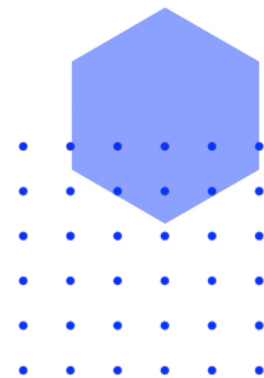


THE DE-SEASONALISATION OF SUNSCREEN

How Sunscreen Formulations are Evolving



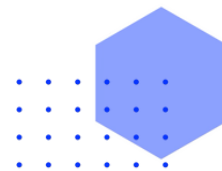
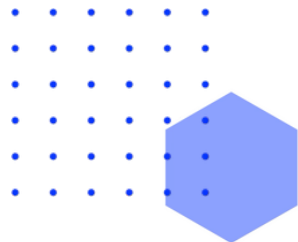
Rising awareness of the risks associated with UV exposure has turned sunscreen into an everyday necessity. At the same time, regulatory pressures, shifting consumer expectations and higher costs are actively reshaping formulations across the industry.

The growing awareness of the harmful effects of ultraviolet (UV) radiation has transformed sun protection from a seasonal concern into a global health priority. The sunscreen market is projected to reach an estimated \$25 billion by 2034, with a CAGR of approximately 6% (source: Fortune Business Insights), as consumers become increasingly conscious of long-term skin damage and skin cancer risks.

The importance of sun protection has been established for thousands of years. Formulations have evolved from natural remedies, such as rice bran and jasmine, used in ancient civilisations, to modern formulations incorporating carbon-based and mineral/physical UV filters.

Concerns surrounding the environmental and potential human health impacts of certain organic UV filters has triggered increased regulatory scrutiny. Equally, shifting consumer preferences for proven effectiveness and skin feel are redefining expectations of sunscreen products. At the same time, broader economic pressures, including rising raw material and packaging costs, are adding further complexity to the market.

Together, these regulatory, consumer, and cost pressures are reshaping the sunscreen industry, driving innovation in product formulation, and expanding the role of SPF across new applications.



WHY DO WE NEED SUNSCREEN?

The sun emits ultraviolet radiation (UV) alongside other electromagnetic rays. UV radiation can be divided into three categories: UVA, UVB and UVC rays. UVA rays penetrate the skin deeply and may contribute to skin cancer, ageing and tans. UVB rays do not penetrate the skin deeply, but they may also damage skin cells and cause DNA mutations that lead to skin cancer. UV filters protect against UVA and UVB rays to varying degrees, so formulations may include multiple filters to get sufficient protection. UVC rays are the most dangerous; however, the ozone layer blocks these.

Beyond personal care, UV filters have many other applications, such as in plastic products, coatings, inks and textiles. This article will focus predominantly on the personal care applications.

THE CHEMISTRY OF SUNSCREEN

Sunscreen formulations are composed of active ingredients which protect the skin against the sun, and inactive ingredients which influence the texture and stability of formulations. Inactive ingredients include oils, water, thickeners, emulsifiers and functional additives. The active ingredients responsible for UV protection are called UV filters, which can be divided into two categories: chemical/organic filters and inorganic/mineral/physical filters.

Table 1 – Organic UV filters versus inorganic UV filters

	Organic (or chemical)	Inorganic (mineral or physical)
Examples	UVA Filters: Avobenzene, oxybenzone, dioxybenzone, meradimate UVB Filters: Para amino benzoic acid (PABA) derivatives, cinnamates, octocrylene, ensulizone, homosalate Broad spectrum: Ecamsule, silatriazole, bemotrizin, biscotrizole, bemotrizinol	Zinc oxide Titanium dioxide
Key Manufacturers	Ashland, BASF, Clariant, Croda, dsm-firmenich, Symrise	Titanium dioxide - Chemours, LB Group, Nexchem, Plater Group, Tronox Holding, Evonik Zinc oxide - BASF, EverZinc, US Zinc, Zochem

In the 1920s and 1930s, zinc oxide emerged as a key ingredient in protecting against sun damage, however, formulations containing zinc oxide were thick, greasy and left 'white casts'. Sunscreens then began to evolve to mitigate this and organic UV filters were adopted.

Today, organic sunscreens make up 58% of the global sunscreen market and inorganic sunscreens make up 42% of the market (source: Suncream Market). However, data has shown that organic UV filters may have a negative impact on human health and the environment. This poses a new hurdle that manufacturers must overcome.

Table 2 – The chemistry of organic UV filters and inorganic UV filters

	Organic (or chemical)	Inorganic (mineral or physical)
Chemistry	These compounds contain aromatic rings or conjugated double bonds. Upon absorbing UV radiation, electrons in these compounds get excited. These are promoted to higher energy-levels. When these electrons eventually relax back into their ground state, they release thermal (heat) energy.	Historically, inorganic filters were thought to have scattered UV radiation, however, recent research shows that they only scatter 5% of UV radiation. They protect the skin by absorbing UV radiation, similar to organic filters.

KEY CHALLENGES IN THE SUNSCREEN MARKET

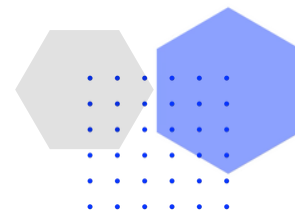
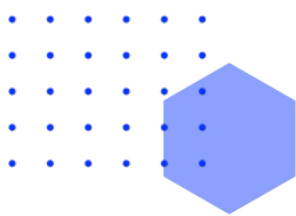
The sunscreen industry is being reshaped by three key pressures: regulatory scrutiny, evolving consumer expectations and cost pressures.

Regulatory Scrutiny

Organic UV filters have come under increased scrutiny due to two primary concerns:

- **Environmental Impact:**
 - Studies have indicated that organic UV filters may cause harm to coral
 - They may cause coral bleaching, coral mortality and endocrine-disrupting activity in marine organisms
- **Human Health Risks:**
 - Some research has shown that certain organic UV filters can be absorbed by humans through the skin
 - Certain organic UV filters are aromatic compounds that share structural similarities with hormones and may interact with hormone receptors, potentially resulting in endocrine-disrupting effects in humans.

In the United States, only titanium dioxide, zinc oxide, and bemotrizinol are currently classified as Generally Recognised as Safe and Effective (GRASE).



While the absence of GRASE status does not prevent the use of other UV filters, the fact that only one organic UV filter has achieved this status reflects the concerns surrounding these compounds.

Bemotrizinol, the only GRASE organic UV filter, was classified as GRASE as it was seen to have negligible systemic absorption. This may suggest that newer-generation organic UV filters are less likely to cause environmental or human harm.

In the EU and UK however, a broader range of organic UV filters are permitted, although at lower concentration to inorganic filters.

Environmental concerns have also led to several jurisdictions banning specific organic filters. For instance, Palau (2020) and Hawaii (2021) have banned the use of octinoxate and oxybenzone, to protect marine ecosystems.



Evolving Consumer Expectations

The increased awareness of the impact sunscreens have on coral reefs is resulting in many consumers gravitating toward inorganic sunscreens, since these are often marketed as 'reef safe'.

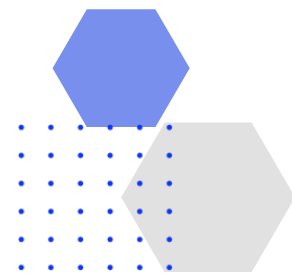
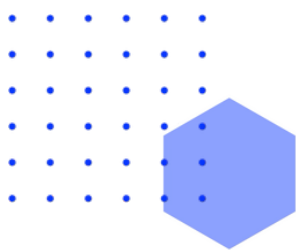
Many companies and influencers on social media are going into more detail about the ingredients and chemistry behind their products. This, in conjunction with beauty journalists, environmentalists and regulators, is leading to consumers becoming more educated about the chemistry and capabilities of personal care products.

Brands with niche and innovative products also become 'viral' on social media and on the news, increasing consumer expectations of what personal care products can offer. As a result, sunscreen has become a distinct category in the cosmetics world.

"Sunscreen has come a long way... it has really evolved into its own beauty category."

— Ava Chandler-Matthews, Co-founder of Ultra Violette





Case Study: The SPF Controversy

A clear example of when consumers and regulators came together to reshape the industry is the Australian SPF (Sun Protection Factor) controversy, in 2025.

SPF measures a sunscreen's ability to protect the skin from harmful UV rays by measuring the fraction of UV exposure required to produce a sunburn on protected skin versus unprotected skin. Hence, a higher SPF value correlates to higher protection.

In 2025, testing conducted by a consumer advocacy group found that many Australian sunscreens did not provide the SPF that was quoted on their labels. This led to many sunscreens being recalled, consumer outrage, and regulatory scrutiny.

Australia's Therapeutic Goods Administration (TGA) has since been evaluating whether testing requirements should be strengthened and considering whether a qualitative labelling system would be more appropriate.

The case illustrates how consumer pressure can accelerate regulatory intervention, ultimately reshaping industry standards.

Cost Pressures



Alongside regulatory and consumer pressures, the industry is facing significant cost challenges.

Geopolitical factors, such as the US-Iran conflict, have driven up the cost of petrochemical-derived raw materials impacting key ingredients.

These include polymer additives, solvents, emollients, preservatives as well as organic UV filters.

As a result, the overall cost of producing personal care products, including sunscreens, has increased.

As organic UV filters are derived from petrochemicals, the conflict has had a greater impact on the cost of these than on the cost of inorganic UV filters. However, the quantity of organic UV filters used is too small for this to cause a significant impact.

Secondary to this, packaging costs have also been affected, so manufacturers are facing a dual challenge: adapting formulations and managing increased packaging expenses.

INCREASED INNOVATION

As a consequence of regulatory scrutiny, evolving customer expectations and rising costs, there has been increased innovation in the sunscreen space.

Reformulation Trends

To reduce the 'white cast' inorganic sunscreens have historically been known to leave, formulators are increasingly using nano-sized titanium dioxide and zinc oxide. These nano-scale particles are smaller than the wavelength of visible light so scatter less visible light and appear more transparent on the skin. For example, Evonik manufacture nano-titanium dioxide under their AEROXIDE® brand.

It is also important to note, many sunscreens are not completely removing organic UV filters from formulations, instead, they are combining organic and inorganic UV filters, making hybrid products.

For example, Nivea's 'Ocean Respect' range does not contain oxybenzone, octinoxate, and octocrylene as these organic UV filters are thought to cause harm to marine life. Instead these products contain other organic UV filters (such as avobenzone) and titanium dioxide.

Human health concerns have also impacted formulations, by giving rise to encapsulation technology, which helps prevent organic UV filters from being absorbed by the skin. For example, Clariant's NanoCon technology, which encapsulates UV filters to prevent degradation and skin absorption.

Beyond altering UV filter content, antioxidants (such as vitamin C and vitamin E) are being incorporated into formulations to provide consumers with more holistic skin protection. Antioxidants neutralise free radicals generated by UV exposure, aligning with consumer demand for multifunctional skincare.

SPF is becoming more ubiquitous

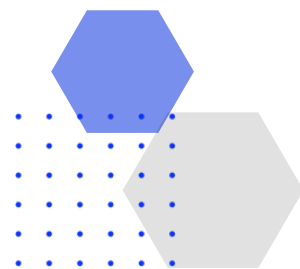
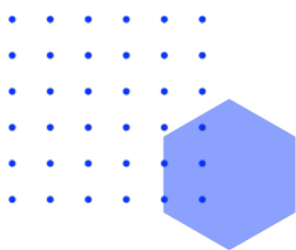
SPF is no longer confined to traditional products but is increasingly incorporated into cosmetics such as lip balms, foundations and hair-care products.

This coincides with consumers perspectives on sunscreen changing from being a seasonal product to an 'everyday essential'.



"I've always said that I wanted to make SPF a healthy habit like brushing your teeth or washing your hands, and I think we've begun to do just that"

– CEO of Supergoop



Tackling packaging issues

Beyond the innovation in formulations, there has been a rise in innovation surrounding packaging, to mitigate rising petrochemical costs.

For example, some companies have adopted 'eco-friendly' paper tubes from a South Korean cosmetics packaging manufacturer, Yonwoo. This packaging uses just 20% of the plastic used by conventional packaging.

Ink prices have also been impacted, affecting the design of packaging. For example, the Japanese brand Calbee have opted to remove colour from their packaging.

These adaptations demonstrate how cost pressures are impacting the aesthetics of sunscreen and personal care products, not only the formulations and functionality.

CONCLUSION

Regulatory, consumer, and cost pressures are collectively reshaping the sunscreen industry. The regulatory scrutiny of organic UV filters has influenced consumer perceptions, which in turn has accelerated demand for safer and more sustainable products. At the same time, rising costs, affecting both formulations and packaging, have added further pressure on manufacturers.

In response, the industry has demonstrated significant flexibility. Formulators are revisiting inorganic UV filters, but with advanced technologies that address previous concerns such as 'white casts'. Simultaneously, SPF is being integrated into a wider range of products, reflecting its transformation into an everyday essential.

Overall, the evolution of UV filters, from inorganic to organic and now back toward improved inorganic formulations, highlights the industry's ability to respond to pressures. This ongoing adaptation illustrates a market that is not only reacting to external challenges but actively innovating to simultaneously meet regulatory requirements, consumer expectations, and economic constraints in conjunction.

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UNDISCLOSED	c.€39m	c. €3bn	UNDISCLOSED	\$360m
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