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LIGHT TEXTURE – HEAVY PROTECTION

Consumers are increasingly looking for sunscreen products that not only provide effective protection but also offer enhanced sensory properties. Beyond the traditional criterion of sun protection factor (SPF), they prefer products that feel lightweight and refreshing, emphasizing characteristics such as "fresh", "watery", and "lightweight"[1]. As a result, demand continues to grow for formulations that balance high levels of UV protection with the sensory attributes of everyday skin care.

Along with changing consumer preferences, regulatory guidelines have influenced the development of sunscreens, particularly with regard to UVA protection. Both UVA and UVB rays are known to contribute to skin cancer, with UVA rays playing a prominent role in skin ageing and chronic skin damage. In September 2025, the WHO decided to include broad-spectrum sunscreen with high SPF on the Model List of Essential Medicines and on the Model List of Essential Medicines for Children.[2] The European Commission has set standards recommending that sunscreen products provide a minimum level of UVA protection, which should be at least one third of the SPF value.[3] These recommendations, introduced in 2006, have led to significant advances toward providing more balanced sun protection.

BALANCING HIGH SUN PROTECTION WITH LIGHTWEIGHT SENSORY APPEAL

Many of today's UV filters are oil-based or oil-soluble, which presents challenges in formulating sunscreens with a light skin feel. In addition, with the removal of UV fil-

ters that raise environmental and health concerns, such as Ethylhexyl Methoxycinnamate (EHMC) and Octocrylene (OCR), water-soluble alternatives have come to the fore. Commonly used in sunscreens for their effective UVB and broad-spectrum protection, EHMC and OCR have come under scrutiny for their potential to cause photosensitization reactions and their impact on marine ecosystems. The move away from these UV filters is in line with regulatory and consumer-driven trends toward safer, more environmentally-compatible products.

In response to these challenges, BASF has introduced a new water-soluble UVA filter to support the creation of lighter formulations that meet the market demand for improved sensory profiles while maintaining the necessary level of protection. The new UVA filter "Uvinul TS Hydro" (INCI: Terephthalylidene dicamphor sulfonic acid (TDSA)) appears as a clear to yellowish, transparent liquid that is supplied as a 30-34% aqueous solution and has been approved for use at concentrations of up to 10% active matter in regions with stringent regulatory standards, including the European Union, Australia, Mercosur, China, South Korea, and Japan. It is photostable, which means it retains its protective properties when exposed to sunlight, increasing the durability and efficacy of the sunscreen.

NEW UVA FILTER INCREASES SPF

A key challenge in formulating effective sunscreen products is to achieve balanced and synergistic UV protection. This requires optimized distribution of UV filters in the oil and water phases of the formulation. Without this distribution in the two phases of the emulsion, some areas of the skin may be under-protected after application of the sunscreen and water evaporation, especially when only lipophilic UV filters are used. When a formulation relies solely on lipophilic filters, the remaining areas of the water phase may not contain any UV filters. This can result in gaps in UV protection, leaving parts of the skin exposed to harmful UV radiation as shown in Figure 1.[4] The red pigment represents the oil, the blue pigment represents the water parts in an emulsion.

Balanced protection in the oil and water phases is therefore key to sunscreen efficacy. Water-soluble filters can bridge

FIGURE 1

Light microscopic pictures of an O/W emulsion containing oil-dispersed Sudan Red III pigment (CI 26100) and water-dispersed blue pigment (CI42090). Residual areas of the water phase leave skin without UV protection if only lipophilic UV filters are used.

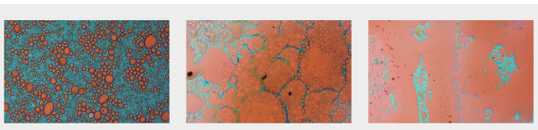


photo and graphics: BASF; Elena Babanova/Shutterstock.com

FIGURE 2

Absorbance spectrum of TDSA.

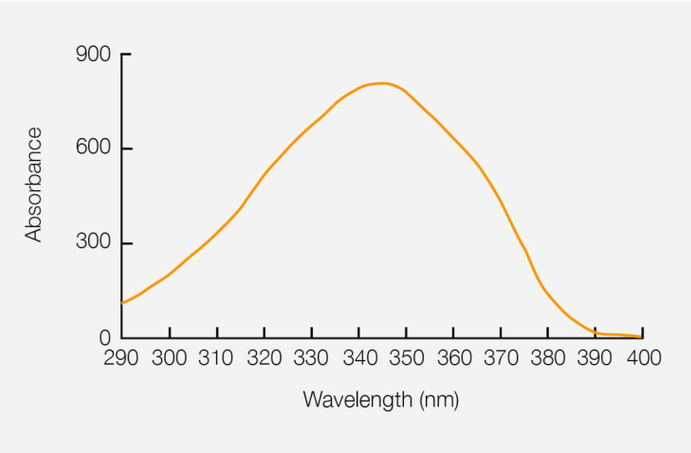


TABLE 1

Formulation with oil-soluble UV filters and "Uvinul TS Hydro", tested at 3% and 9%.

	Trade name	INCI	% by weight		
			UV-22-009-11-1	UV-22-009-11-2	UV-22-009-11-4
A	"Eumulgin Prisma"	Disodium Cetearyl Sulfosuccinate	1.00	1.00	1.00
	"Emulgade PL 68/50"	Cetearyl Glucoside (and) Cetearyl Alcohol	3.00	3.00	3.00
	"Lanette O"	Cetearyl Alcohol	0.80	0.80	0.80
	"Cetiol ABV"	C12-15 Alkyl Benzoate	7.00	7.00	7.00
	"Cetiol B"	Dibutyl Adipate	15.00	15.00	15.00
	"Cetiol Sensoft"	Propylheptyl Caprylate	5.00	5.00	5.00
	"Euxyl PE9010"	Phenoxyethanol (and) Ethylhexylglycerin	1.00	1.00	1.00
	"Uvinul T 150"	Ethylhexyl Triazone	3.00	3.00	3.00
	"Tinosorb S"	Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine	3.50	3.50	3.50
	"Uvinul A Plus"	Diethylamino Hydroxybenzoyl Hexyl Benzoate	4.50	4.50	4.50
B	Water	Aqua	47.90	44.30	37.10
	Glycerin	Glycerin	5.00	5.00	5.00
	"Verdessence" Xanthan	Xanthan Gum	0.30	0.30	0.30
C	**"Uvinul TS Hydro"**	**Aqua (and) Terephthalylidene Dicamphor Sulfonic Acid**		**3.00**	**9.00**
	L-Arginine	Arginine		0.60	1.80
D	"Cetiol Ultimate"	Undecane (and) Tridecane	3.00	3.00	3.00

FIGURE 3

The new UVA filter significantly increased SPF and UVA-PF in a test formulation with oil-soluble UV filters containing 3% and 9% "Uvinul TS Hydro", respectively.

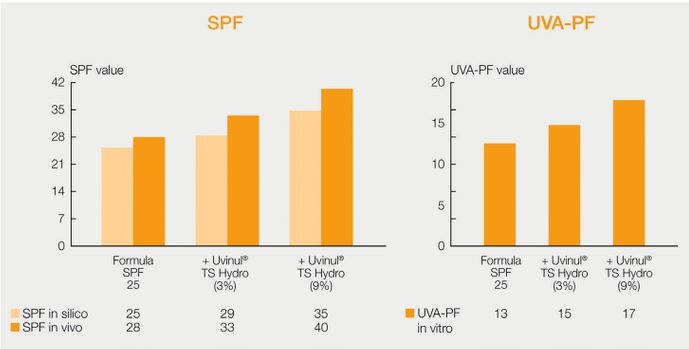


TABLE 2

Formulation with oil-soluble and water-soluble UV filters and "Uvinul TS Hydro", tested at 3%.

	Trade name	INCI	% by weight	
			UV-22-009-15-1	UV-22-009-15-2
A	"Eumulgin Prisma"	Disodium Cetearyl Sulfosuccinate	1.00	1.00
	"Emulgade PL 68/50"	Cetearyl Glucoside (and) Cetearyl Alcohol	3.00	3.00
	"Lanette O"	Cetearyl Alcohol	0.80	0.80
	"Cetiol ABV"	C12-15 Alkyl Benzoate	7.00	7.00
	"Cetiol B"	Dibutyl Adipate	15.00	15.00
	"Cetiol Sensoft"	Propylheptyl Caprylate	5.00	5.00
	"Euxyl PE9010"	Phenoxyethanol (and) Ethylhexylglycerin	1.00	1.00
	"Uvinul T 150"	Ethylhexyl Triazone	2.50	2.50
	"Tinosorb S"	Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine	2.00	2.00
	"Uvinul A Plus"	Diethylamino Hydroxybenzoyl Hexyl Benzoate	3.00	3.00
B	Water	Aqua	47.90	44.30
	Glycerin	Glycerin	5.00	5.00
	"Verdessence Xanthan"	Xanthan Gum	0.30	0.30
C	"Uvinul TS Hydro"	Aqua (and) Terephthalylidene Dicamphor Sulfonic Acid	-	3.00
	L-Arginine	Arginine	-	0.60
D	PBSA	Phenylbenzimidazole Sulfonic Acid	1.50	1.50
	Water	Aqua	10.00	10.00
	L-Arginine	Arginine	0.83	0.83
E	"Cetiol Ultimate"	Undecane (and) Tridecane	3.00	3.00

the protection gap by ensuring that the water phase contributes to the overall UV defense. Incorporating water-soluble UV filters alongside traditional lipophilic filters can result in a wider distribution of UV filters and more uniform protection. Ensuring the integration of both oil-soluble and water-soluble UV filters is therefore critical to providing thorough and continuous photoprotection to all areas of the skin.

TDSA is a highly effective, broad-spectrum water-soluble UVA filter. (Figure 2) Its efficacy was tested in formulations with oil-soluble UV filters (Table 1). These included the addition of 3% and 9% "Uvinul TS Hydro". ("Uvinul TS Hydro" is a 33% active solution of TDSA, therefore this corresponds to 1% and 3% TDSA, respectively). The UVA-PF was assessed using the in vitro method described in ISO 24443:2021. The SPF values of the formulations were determined both in silico and in vivo. The in silico SPF values were calculated using the "BASF Sunscreen Simulator"[5], following the approach described by Herzog and Osterwalder[6]. SPF in vivo was measured according to the SPF in vivo method described in ISO 24444:2019.

The results show that the new UVA filter significantly increases SPF and UVA-PF in formulations, as shown in Figure 3.

A test formulation containing both oil-soluble and water-soluble UV filters with 3% "Uvinul TS Hydro" was evaluated for photoprotective efficacy (Table 2).

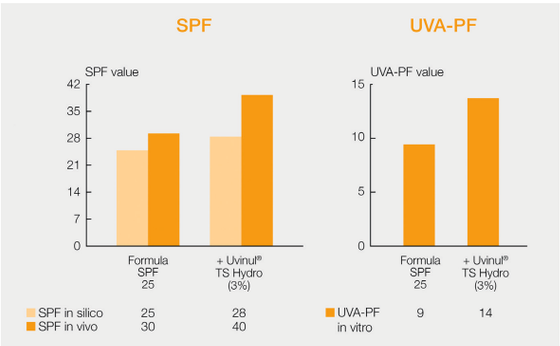
The analysis revealed an improvement in sun protection, with significant increases observed in both SPF and UVA-SPF values as shown in Figure 4. These results indicate an improved ability of the formulation to provide broad-spectrum protection against UV radiation.

WATER-SOLUBLE FILTER REDUCES THE NEED FOR HEAVY, OILY EMOLLIENTS

The removal of EHMC and OCR for different reasons is an issue in terms of solubilization of other solid UV filters. Their removal reduces the solubility capacity of the oil

FIGURE 4

SPF and UVA-PF significantly increased in the test formulation containing oil-soluble and water-soluble UV filters with "Uvinul TS Hydro" at 3%.



phase, presenting reformulation challenges. These challenges are particularly pronounced in traditional formulations that rely solely on solid oil-soluble UV filters and require significant concentrations of emollients to dissolve these filters effectively. This can lead to higher levels of oily and potentially sticky ingredients, which can affect the consumer's experience (Figure 5).

In contrast, the incorporation of water-soluble UV filters offers a more flexible formulation strategy by reducing the reliance on oil-soluble filters. This reduction diminishes the need for heavy, oily emollients and allows formulators to choose emollients that improve the sensory profile of the sunscreen. As a result, the sunscreen feels lighter and more comfortable on the skin. In this way, the new water-soluble UVA filter simplifies the formulation process by reducing the need for additional solubilizers. As shown in Table 3, the new UVA filter allows for a reduction in the concentration of emollients that is required in the formulation, while maintaining adequate photoprotection. This reduction improves the sensory attributes of the sunscreen by allowing the use of lighter, non-greasy emollients that can improve the overall aesthetics and feel on the skin.

CONCLUSION

Consumer preferences and regulatory standards are shaping the future of sun care products, resulting in formulations that provide high levels of protection in lightweight textures and that are suitable for daily use. The task of sunscreen reformulation is inherently complex, as it requires maintaining both efficacy and user acceptability. As the industry moves away from certain traditional UV filters such as EHMC and OCR, formulators are increasingly using water-phase UV filters to achieve high protection with a lightweight feel. To support this evolution, a new water-soluble UVA filter was introduced to the market to facilitate the creation of sunscreens that balance effective protection with consumer preferences, giving formulators even greater flexibility in creating modern, aesthetically pleasing sunscreens.

References:

1 Mintel GNPD.
2 Report of the 25th WHO Expert Committee on Selection and Use of Essential Medicines 2025.
3 Commission recommendation of 22 September 2006 on the efficacy of sunscreen products and the claims made relating thereto 2006/647/EC, (2006).
4 Sohn, M, Chaper 13: UV Booster & Photoprotection, Extract from Wang, S.Q, Lim H W: Principles and Practice of Photoprotection.
5 Available at BASF Sunscreen Simulator.
6 Herzog B, Osterwalder U: Simulation of Sunscreen Performance, Pure and Applied Chemistry, October 2015, 87 (9-10): 937.

FIGURE 5

By removing EHMC and OCR, a higher concentration of emollients is needed to dissolve modern crystalline UV filters.

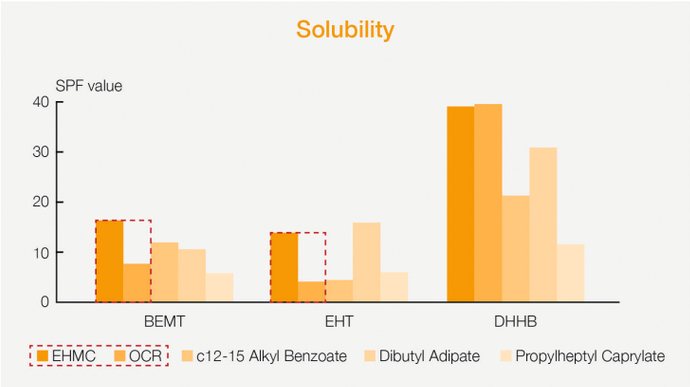


TABLE 3

The addition of water-soluble TDSA in a formulation enables emollient concentrations to be reduced without compromising on SPF or UVA-PF. "Uvinul TS Hydro" is supplied as a 33% active solution.

SPF ~50; UVA-PF > 20 proposals		
UV filters	**Oil-soluble**	**Oil-soluble + Water-soluble**
Ethylhexyl Triazone (EHT)	5.0%	4.0%
Diethylamino Hydroxybenzoyl Hexyl Benzoate (DHHB)	10.0%	7.5%
Aqua (and) Terephthalylidene Dicamphor Sulfonic Acid ("Uvinul TS Hydro", 33% active solution)	**-**	**10.5%**
Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine (BEMT)	5.0%	3.5%
Emollients		
c12-15 alkyl benzoate	10%	4%
Dibutyl Adipate	11%	11%
Dicaprylyl Carbonate	10%	3%
Propylene Glycol Dicaprylate/ Dicaprate	5%	3%
Oil Phase		
Emollients + Oil-soluble UV Filters	56%	36%

photos and graphics: BASF

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