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ASSESSING BROAD-SPECTRUM SUNSCREENS FOR UVA1 AND BLUE LIGHT PROTECTION IN HYPERPIGMENTATION AND PHOTOAGING PREVENTION

P. Lapalud[1], M. Noizet[1], J. Haga[1], C. Boudet[2], G. Doat[2*]
1. R&D Department, Pierre-Fabre Dermo-Cosmetics & Personal Care, Toulouse, France
2. Medical Department, Laboratoires Dermatologiques Avène, Lavaur, France

INTRODUCTION

Exposure to solar radiation, particularly long UVA (UVA1) and blue light (BL), is a significant contributor to the process of skin aging. To mitigate the cumulative and long-term effects (wrinkles & brown spots), daily photoprotection is essential when exposed to the sun. This study aims to demonstrate the effectiveness of different sunscreens in protecting against UVA1 and BL radiation and to assess the effectiveness of a well-balanced sunscreen formulations in preventing hyperpigmentation and photoaging through *in vitro* and *ex vivo* studies

MATERIAL AND METHOD

Marketed sunscreens exhibiting high photoprotective efficacy (SPF>50) with different filtering systems (UVF) were screened (table 1) in terms of UVA1-PF/labelled SPF ratio, UVA1/UV ratio (Fig. 1), percentage of blue light (BL) blocked (Fig. 2), and BL-CW, using *in vitro* methods (HD6, PMMA plate).

Table 1 Sunscreen Characteristics	#1	#2	#3	#4	#5	#6	#7
InOrganic UVF (ZnO+TiO2)	-	-	-	-	-	v	v
Organic UVF (UVB-UVA)	v	v	v	v	v	-	-
Containing PBDT (UVB-UVA-HEVBL)	v	v	-	-	-	-	-
Containing Iron Oxid	v	-	-	v	-	-	v

Additionally, the efficacy of one other particular sunscreen in preventing sun-induced hyperpigmentation and dermal collagen degradation was measured both *in vitro* and *ex vivo*.

RESULTS

Efficacy assessment through photobiology testing

Fig. 1: *UVA1/SPF and UVA1/UV ratio*
Results below minimum threshold (indicated in parentheses) are highlighted in orange

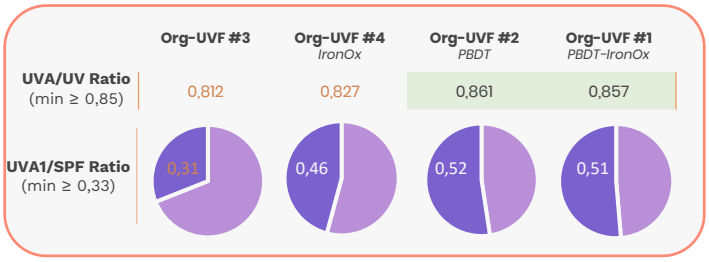
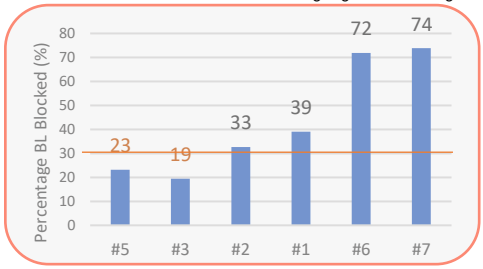


Fig. 2: *Blue Light Protection*
Results below minimum threshold are highlighted in orange



Compared to other Organic sunscreens, #1 and #2 successfully met all the minimum thresholds required for each parameter. Those formulations **containing the PBDT filter** demonstrated a **UVA1-PF/SPF ratio greater than 0.5**, and **extended protection against blue light**, with a %BL blocked around 33% (~**40% with Iron Oxid**). As expected, inorganic Sunscreens #6 and #7 showed high performance in blue light protection. Products #1 and #2 remain an interesting alternative to mineral sunscreens (#6 and #7) and are more powerful than organics without PBDT (#3, #4, and #5).

Efficacy assessment through vitro/ex-vivo testing

Repeated topical applications of an SPF50+ sunscreen, utilizing the same filtering system containing PBDT as sunscreen #2, on photoexposed human skin explants showed significant prevention (58% (p<0.05)) of UVA induced dermal collagen alteration.

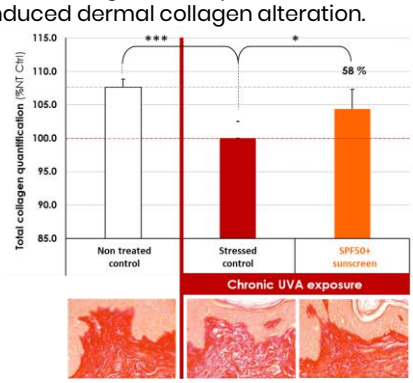


Fig. 3: prevention of dermal collagen alteration of SPF50+ sunscreen after chronic UVA exposure

The SPF50+ sunscreen applications increased *in vitro* the lightness L*parameter (+8% (p<0.001) vs UV stressed control) associated with color modification markedly detectable by human eye (ΔE=4) on UV-pigmented reconstructed epidermis.

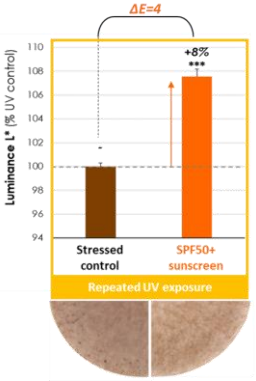


Fig. 4: prevention of UV-induced skin pigmentation of SPF50+ sunscreen after repeated UV exposure

CONCLUSION

Well-balanced broad-spectrum sunscreens, particularly those containing phenylene bis-diphenyltriazine, prevent cumulative and long-term damages caused by UVA1, BL radiation, and overall sun-induced photoaging damages. *In vitro* and *ex vivo* studies indicate that the repeated use of these sunscreens can effectively prevent dermal collagen degradation and improve skin lightness. For those resistant to mineral (whit effect) or heavily tinted products, these formulations with PBDT (+/- light tint) are more appealing, thus encouraging more quantity, regular use and ensuring real life protection.