

From Clean



to Conscientious Sunscreens

Clean Sunscreen Market

Clean is evolving

- **Greater ingredient transparency** is still demanded by consumers, especially younger generations
- **Minimalist formulations** emerging
- Brands claiming to be **circular and responsible**
- However sustainable merits are not a priority over **format, brand and formula**

Mineral/physical
sunscreens perceived
as **safer** on
consumer and
planetary health



15.8%

sunscreens launched
Jan 2020 to Dec 2020
used **mineral**
sunscreens only**

This represents an

89.7%

increase over a 5-year
period**

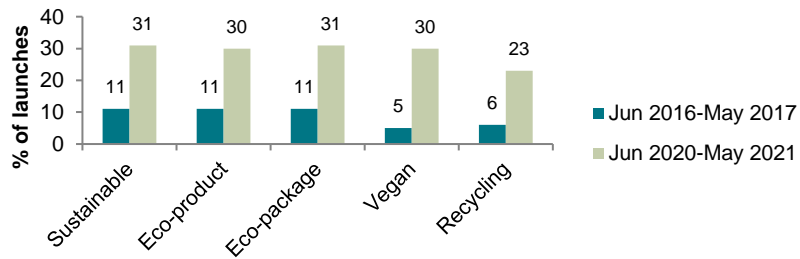
Mineral is set to
gain further
traction as
**mass market
players** move
into the segment

Clean Sunscreen Market

Regional outlook

Europe

Europe: suncare launches by fastest-growing claims, 2016-17 vs 2020-21

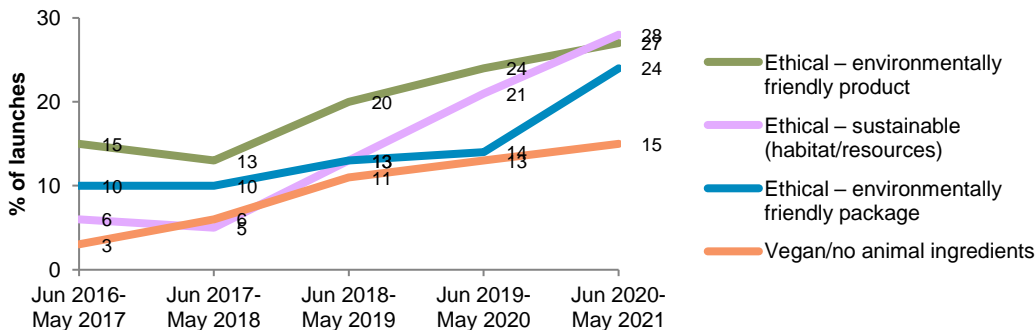


APAC

- Natural/botanical claims predominate but are declining
- Eco-claims are largely limited despite consumer interest
- Expect a **bigger focus** on **climate change** in the coming years

Americas

Americas: sunscreen launches by fastest-growing claims, 2016-21



In China
50%+
of sunscreen users associate a 'safe' sunscreen as having a natural formula or an eco-friendly formula

Conscientious Sunscreens



What are conscientious sunscreens?

Evolution of clean sunscreens to a more responsible way of meeting consumer demands

Clean beauty without the fear-mongering

Risk vs hazard
(hazard classifications
are not risk
assessments)

Ethical and responsible

Balance skin safety and
eco-impact

Social outreach

Choosing the most sustainable
option at present

Conscientious Sunscreens



People Positive

Croda's Commitment

To be Climate, Land and People positive by 2030



We will use our Smart Science to promote healthy lives and wellbeing through the development and application of our ingredients and technologies

By 2030, we will protect at least **60** million people annually from potentially developing skin cancer from harmful UV rays, through the use of our solar protection ingredients



Target 3.4 of SDG 3, Good Health and Wellbeing, references cancers as part of reducing premature mortality from noncommunicable diseases.

Croda's Commitment

Solaveil mineral sunscreens are amongst the safest sunscreens available



Our priority is keep people safe from **skin cancer**, the main cause of which is sun exposure

Mineral filters are broadspectrum and have the added benefit of preventing **early skin aging**

2-3m



Skin cancer cases occur **globally** each year*

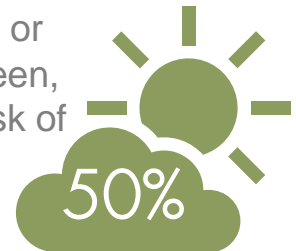
Climate change driving skin cancer WHO estimates that just a **10% reduction** in the **ozone layer**

could generate

300,000

additional **skin cancer cases** in any one year*

Regular daily use of an **SPF 15 or higher sunscreen, reduces the risk of melanoma by



Having **5** or more **sunburns** doubles your risk for melanoma.**

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*<https://www.who.int/uv/faq/skincancer/en/index1.html>

**<https://www.skincancer.org/skin-cancer-information/skin-cancer-facts/>

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Skin Safety Regulations



All regulatory bodies globally approve TiO_2 and ZnO as UV filters at levels up to 25% active, highest permitted use level of any sunscreen active

The past controversy around nanoparticles was linked to fears that they pass the skin barrier

Extensive safety reviews have been conducted by the EU Scientific Committee for Consumer Safety (SCCS)** and the US Food & Drug Administration (FDA)*

*"There is substantial evidence that these mineral compounds largely do not penetrate the skin (even particles on the nanoscale (1-100 nanometers)), and to the extent that "de minimis" penetration occurs, do not cause adverse health effects."



*<https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm631736.htm>
<https://www.crodapersonalcare.com/en-gb/news/2019/03/personal-care-new-fda-regulations-for-suncare>

**https://ec.europa.eu/health/scientific_committees/consumer_safety/docs/sccs_o_136.pdf
https://ec.europa.eu/health/sites/health/files/scientific_committees/consumer_safety/docs/sccs_o_206.pdf
https://ec.europa.eu/health/scientific_committees/consumer_safety/docs/sccs_o_103.pdf

Skin Safety at Croda

Research review conducted by Croda in collaboration with other leading suppliers and end-use formulators on the human safety of nano TiO₂ and ZnO (Unilever, J&J, L'Oreal, P&G, Beiersdorf, BASF, Croda, Umicore, Colipa)

Human safety review of “nano” titanium dioxide and zinc oxide

Schilling et al, Photochemical & Photobiological Sciences, March 2010

<https://pdfs.semanticscholar.org/c866/32a405e6ae1d1f34d9bd37c5ce05e753dc3c.pdf>



- Multiple studies under exaggerated conditions show they don't penetrate beyond the stratum corneum
- In vitro genotoxic and photogenotoxic profiles are of no consequence to human health

FDA Position on Skin Safety



Proposed Rule, Feb 2019

Minerals

TiO₂ and ZnO largely do not penetrate and are not absorbed through the skin. GRASE (Generally Recognised As Safe Effective) Category 1 – no further information required

Organics

For the organic sunscreens listed* they have not identified safety concerns, but existing evidence suggests that these are, or may be, **absorbed through the skin**, and data about the consequences of this absorption are missing

*Cinoxate, dioxybenzone, ensulizole, homosalate, meradimate, octinoxate, octisalate, octocrylene, padimate O, sulisobenzene, oxybenzone, and avobenzone



Despite this they state:

It is important that, as... the FDA gathers additional scientific information, given the recognized public health benefits of sunscreen use, consumers continue to use sunscreen in conjunction with other sun-protection measures



Conscientious Sunscreens



Coral safe issues and data

Sunscreens in the News



Consumers are increasingly environmentally conscious and coral bleaching is a hot topic



Strong media narrative and sometimes damaging propaganda about sunscreens



Consumers are left confused, do sunscreens damage coral, which ones should I use?

Palau is first country to ban 'reef toxic' sun cream

© 1 January 2020

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Sunscreen pollution accelerating demise of coral reefs, experts say

Chemicals commonly found in sun

By Ashley LoFaso

22 February 2020, 10:03 • 10 min read

The Rock Islands in Palau

What sunscreens are best for you—and the planet?

Harmful chemicals from sunscreen can damage coral. Here's how to protect both your skin and the reefs.

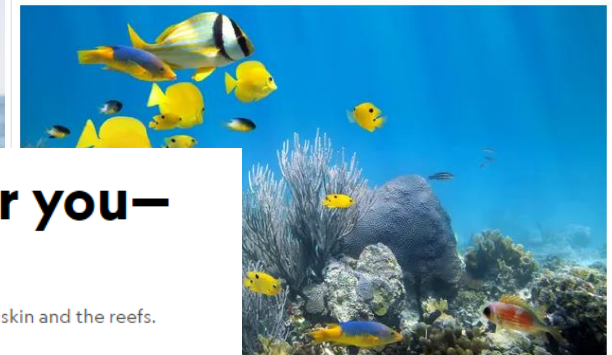
Wednesday, 22 May 2019

Could banning sunscreen to help save coral do more harm than good?



Republicans seek to overturn Key West ban on coral-damaging sunscreens

Backlash to prohibition on reef-harming chemicals frames issue as one of public health focused on skin cancer risk



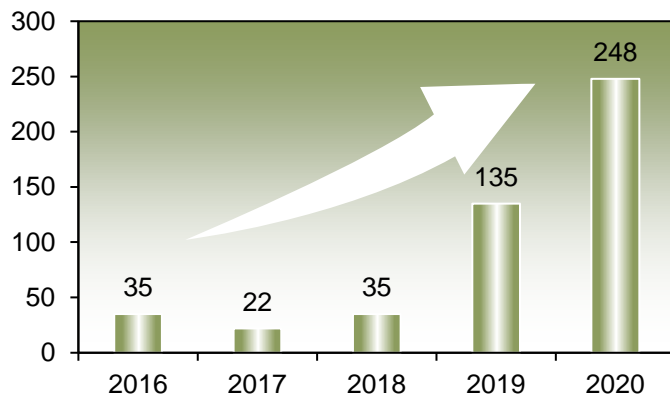
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Source: Google.com search "sunscreens damage coral news"

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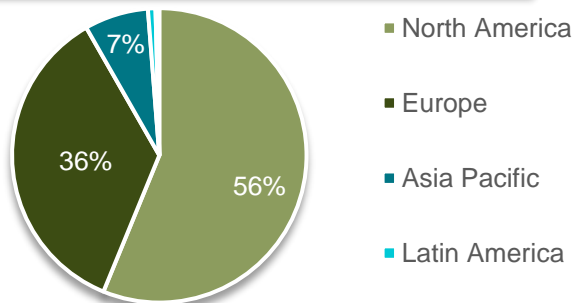
Coral Safe in the Market

Number of launches (skin care) claiming
“coral/ocean/reef” “safe/friendly”

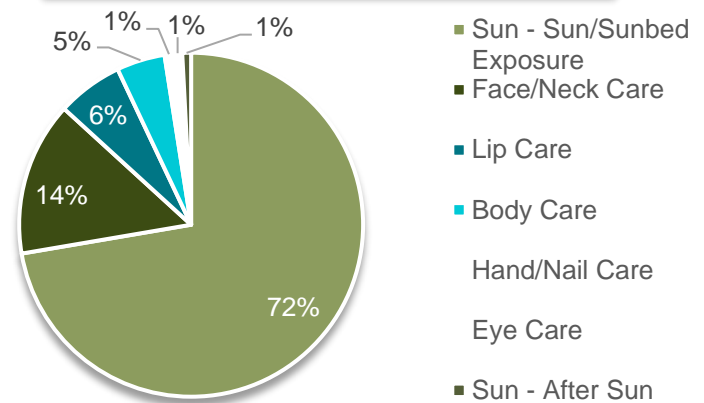


In 2020, **11.5%**
sunscreen launches claimed
“coral/ocean/reef”
“safe/friendly”

North America and Europe are
the major markets



Sunscreens in the dominant
category (representing 72%)

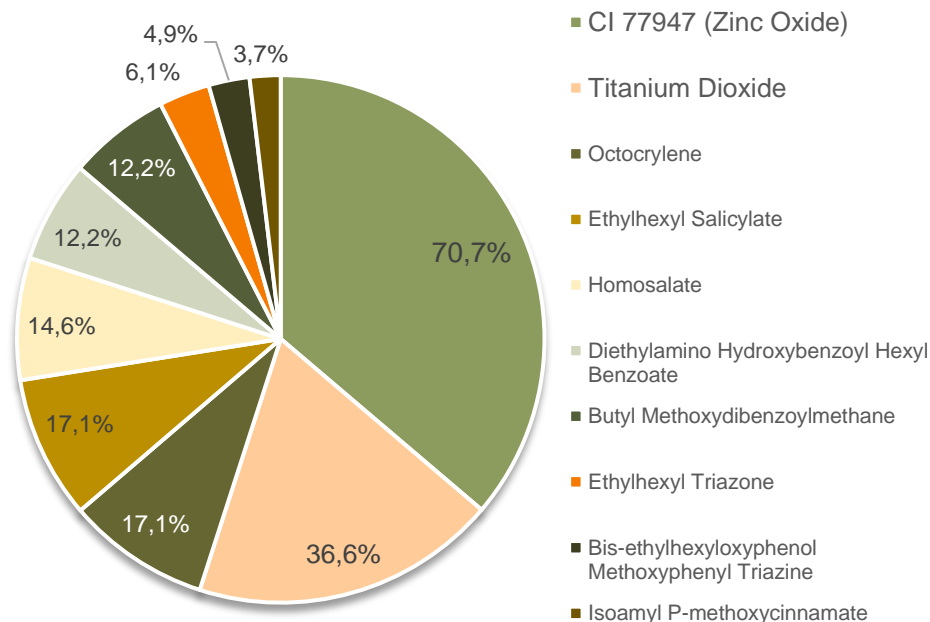


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Sunscreen Actives Used

Launches in sun care – sun protection, claiming “coral/ocean/reef” “safe/friendly” (2016-2020)



NO Benzophenone-3 (Oxybenzone)
but this appears in 16% ALL sunscreen launches

NO EHMC (Octinoxate)
but this appears in 40% of ALL sunscreen launches



Unregulated Claims Landscape



EcolCare:
Ecoreach labs test on marine
organisms

Protect Land + Sea Certified:
Hereticus Labs (Dr Downs)
Absence of ingredients on the a
list of "known pollutants"

Supplier Claims



BASF

REACH intrinsic properties of UV filter

Eco-tox hazard score

Formulation calculation based on UV filter score, % inclusion and SPF/UVA

0 = not eco-friendly

200 = best possible score



DSM Eco-Label

Toxicity test data of UV filter

Eco-profile of UV filter

Formulation score based on % inclusion and rank formulation against already marketed products (logo can be used on pack)

A = best possible

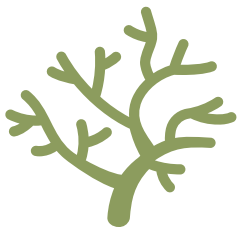
G = worse possible

Note: not based on coral data, uses hazard not risk based approach, not based on exposure scenarios (how much UV filter will enter the environment)

Coral Safe Claims

- ✗ No universal definition of what “coral/ocean/reef-safe” means
- ✗ No industry regulations or standards

Coral safe (or ocean safe, reef safe, eco) claim



- Most often it is the absence of banned organic sunscreens
- Sometimes it is testing formulation for absence of alleged “pollutants”
- Sometimes it is testing formulation on coral under laboratory conditions
- Sometimes it is based on REACH data for the UV filter and inclusion level

A Trend and a Distraction?

It is widely acknowledged within the scientific community that **extreme climate events** and **warming sea temperatures** are the major contributing factors to coral bleaching.*

🔄 "The conclusion from the media is sunscreen is killing the world's coral, and that's laughable,"

Professor Hughes, interview with Mashable:
<https://mashable.com/2015/11/10/sunscreen-killing-coral-reefs/?euope=true>



In addition, regions of the world where most severe coral bleaching has occurred do not match human population density.***

*Hughes, T. et al, Nature volume 568, p387–390 (2019)

*Hughes, T. et al, Nature volume 546, p82–90 (2017)

***<https://www.nature.com/articles/srep29778>

Coral Reef – The Real Issues

Roughly one-quarter of coral reefs worldwide are already considered damaged beyond repair, with another two-thirds under serious threat.

According to the WWF the main threats to coral reefs are:

Unsustainable coastal development

Tourist resorts and other coastal infrastructure have been built directly on, or close enough to, reefs to cause significant damage. The impacts of coastal development can put coral reef systems under considerable additional pressure. Some resorts and coastal developments empty their sewage or other wastes directly into water surrounding coral reefs.

Sedimentation

Erosion caused by construction (both along coasts and inland), mining, logging, and farming is leading to increased sediment in rivers. This ends up in the ocean, where it can 'smother' corals. The destruction of mangrove forests, which normally trap large amounts of sediment, is exacerbating the problem.

CLIMATE CHANGE

Corals cannot survive if the water temperature is too high. Rising ocean temperatures and acidification of the ocean caused by higher concentrations of carbon dioxide in the atmosphere are leading to wide-scale coral "bleaching" and disrupting the entire reef ecosystem.

Pollution

Urban and industrial waste, sewage, agrochemicals, and oil pollution toxins are dumped directly into the ocean or carried from sources upstream. Some pollutants increase the level of nitrogen in seawater, causing an overgrowth of algae, which 'smothers' reefs by cutting off their sunlight.

Over Fishing

This affects the ecological balance of coral reef communities, warping the food chain and causing effects far beyond the directly overfished population.

Destructive Fishing Practices

These include cyanide fishing, blast or dynamite fishing, bottom trawling, and muro-ami (banging on the reef with sticks). Bottom-trawling is one of the greatest threats to cold-water coral reefs.

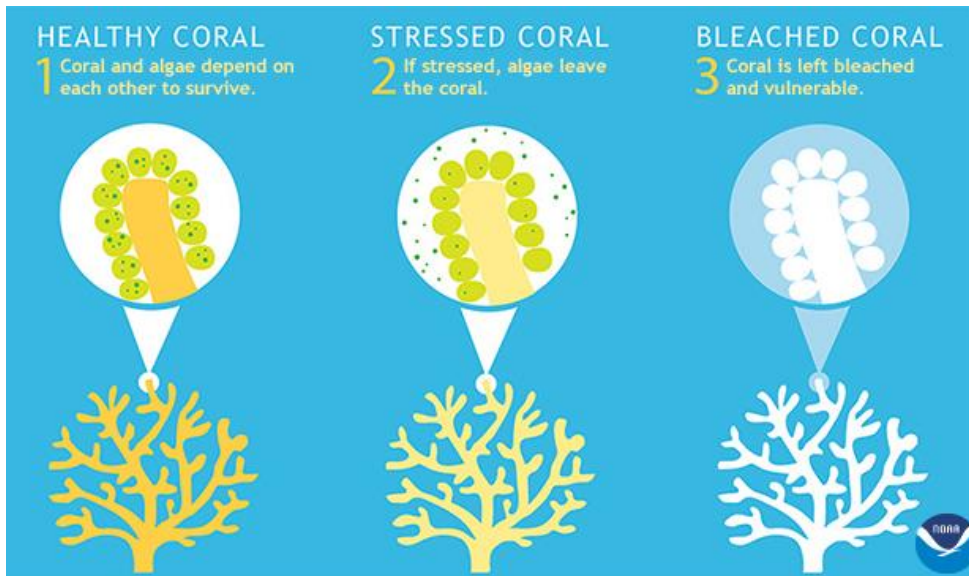
Coral Bleaching



Symbiotic relationship between Coral and Algae

Coral excrete their waste (CO_2 , Nitrate, Phosphate) to Zooxanthellae algae

The algae produce nutrition (sugar, lipids, amino acids) for coral polyps



In stressed coral, algae leaves the coral and it turns white

The main stress factor is water temperature (greater than 32 degrees)

If this stress is temporary, algae can return to coral, but prolonged stress will cause coral to die

Coral Bleaching



You Tube link: <https://youtu.be/bFdPmiwZzVE>

Time-lapse footage (8 days) of coral bleaching taken by scientists in a laboratory at Queensland University of Technology in Brisbane, Australia, captures a coral ejecting its resident population of algae (National Geographic)

<https://www.qut.edu.au/news?news-id=108238>

Trade Association Viewpoints

“Scrutiny on UV filters which is not based on robust science has the potential to undermine sun protection products in general.”

CTPA's concerns that **unfounded fears** of the negative impact of sunscreen on coral health can lead to an **increased risk of skin cancer** are shared by medical and dermatological communities*.



'Ocean-Friendly' Claims

CTPA strongly advises its members against making 'ocean friendly' or 'reef-safe' claims

Not only would such claims be **extremely difficult to substantiate**, the legislation to ban benzophenone-3 and ethylhexyl methoxycinnamate is **based on a limited body of scientific research** from which concrete conclusions cannot be drawn.

PCPC:

“There is **no definitive scientific evidence** that products containing oxybenzone or octinoxate damage coral in natural environments like Key West, nor any evidence that banning these ingredients improves the plight of coral. The ingredient ban in Key West **ignores the real causes** of coral decline according to scientists in Florida and from around the world: global warming, agricultural runoff, sewage, and overfishing. Public policy that will likely adversely impact public health should not be based on a limited number of exploratory lab-based studies alone.”



A decorative image showing several palm fronds in shades of green and yellow, set against a white background. The fronds are arranged in a way that they appear to be reaching upwards and outwards, creating a sense of growth and vitality.



There is actually no direct evidence that sunscreens cause coral bleaching in the wild.*

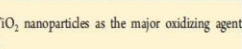
This is also the conclusion of a recent critical review on organic UV filter exposure hazard and risk to corals.**

TiO₂ Eco-Impact

MYTH

Concerns around environmental impact of TiO₂ are largely based on this one study, not coral damage, but hydrogen peroxide production

ABSTRACT: Sunscreens have been shown to give the most effective protection for human skin from ultraviolet (UV) radiation. Chemicals from sunscreens (i.e., UV filters) accumulate in the sea and have toxic effects on marine organisms. In this report, we demonstrate that photoexcitation of inorganic UV filters (i.e., TiO₂ and ZnO nanoparticles) under solar radiation produces significant amounts of hydrogen peroxide (H₂O₂), a strong oxidizing agent that generates high levels of stress on marine phytoplankton. Our results indicate that the inorganic oxide nanoparticle content in 1 g of commercial sunscreen produces rates of H₂O₂ in seawater of up to 463 nM/h, directly affecting the growth of phytoplankton. Conservative estimates for a Mediterranean beach reveal that tourism activities during a summer day may release on the order of 4 kg of TiO₂ nanoparticles to the water and produce an increment in the concentration of H₂O₂ of 270 nM/day. Our results, together with the data provided by tourism records in the Mediterranean, point to TiO₂ nanoparticles as the major oxidizing agent entering coastal waters, with direct ecological consequences on the ecosystem.



*Sanchez-Quiles, Tovar-Sanchez, Environ. Sci. Technology, October 2014
(<https://www.ncbi.nlm.nih.gov/pubmed/25069004/>)

**ECHA REACH dossier:

<https://echa.europa.eu/registration-dossier/-/registered-dossier/15560/5/1>

Additionally 8 references in PubChem:

<https://pubchem.ncbi.nlm.nih.gov/compound/Titanium-dioxide>

***Hopwood et al, Nature, March 2017 (<https://www.nature.com/articles/srep43436>)

FACT

The study has been discredited by experts who point out that TiO₂ UV filters are insoluble** and there is no evidence that they are a source of metals found in coastal waters.

Also hydrogen peroxide is naturally occurring in the oceans and the levels found within the study are well **within normal levels.*****

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ZnO Eco-Impact



MYTH

ZnO is aquatoxic and therefore harmful to coral

FACT

It is true that ZnO has a hazard label of very toxic to aquatic life with long lasting effects.*

However hazard is not the same as risk, and we must consider the **exposure** in the marine environment.

Based on the current available data, it can be concluded that **zinc exposure due to ZnO use in sunscreens is not predicted to be of concern** for risks to the aquatic environment.**

ZnO remains the most widely used UV filter in products launched making a coral/reef safe claim according to Mintel GNPD

Biodegradability



MYTH

TiO₂ and ZnO are not biodegradable and therefore not safe for the environment

FACT

Biodegradable means to be able to decay naturally and without harming the environment [1].

Biodegradability is a measure of how quickly organic carbons are degraded in the eco-system, and when there are no organic carbons (for examples with minerals such as TiO₂ and ZnO) such measurement is not relevant.

So, TiO₂ and ZnO cannot biodegrade as they are **inert minerals** and they already **occur naturally in the environment**.

Bioaccumulation



MYTH

TiO₂ and ZnO are bioaccumulating

FACT

Mineral UV filters are not known to be bioaccumulating.

TiO₂

According to ECHA the available data on bioaccumulation of nanosized-TiO₂ in invertebrates and fish indicate that it does not appear to bioaccumulate or biomagnify.*

ZnO

For Zinc Oxide ECHA state that zinc is an essential element which is actively regulated by organisms, so bioconcentration/bioaccumulation is not considered relevant for inorganic zinc substances.**

Conscientious Sunscreens

A tropical beach scene with palm trees, turquoise water, and a clear blue sky. The sun is shining brightly, creating a warm, golden glow. The palm fronds are in the foreground, framing the view of the ocean and distant mountains.

Climate Positive

Nature Identical Minerals



TiO₂ is obtained by transformation of titanium compounds mined from the earth

ZnO occurs naturally as the mineral zincite but commercial ZnO is produced synthetically

Chemical/Organics



Organics sunscreens are entirely carbon based, fossil derived in origin and are entirely synthetic chemical compounds



Typically produced by solvent processes with solvent waste streams

Mineral/Inorganics



Inorganics are based on natural minerals, they are coated and dispersed to improve performance and formulatability



TiO₂ produced by an aqueous process with salt water waste streams. ZnO produced by vaporization at high temperatures.

Climate Positive Actions

Tackle the major cause of coral bleaching, climate change

Climate, Land and People Positive by 2030

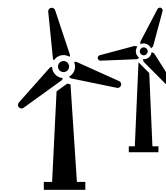


We have committed to set Science Based Targets* to reduce our emissions in line with limiting the global temperature rise to **1.5°C**

1.5°C scenario is the most challenging to meet. Croda publicly signed up to this in July 2019. We will reduce our scope 1 and 2 emissions to net zero by 2050

BUSINESS AMBITION FOR **1.5°C** OUR ONLY FUTURE

Our sun care manufacturing sites in Ditton, UK and Girona, Spain source **100% renewable electricity**



The **carbon footprint** associated with manufacturing our products will be reduced by **half** in the next 10 years

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*Science Based Targets Initiative is an organisation that validate individual company or government decarbonisation targets to fit with the science of climate change.

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Conscientious Sunscreens



Conclusion

What Next?

Regulation and research is progressing



Industry is developing new models of ecotoxicology and working to understand the environmental fate when UV filters are used in sunscreens

Example Cosmetic Industry Project
(led by PCPC, Cosmetics Alliance Canada
and Cosmetics Europe)

Environmental Exposure of UV Filters in Marine and Freshwater Environments

This project evaluates a wide range of potential models that can be used to model the exposure of marine and freshwater environments, with a focus on coral. The aim then is to develop a tiered coral risk assessment scheme for the marine environment.

Caroline Rainsford, CTPA

At **Croda** we are taking a leadership role in life cycle assessment of our ingredients and their impact on the life cycle of our customers' products. This will help the markets in which we operate move towards more circular economies and reduce consumer and employee exposure to chemical hazards.

By 2030, we will have conducted full life cycle assessments for our top 100 ingredients

Conscientious Sunscreens



People Positive

Protect people from harmful UV rays. Prevent skin cancer and early skin aging.



Climate Positive

Carbon reduction, fight global warming, protect coral ecosystems.



Responsible supplier

Debunk myths and endorse credible science. Supporting customers in the use of mineral actives for conscientious sunscreens.

Conscientious Sunscreens



Croda Europe Non-warranty

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