

Declaring Octocrylene as the "Toxin of the Month" for August...

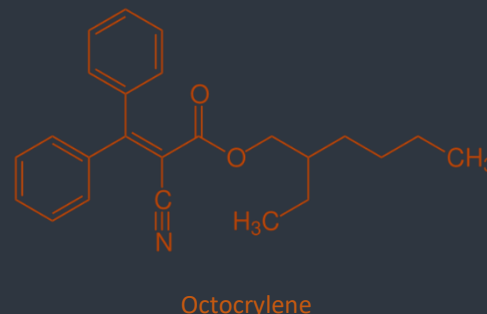
...was decided in consultation with Dr. Denise Bloch (BfR), the head of the Mixture Toxicity Working Group of the GT. In mixtures, substances can influence each other's toxicity, either weakening or enhancing their effects. The working group discusses mechanisms of mixture toxicity, experimental models and testing systems, methods for exposure assessment to everyday mixtures, and strategies for evaluating them. The working group serves as a discussion platform for mixture experts from universities, regulatory authorities, and industry, promoting communication across different disciplines.

In recent years, consumer uncertainty regarding the safety of sunscreens has increased. The aim of this article is to inform about a critical organic UV filter while emphasizing the benefits and necessity of sunscreens for effective protection against harmful UV radiation.

Octocrylene

Chemically, octocrylene is an ester formed by the esterification of 2-ethylhexanol and 2-cyano-3,3-diphenylacrylic acid (octocrylic acid). Octocrylene consists of an acrylate backbone (an unsaturated carboxylic acid) with a cyano group ($-C\equiv N$) and two phenyl rings (aromatic rings) at the α -position. On the other side of the acrylate backbone, a 2-ethylhexyl ester is attached. The combination of the phenyl rings and the cyano group gives octocrylene its ability to absorb UV rays, particularly in the UV-B range (280–320 nm) and partially in the UV-A range (320–400 nm).

Octocrylene is also known under the following trade names: Octocrilene, 2-Cyano-3,3-diphenylacrylate, 2-Ethylhexyl 2-cyano-3,3-diphenylacrylate, 2-Ethylhexyl-2-cyano-3,3-diphenylacrylate, Eusolex OCR, Uvinul N-539, and Parsol 340.w



Octocrylene-Containing Sunscreens – Better Avoid for Safety!

Sunlight consists of high-energy ultraviolet (UV) radiation, which has been classified as carcinogenic to humans by the International Agency for Research on Cancer (IARC) and is considered a significant risk factor for skin cancer, making protection essential. This becomes especially important during long, sunny days when we spend time at the pool, in the mountains, or at the beach.

Sunscreens are an important tool for daily sun protection as they shield the skin from harmful UV radiation. They may contain organic (chemical) UV filters that absorb UV rays and convert them into heat, thereby protecting the skin from damage. In addition, inorganic (physical) UV filters are used, which reflect or scatter UV rays and thus effectively protect the skin from sunburn.

Absorption studies on organic UV filters indicate that these substances do not remain on the skin but can enter the bloodstream at high concentrations, making it important that they are safe for human health.

One commonly used UV filter is octocrylene, an organic UV filter found not only in sunscreens but also in other cosmetic products. Due to its chemical structure, octocrylene can absorb UV radiation, preventing harmful rays from penetrating the skin and causing cellular damage. Its lipophilic (fat-soluble) properties make it well-suited for cosmetic formulations and contribute to the water resistance of sunscreens. Additionally, octocrylene is often used as a stabilizer for other UV filters, such as avobenzone, to enhance their photochemical stability. Various *in vivo* studies suggest that octocrylene possesses endocrine-disrupting properties. Consequently, the Scientific Committee on Consumer Safety (SCCS) of the European Union reviewed the potential endocrine risk associated with octocrylene in cosmetic products in 2021 and concluded

Storage Stability Studies

Storage stability studies are designed to expose a product to defined laboratory conditions in a way that simulates the aging process under the storage conditions intended for the product. This allows for conclusions to be drawn about the product's shelf life. In the studies mentioned for octocrylene, conditions were selected to simulate stability after one year of storage at room temperature. These studies not only demonstrated the degradation of octocrylene into benzophenone over time but also showed that the amount of benzophenone formed depends less on the concentration of octocrylene and more on the composition of the product. This makes it difficult to accurately predict the benzophenone content of a slightly older sunscreen.

Ecotoxicological Concerns of Octocrylene

In 2020, the Pacific island nation of Palau was the first to ban chemical sunscreens. This decision was based on scientific studies showing a link between organic sunscreens and increased coral bleaching, as well as toxic effects on algae and fish. Many other Pacific island nations, as well as French Polynesia, have since followed suit, banning sunscreens that contain oxybenzone, octinoxate, and octocrylene.

Possible Alternatives

In addition to octocrylene, there are several other effective organic UV filters. However, some of these are also suspected of having hormonal effects or causing environmental damage. Apps that provide information on toxicologically concerning ingredients, such as ToxFox or CodeCheck, can help in finding safe products.

Consumers can be certain, however, when using inorganic, mineral filters like zinc oxide or titanium dioxide, as long as these mineral filters are not in nano-form. They protect just as effectively as organic filters against UV radiation.

that concentrations of up to 10% are safe. The same applies to potential contact-allergic properties, which have been observed in rare cases. Here too, the SCCS considers concentrations of up to 10% to be safe.

However, stability studies have shown that octocrylene in cosmetic products can degrade over time through hydrolytic decomposition into benzophenone. Benzophenone is toxicologically concerning; direct skin contact can cause rashes, inflammation, or hypersensitivity. Animal studies have shown that benzophenone also has endocrine activity, affecting the thyroid and reproductive organs. Additionally, oral intake of benzophenone in various animal studies caused liver cancer or lymphomas.

To date, however, there is no evidence that direct skin contact with benzophenone is carcinogenic in humans. Due to limited data, benzophenone is classified internationally as "possibly carcinogenic". In the EU, benzophenone, which was also used as a preservative in cosmetic products in the past, has been banned since November 2023. Therefore, new sunscreen products are free of benzophenone. To avoid possible contact with benzophenone as a degradation product of octocrylene-containing sunscreen that has been stored for too long, these products should ideally be discarded at the end of the season.

For reasons of ecotoxicological responsibility, it is advisable to avoid octocrylene-containing sunscreen products altogether and to opt for alternative inorganic UV filters.

However, a complete omission of sunscreen would be a fatal decision, as the risk of skin cancer from unprotected exposure to UV radiation is significantly higher.

By Ute Haßmann

Literature and links:

- [Benzophenone Accumulates over Time from the Degradation of Octocrylene in Commercial Sunscreen Products | Chemical Research in Toxicology \(acs.org\)](#)
- [Matta MK et al. Effect of Sunscreen Application on Plasma Concentration of Sunscreen Active Ingredients. JAMA 2020. doi.org/10.1001/jama.2019.20747](#)
- [Opinion of the Scientific Committee on Consumer Safety on Octocrylene \(europa.eu\)](#)
- [Kateryna Hliznitsova \(@kate_gliz\) | Unsplash-Foto-Community](#)
- [Datei:Octocrylene Structural Formula V1.svg – Wikipedia](#)
- [Sunscreen Pollution Analysis in Jellyfish Lake \(coralreefpalau.org\)](#)
- [Ecotoxicological evaluation of the UV-filter octocrylene \(OC\) in embryonic zebrafish \(Danio rerio\): Developmental, biochemical and cellular biomarkers - ScienceDirect](#)