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Topical sunscreen agents

Based on their mechanism of action, topical sunscreens can be broadly classified into two groups, chemical absorbers and physical blockers. Chemical absorbers work by absorbing ultraviolet (UV) radiation and can be further differentiated by the type of radiation they absorb, UVA or UVB, or both UVA and UVB. Physical blockers work by reflecting or scattering the UV radiation.

Chemical absorbers

The table below is a list of some of the common chemical absorbers available and the protection they provide against the UV range.

Chemical	UVB (290–320nm)	UVA II (320–340nm)	UVA I (340–400nm)
Aminobenzoic acid derivatives			
PABA	Partial	None	None
Glyceryl PABA	Partial	None	None
Padimate O	Partial	None	None
Roxadimate	Complete	Partial	None
Benzophenones			
Dioxybenzone	Complete	Complete	Partial
Oxybenzone	Complete	Complete	Partial
Sulisonbenzone	Complete	Complete	Partial
Cinnamates			
Octocrylene	Complete	Complete	Partial
Octyl methoxycinnamate	Complete	None	None
Salicylates			
Homosalate	Partial	None	None
Ethylhexyl salicylate	Complete	None	None
Trolamine salicylate	Complete	None	None

Chemical absorbing sunscreens often contain a combination of ingredients to get coverage against both UVB and UVA radiation. Some are also combined with physical blockers.

Some organic formulations may degrade when exposed to sunlight; they may therefore not perform as well as expected.

Physical blockers

Physical blockers are effective at protecting against both UVA and UVB radiation. The two most common physical

blockers are titanium dioxide and zinc oxide. These agents are the near ideal sunscreen as they are chemically inert, safe, and protect against the full UV spectrum. Their only drawback is their poor cosmetic appearance when applied to the skin. By decreasing the particle size, microsized or ultrafine grades have been developed, thereby reducing the whitening appearance. In some products, bright fluorescent colours have been added.

What is SPF?

SPF stands for Sun Protection Factor and is the system used worldwide to determine how much protection a sunscreen provides, applied to the skin at a thickness of 2 mg/cm². The test works out how much UV radiation (mostly UVB) it takes to cause a barely detectable sunburn on a given person with and without sunscreen applied. For example, if it takes 10 minutes to burn without a sunscreen and 100 minutes to burn with a sunscreen, then the SPF of that sunscreen is 10 (100/10).

A sunscreen with a SPF of 15 provides >93% protection against UVB. Protection against UVB is increased to 97% with SPF of 30+. The difference between a SPF 15 and a SPF 30 sunscreen may not have a noticeable difference in actual use as the effectiveness of a sunscreen has more to do with how much of it is applied, how often it is applied, whether the person is sweating heavily or being exposed to water. Hence a sunscreen with SPF 15+ should provide adequate protection as long as it is being used correctly. However, most people apply their sunscreen at about one third the thickness used for testing; they fail to apply it to all exposed areas of skin; and they forget to reapply it every couple of hours. Therefore, the actual protection may be a lot less than the tests indicate.

Currently there is no internationally agreed test for measuring UVA protection in human skin. An estimate is made by a laboratory test in which the proportion of radiation passing through a measured amount of sunscreen is determined. To ensure some protection against UVA, products with physical blocking agents making up some of the active ingredients are recommended.

How to use sunscreens

To get the best protection from your sunscreen you should consider the following points:

- Use a good broad-spectrum sunscreen of at least SPF 15 and made up of a benzophenone chemical absorber plus a physical blocker (titanium dioxide or zinc oxide).
- Choose a product that complies with the current Australian and New Zealand [Standard](#) for Sunscreens (AS/NZS2604:1998), or equivalent in other countries.
- Apply sunscreen liberally to all sun-exposed areas so that it forms a film when initially applied. Most people use sunscreens improperly by not applying enough.
- It takes 20–30 minutes for sunscreen to be absorbed by the skin and it can be rubbed off very easily, so apply it at least half an hour before going out in the sun. Reapply after half an hour so that the 'mountains' as well as the 'valleys' are protected (imagine you are painting a wall – two coats of paint provide a more even cover than one).
- Re-apply sunscreen every 2 hours if staying out in the sun for more than an hour during the day.
- Re-apply immediately after swimming, excessive sweating, or if rubbed off by clothing or toweling. This should be the case even if the product claims to be "water resistant".
- Insect repellents reduce the sunscreen's SPF so when using together, use a sunscreen with a higher SPF and re-apply more often.

Alcohol-based lotions, sprays or gels are better for oily or hairy skin. Creams are suitable for dry skin, and milky lotions are the easiest to apply. Special sticks are suitable for noses, lips and around the eyes.

Rashes from sunscreens

Unfortunately, some people find that sunscreens irritate, and others develop [dermatitis](#) where they have applied them.

Sometimes this is because of generally sensitive skin ([irritant contact dermatitis](#)), at other times because of an [allergic reaction](#) to one of its components: this may be a [fragrance](#), a preservative or a sunscreen chemical.

The cause can be difficult to work out, so if simply changing the brand doesn't solve the problem, ask your [dermatologist](#) for advice. He or she may organise [patch tests](#). Be careful to test a new product on a small area for a day or two before applying it widely.

Photoallergic contact dermatitis to sunscreen



Related information

- Edlich RF, Winters KL, Lim HW et al. Photoprotection by sunscreens with topical antioxidants and systemic antioxidants to reduce sun exposure. Journal of Long-Term effects of Medical Implants 2004;14(4):317-340. [Medline](#).

References:

On DermNet NZ:

- [Sun protection](#)
- [Sun protective clothing](#)
- [Which sunscreen should I use?](#)

Other websites:

- [Australian Photobiology Testing Facility](#)
- [Sunscreens and photoprotection](#)

Books about skin diseases:

See the [DermNet NZ bookstore](#)

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DermNet does not provide an on-line consultation service.

If you have any concerns with your skin or its treatment, see a [dermatologist](#) for advice.

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