*** This report should not be interpreted as indicating full compliance with the test protocol.**
Protocol specific formatted reports will be provided upon completion of the full study.

Data Rejection Reasons

1	MEDp no spots show erythema
2	MEDp no spots show erythema
3	
4	
5	

Full Study ISO 24444:2019 Requirements

- 10 Valid Results
- No more than 5 invalid results
- 95% Confidence Interval <17%

Reference sunscreen formulation	Mean SPF	Acceptance limits	
		Lower limit	Upper limit
P2	16,1	13,7	18,5
P3	15,7	13,7	17,7
P5	30,6	23,7	37,4
P6	43,0	31,0	54,9
P8	63,1	43,9	82,3

— SPF Claim ≤24: P2 or P3 reference standard (all subjects);

— SPF ≥25 but less than SPF 50: P5 or P6 reference standard (on at least 5 subjects) and P2 or P3 on remaining subjects;

— SPF ≥50: P8 reference standard (on at least 5 subjects) and P2 or P3 on the remaining subjects.

Water Resistance Testing

AS/NZS 2604:2021

ISO 16217:2020 – Up to 4hrs

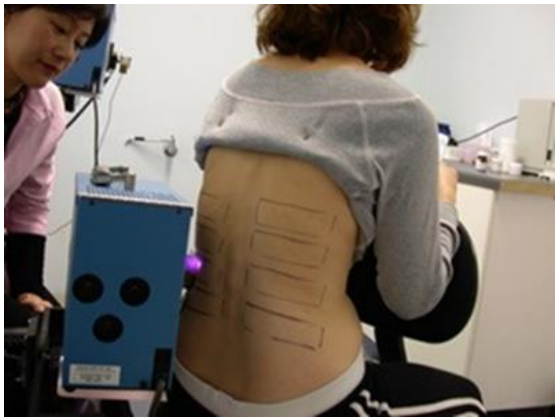
Followed by

ISO 24444:2019

Label SPF must be achieved post-immersion

Laboratory (Expectation)

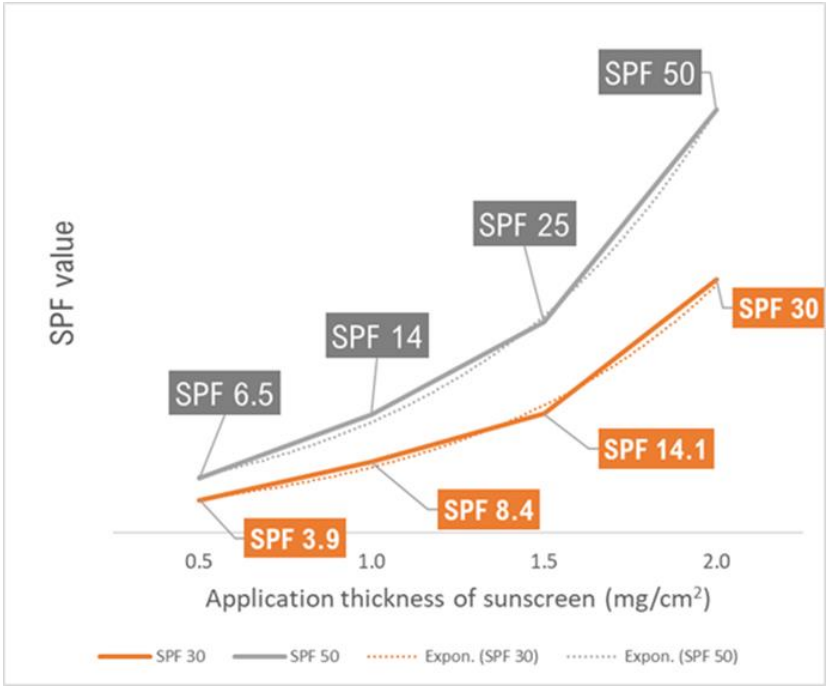
- Application rate = 2mg/cm^2
- Room Temperature: 23°C +/- 2°C
- Skin settled prior to application (dry skin)
- Allowed to dry for 15 minutes
- Testing completed within 30 – 90 mins
- Minimal movement / friction
- Minimal water flow for WR testing



Reality

- Application rate ????
- Skin temperature, moisture ???
- Was the product allowed to dry?
- Sweat
- Waves
- Friction – clothes, towels, sand
- Time between re-application

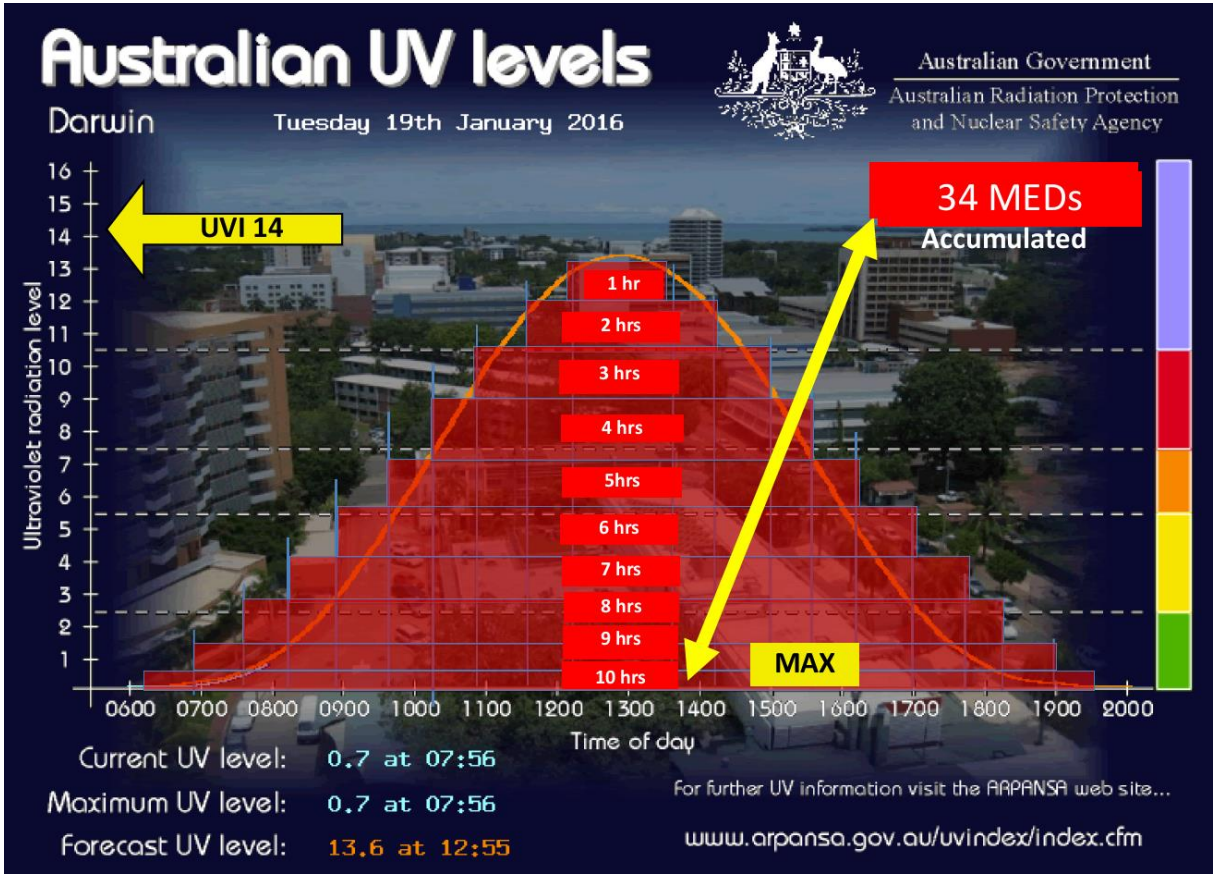
Application Rate



Theoretical – Beers Law

- **Laboratory: 2 mg/cm²**
- **Adults: 1.1 mg/cm²**
- **Kids: 0.7 mg/cm²**

SPF30 Used Correctly!!

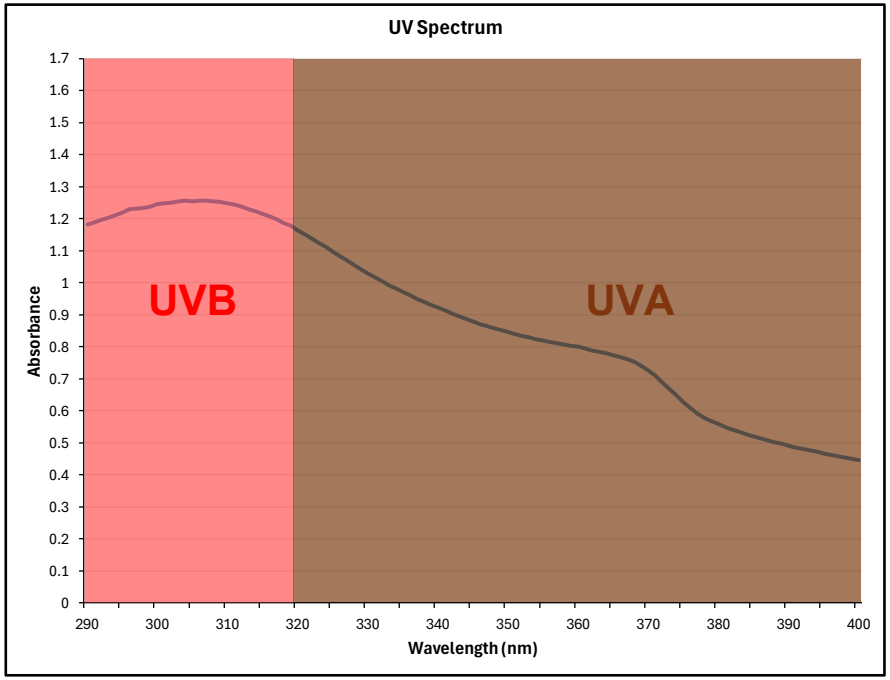


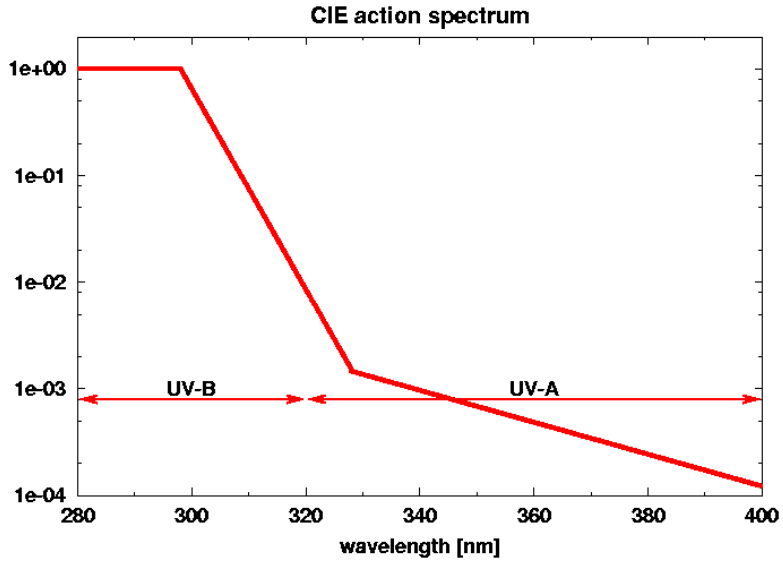
IN THEORY ONLY!!

A SPF 34 sunscreen would provide all day protection

UVA / Broad Spectrum (ISO 24443:2021)

SPF could be seen as a UVB Protection Factor





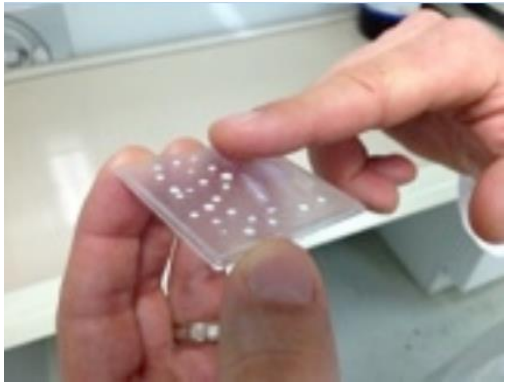
Broad Spectrum – UVA Protection Factor

Step 1

Apply @ 1.3 mg/cm² to moulded PMMA plates

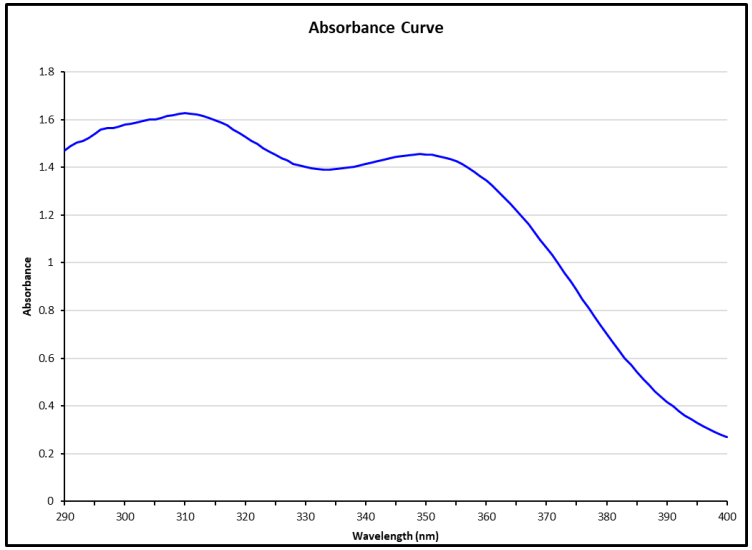
or

1.2 mg/cm² to sand blasted PMMA plates & dried @30°C for 30m



Step 2

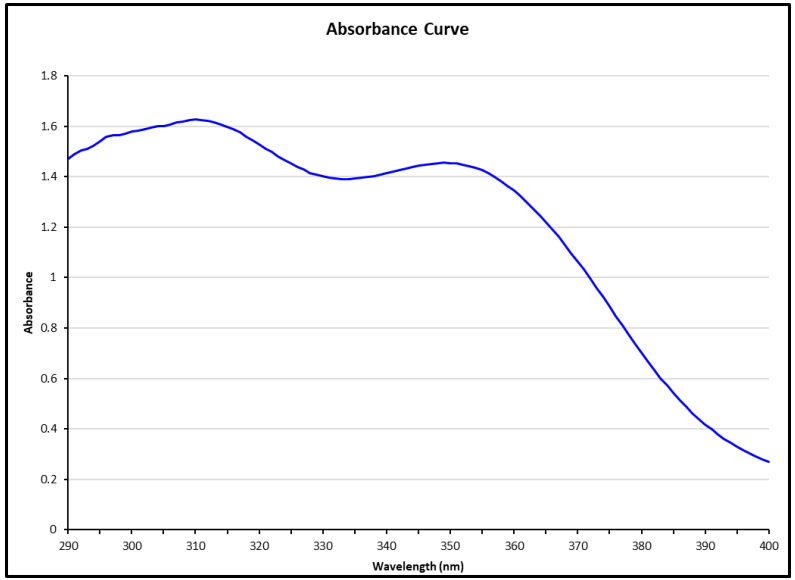
Scan 290 – 400nm

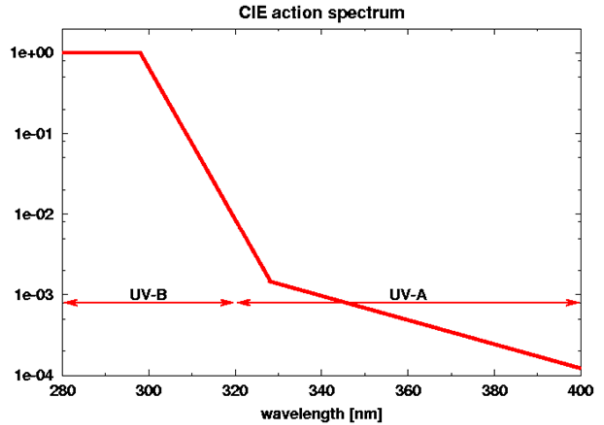


Broad Spectrum – UVA Protection Factor

Step 3

Calculate *in vitro* SPF using the absorbance, erythemal action spectrum and spectral irradiance



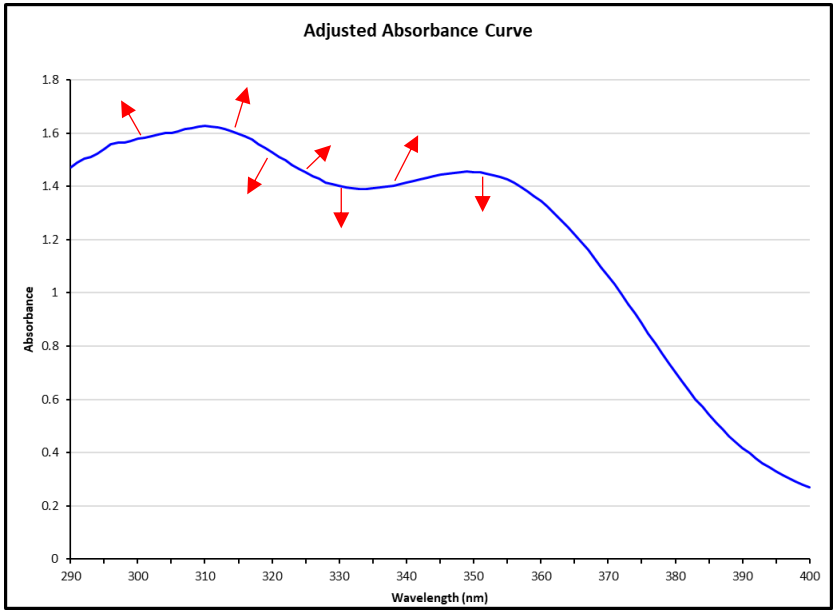


$$SPF_{in\,vitro,0} = \frac{\int_{\lambda=290}^{\lambda=400} E(\lambda)\times I(\lambda)\times d\lambda}{\int_{\lambda=290}^{\lambda=400} E(\lambda)\times I(\lambda)\times 10^{-A_0(\lambda)}\times d\lambda}$$

Broad Spectrum – UVA Protection Factor

Step 4

Adjust *in vitro* SPF to correspond to the *in vivo* SPF (must be with a valid *in vivo* SPF) (turning *in vitro* into *in vivo* data)



The initial absorbance curve values are multiplied by a scalar value "C" until the *in vitro* calculated SPF values are equal to the *in vivo* measured SPF

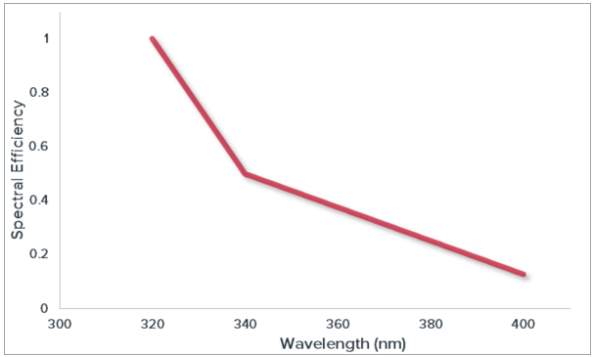
The initial absorbance values multiplied by this "C" value become the adjusted sunscreen absorbance curve that is used for determination of the initial UVAPF

Broad Spectrum – UVA Protection Factor

Step 5

Calculate the UVAPFo (pre irradiation)

$$UVA\text{-}PF_0 = \frac{\int_{\lambda=320}^{\lambda=400} P(\lambda)\times I(\lambda)\times d\lambda}{\int_{\lambda=320}^{\lambda=400} P(\lambda)\times I(\lambda)\times 10^{-A_0(\lambda)}\times d\lambda}$$



Step 6

Irradiation Step: Calculated from the UVAPFo and solar simulator intensity.
Checking for photo-stability

(Theoretically the time taken for a PPD to form)

Broad Spectrum – UVA Protection Factor

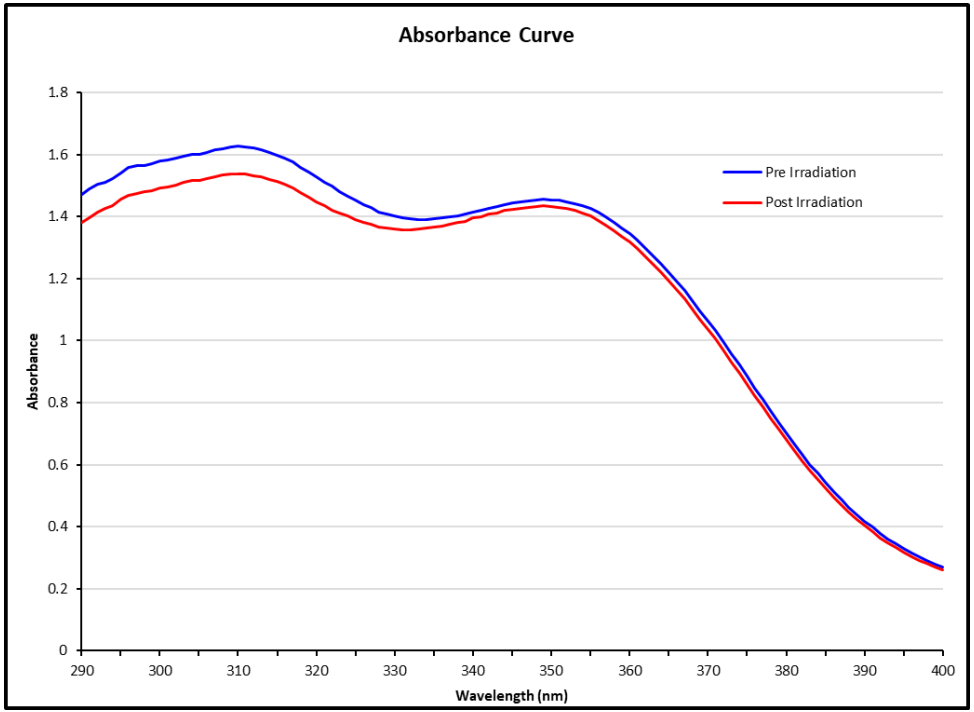
Step 7

Scan 290 – 400nm (post irradiation)

Step 8

Calculate the UVAPFDx (post irradiation)

= UVAPF



Broad Spectrum – UVA Protection Factor

PASS / FAIL Criteria (AUS/NZS)

1) Critical Wavelength
greater than 370nm

2) UVAPF divided by the label SPF
greater than 0.333

Example: A SPF50+ (SPF > 60) requires a
UVA Protection Factor of at least 20

Where is SPF Testing Headed?

New *In Vitro* SPF Methods

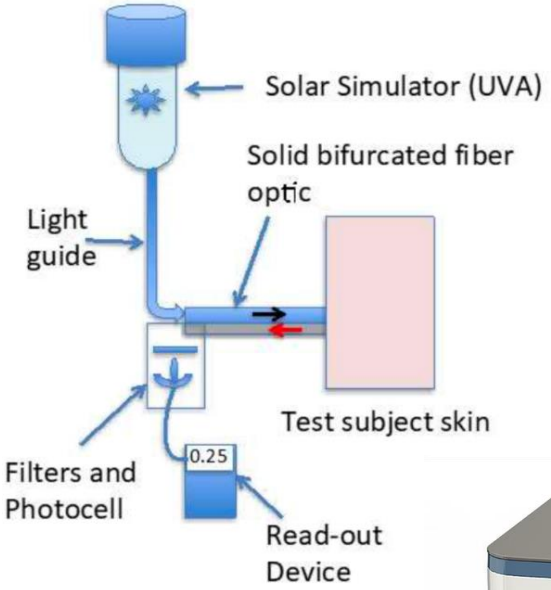
- HDRS (Hybrid Diffusion Reflectance Spectroscopy) method (ISO 23698:2024)

- Double Plate method (ISO 23675:2024)

NOT TESTED ON ANIMALS

HDRS (ISO 23698:2024)

A method combining spectroscopic data by *in vivo* and *in vitro* methods



- Hybrid because it is not a true *in vitro* method
- Still utilizes the test subject skin!
- Non-invasive: UV dose < 21 J/m^2 (Erythema: 250 – 400 J/m^2)
- Can report SPF and UVAPF

HDRS Methods _ ISO23698

Global Expertise, Personal Touch

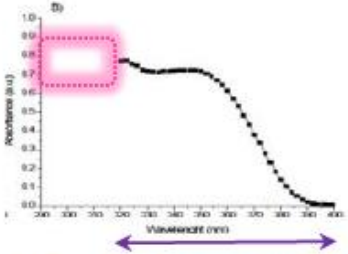
IN VIVO part : HDRS

1) **Subjects selection**
same as **ISO24444** *in vivo*

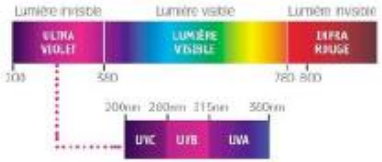
2) **DRS polychromatic measurements**
9 points per zones
SolarLight Poly602

3) **Product application**
same as **ISO24444** *in vivo*

4) **New DRS** polychromatic measurements
9 points per zones



Obtention of DRS **UVA** spectrum

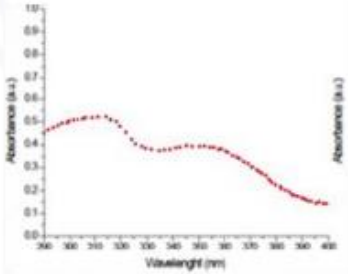


IN VITRO part

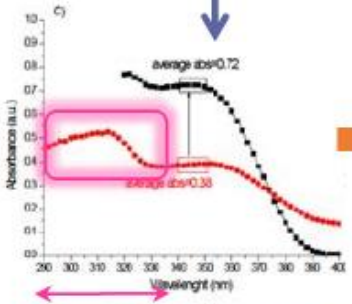
Incubation 24±2°C au moins 12h

Mesures d'absorbance AVANT et APRES exposition UV

Determination of **UVB+UVA spectrum**
according to ISO 24443 norm

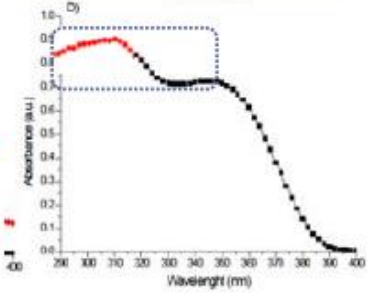


ISO 24443 :
FP-UVA *IN VITRO*
+ LOC (λ critic)



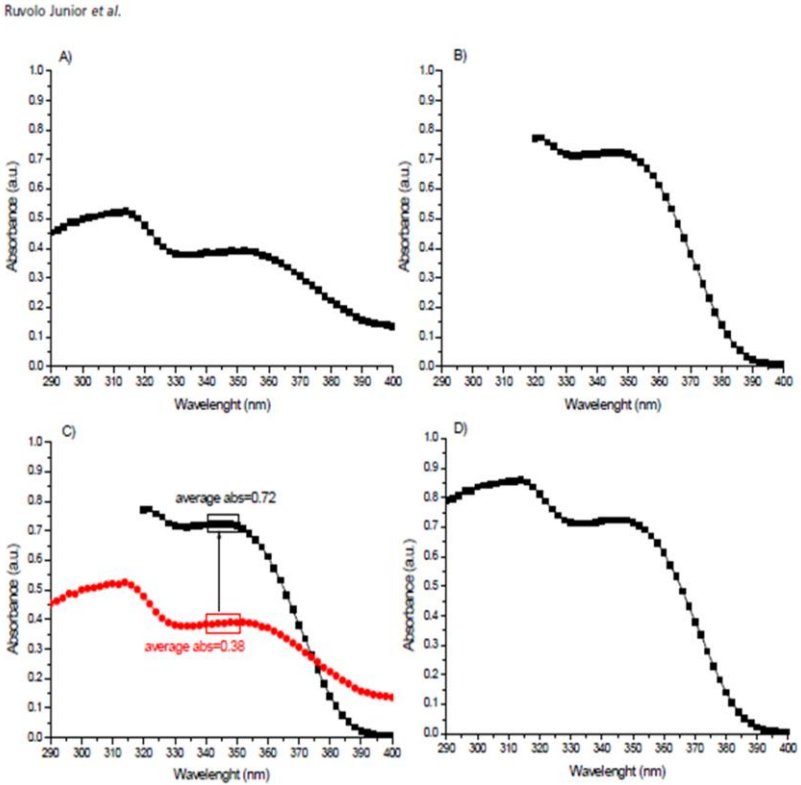
Extraction of the missing portion

Hybridation



=> 3 results
SPF + FP-UVA + LOC

HDRS (ISO 23698:2024)

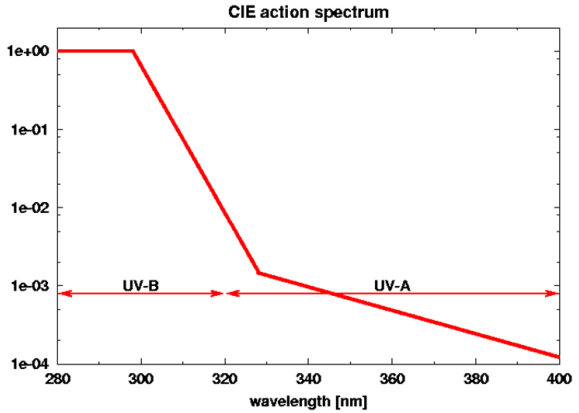


A) ISO 24443 *In vitro* Method

B) HDRS (only UVA)

C) Adjust *in vitro*

D) HDRS for UVA and UVB (SPF)



HDRS (ISO 23698:2024)

Pros

- Still utilizing human skin
- Compatible with most sunscreen forms
- Able to test water resistance
- Can report SPF and UVAPF

Cons

- Not 100% *in vitro*
- Must still recruit test subjects
- Currently not much cheaper than ISO 24444
- Minimal independent *in vivo* SPF data correlation

Double Plate (ISO 23675:2024)

Based on UV-Vis Transmittance Spectroscopy

- No ethical concerns
- Similar Instrumentation and theory to ISO 24443
- No test volunteers

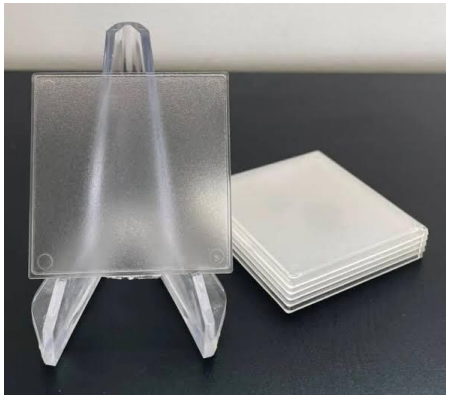
Replicable robotic spreading

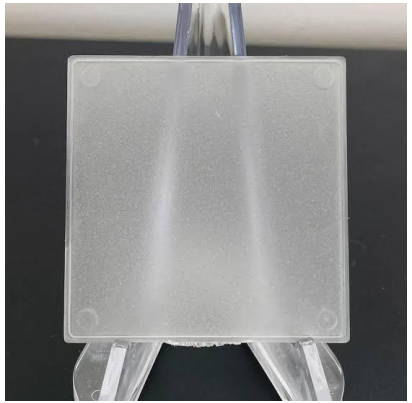
Double Plate (ISO 23675:2024)

The Robot

Double Plate (ISO 23675:2024)

Double Plate (ISO 23675:2024)





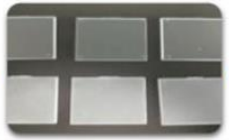
PMMA (Poly(methyl methacrylate)) plates – Moulded and Sand-Blasted

- To account for different skin types
- To account for various galenic behaviors

Double Plate (ISO 23675:2024)

Incubation of a product in 27+/-2°C for at least 12h

Robot preparation

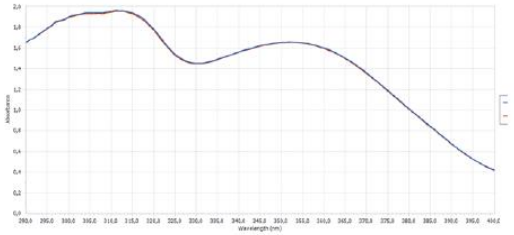


Application on 3 sandblasted plates 1,2mg/cm² and 3 plaques moulded 1,3mg/cm² + drying period (30-60 minutes)

1st measurement of absorbance

Irradiation dose calculation

2nd measurement of absorbance



Calculation of SPF

Double Plate (ISO 23675:2024)

Pros

- Quick – Results in a few hours
- Much cheaper than current ISO 24444
- Could become part of stability and QA
- Scale up validation, especially mineral sunscreens
- TGA checks
- Can be accredited under ISO 17025
- No ethical concerns
- Aims to minimize variability – BIPEA proficiency testing program

Double Plate (ISO 23675:2024)

Cons

- Only emulsions and alcoholic one-phase formulations
- Not compatible for water resistance testing
- Not all regions are convinced with the method
- Minimal independent *in vivo* SPF data correlation
- Already widespread industry concerns with mineral formulations

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THANK YOU