PHYSIK

A Sunscreen Primer

Physik

Simplicity in the service of performance. At Physik, this principle underlies everything we do. Our skin care and other topical products for active people blend cutting-edge science with the art of formulation. We use only the essential ingredients, ensuring each one is integral to achieving unparalleled results.

Introduction

Skin cancer is a worldwide public health problem, with more than 9,500 people diagnosed with skin cancer every day in the United States alone *(Gruber and Zito, 2022).* It is significant that the vast majority of such cases can be prevented simply by reducing the population's exposure to Ultraviolet Radiation (UVR). Additionally, there is virtually no dispute that the majority of changes to our skin as we age are due to sun exposure.

To be clear, there are a lot of good reasons to make sure we get some, but not excessive, sun exposure. Numerous studies have shown the positive impact sun exposure can have on our mood and circadian rhythm regulation. Importantly, these effects result from blue light exposure, not ultraviolet, the component of sunlight sunscreens block. Emerging evidence also suggests that low levels of UVR exposure may be beneficial for cardiovascular health *(Hazell, 2023*), but the exposure requirements are so low that even daily sunscreen use is unlikely to inhibit. Another benefit of sun exposure is vitamin D synthesis. This, unlike the mental health benefits, is a result of UVR exposure and it has been proposed that sunscreen use could theoretically reduce vitamin D levels. However, in real world use this does not seem to be the case *(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6899926/).* So, while getting outside is important, a sensible approach could include proper clothing, hats, sunglasses, sun-avoidance at peak hours between 10 am and 4 pm and the use of effective sunscreens. Of course, this is different for those with a history of skin cancer, a family history of skin cancer or other sunlight related issues where avoidance and protective clothing are much more emphasized (*https://www.cancer.net/cancer-types/melanoma/risk-factors-and-prevention)*.

What is an effective sunscreen? That definition has changed over the past few decades as our knowledge of the biologic effects of sunlight has advanced. Regulations governing the labeling and formulation of sunscreens have only recently incorporated much of this new understanding but there are still many misconceptions. Thus, it is the responsibility of not only health care providers and concerned manufacturers of personal care products, but also consumers themselves to ensure that the best information and products are available.

Microfine zinc oxide is an ideal sunscreen ingredient. It is safe, effective, photostable and cosmetically superior. It is the only single ingredient that uniformly blocks both UVB and UVA including the long UVA that has now been implicated in both photoaging and photocarcinogenesis.

The purpose of this primer is to provide a basic understanding of sunscreens for health care professionals and concerned consumers. Included is a description of the Ultraviolet Radiation spectrum, an explanation of the SPF (Sun Protection Factor) system, a brief discussion of the sun's effect on human skin, and a short history of sunscreens and their US regulation. This information provides the foundation necessary to appreciate fully the human health benefits of microfine zinc oxide used as a sunscreen.

Ultraviolet Radiation (UVR)

The solar spectrum, the range of light emitted by the sun, is divided name into ranges defined by wavelengths *(see Figure 1)*. UVR covers from 200 nanometers (nm) to 400 nm. UVR is, in turn, divided into UVC (200–290 nm), UVB (290–320 nm) and UVA (320–400 nm). UVA is further categorized as UVA I (340–400 nm) and UVA II (320–340 nm), also called long and short UVA respectively. UVR is generally credited with most of the biologically significant negative consequences of sun exposure like visible skin aging and skin cancer.

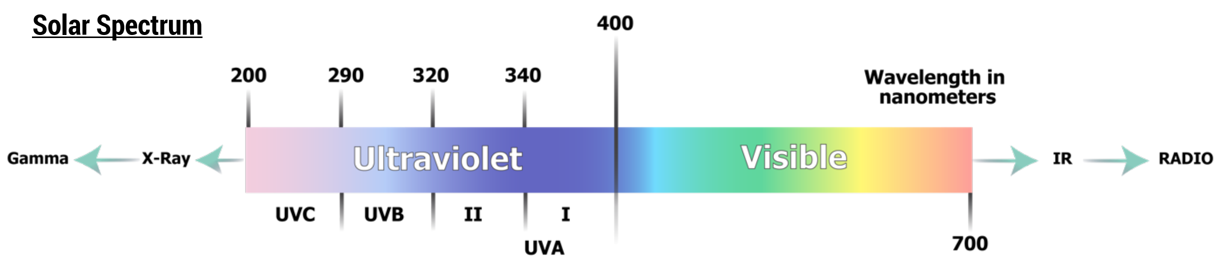

Figure 1

UVC, also known as Germicidal UV, is very toxic. As it implies, it is lethal to many microorganisms as well as to most plant life. In addition, it damages DNA which is still generally recognized as the primary mechanism for producing various cancers in humans. Fortunately, virtually all UVC is filtered out by the ozone layer *(see Figure 2)*.

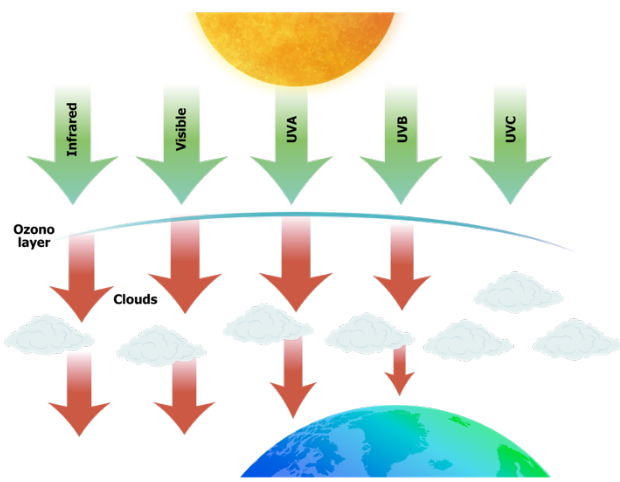

Figure 2

UVB makes up about 18% of the solar UV spectrum1 (prior to attenuation by the earth's atmosphere) but only about 1% of the UVR that reaches to the earth's surface. Like UVC, it is largely filtered out by the ozone layer. Despite its relatively low presence however, UVB is associated with much of the damage caused to humans by sun exposure. Traditionally, UVB was credited as the sole cause of sunburn and various skin cancers. Although still considered a major cause of skin cancers, UVB is no longer thought to be the only culprit.

UVA makes up about 75% of the solar UV spectrum but about 99% of the terrestrial spectrum, the sun's UVR that makes it the earth's surface. This is because UVA is largely unaffected by the ozone layer. Much more abundant, UVA is also much less energetic than UVB and thus was thought to be biologically less significant. However, a large body of evidence over the past two decades has now shown that UVA is also involved in cancer formation, and perhaps, in some cases, even as the primary cause.

Additionally, we now know that UVA is certainly a causative factor in photoaging, the wrinkling, thinning and discoloration that happens to our skin as we age. Though the specific UVA wavelengths (action spectrum) remain to be determined, UVA is also the portion of the UV spectrum most often associated with photosensitivities resulting from drugs or disease. It is only prudent that any product claiming sun protection attenuate both the short and long UVA. To do otherwise, places the consumer at a significant and unnecessary risk.

Visible Light

Visible light is a small but significant portion of the solar spectrum, constituting about 400 to 750 nanometers in wavelength. It accounts for approximately 43% to 44% of the total solar radiation reaching the Earth's surface and is what humans see. Interestingly, many other animals can see UVR and even IR, but not us.

The biological effects of visible light are crucial. For example, exposure to natural light during the day helps regulate the human circadian rhythm, which is essential for maintaining a healthy sleep-wake cycle. Moreover, visible light influences the production of important hormones like melatonin and serotonin in the body.

Of course, visible light is fundamental to photosynthesis, the primary energy source in plants, converting carbon dioxide and water into oxygen and glucose which sustains the rest of life on earth.

Infrared Radiation (IR)

In descending wavelength order IR (>700 nm) follows visible light (400–700 nm) which follows UVR (200–400 nm) with respect to energy and damage to human skin. We are most concerned with the near IR from about 700 nm to 1800 nm. IR is currently considered to be only a minor factor in skin damage. It is thought to potentiate the damage caused by UVR and can, almost by itself, cause at least one human skin disease, erythema abigne.

Ozone

The ozone layer is located about 20 to 60 km above the earth. Ozone, three oxygens bound together ($O3$), is formed when ultraviolet radiation causes $O2$ to breakdown into single O molecules which then combines with $O2$ in the air forming $O3$ in the first steps in the Chapman Cycle by which ozone is continually regenerated in Earth's stratosphere.

The density of the ozone layer varies according to location and time of year. There is, for instance, generally more ozone as you move away from the tropics and more in the winter and spring than in the fall and summer. A notable exception to this is the much publicized "ozone hole" over Antarctica. The ozone layer filters out virtually all UVC and much of the UVB, but has relatively little effect on UVA. It is estimated that a 1% decrease in the ozone concentration could increase the incidence of skin cancer by as much as 2 to 4%.

Unfortunately, the ozone layer is delicate and the use of chlorofluorocarbons (CFCs) has severely damaged it. CFCs are used as, among other things, refrigerants and aerosol propellants. Once released, CFCs take about seven years to reach and damage the ozone layer. The average CFC "life span" is about 100 years which means that even after their use ceases, they will be disturbing the ozone layer for a long time to come. On the bright side, CFC emissions began decreasing drastically decades ago. This is mostly due to the "Montreal Protocol"— a treaty ratified in 1987 by most of the industrialized nations that called for a 50% reduction in CFC production from 1986 levels.

Environmental Factors

Of course, the environment beneath the ozone layer also affects UVR. For instance, particulates (air pollution) will scatter UVR preventing it from reaching the earth. UVR intensity is greatest during the hours between 10:00 a.m. and 4:00 p.m. Elevation is also important. Every 1000-foot increase in altitude brings with it a 4% increase in short wavelength UVB exposure. Many surfaces, including snow and sand, are efficient reflectors of UVR. Snow, for instance, can reflect as much as 85% of the incident UVR making it especially important that skiers wear sunscreen.

Clouds and fog scatter longer wavelengths more efficiently than shorter wavelengths. Thus, IR is effectively blocked by clouds but substantial amounts of UVR, especially UVB, pass through. This is why it is still possible to be sunburned on an overcast day.

UVR intensity also varies with the season. UVR increases in the summer months and decreases in the winter. This is due to the lower angle of contact between the earth and the sun's radiation during the winter months (*see Figure 3*). During the summer, when the sun is more directly overhead with a greater contact angle, the UVR has a shorter path to the earth's surface. The longer wintertime path gives the atmosphere a greater opportunity to attenuate some of the energy. Seasonal fluctuations in the ozone layer also affect UVR intensity. Because UVB is more affected by this change in path-length, it varies more than UVA with seasonal changes.

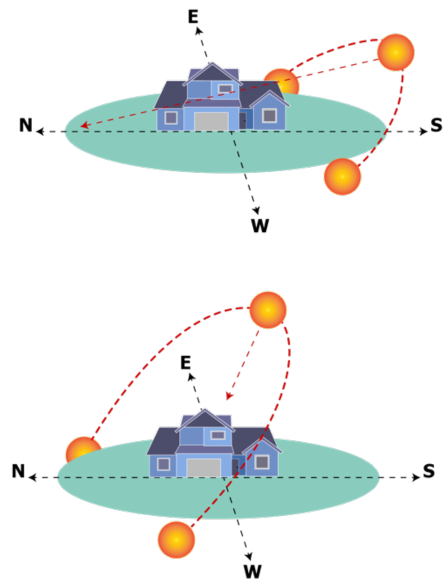

Figure 3

In addition to the sun, there are some man- made sources of UV exposure. They include welding arcs, germicidal lamps, laboratory equipment and popular, but very dangerous, tanning lamps which are known to cause cancer according to the US Department of Health and Human Services *(https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc).*

SPF (Sun Protection Factor)

The SPF system was first adopted in the US in 1978 and the regulations were essentially settled on in 2011 but, as of this writing in early 2024, are still not finalized. To establish an SPF, the MED (minimal erythemal dose) is first determined for each of a panel of human test subjects. This is the amount of solar-simulated full spectrum UVR needed to produce a barely perceptible erythema (redness) in subjects examined 24 hours after UVR exposure. Radiation for determination of SPF is administered using a solar simulator. Experienced testing labs can accurately estimate the amount of energy needed for a given skin type and thus "burning" of the test subjects is avoided. The next day, a standard amount of test sunscreen (2mg /cm2) is applied to a different area and that skin is exposed to incrementally increasing amounts of solar simulated radiation depending on the determined MED and the estimated SPF of the sunscreen. Test subjects are then evaluated 24 hours later and the MED is determined for the sunscreen protected skin. The FDA requires testing on at least 10 subjects prior to marketing a sunscreen. The ratio of the MED (sunscreen present) to the MED (no sunscreen) is the SPF. So, for instance, if it takes five times as much radiation to cause redness on the sunscreen treated site as it did on the untreated site, then the SPF of that product is 5. The relationship between SPF and percentage of sunburn-causing UVR blocked is plotted in figure 4.4 From the graph. One can see why an SPF 15 is often regarded as sufficient since it blocks the vast majority of the incident radiation. Nonetheless, the American Academy of Dermatology recommends a minimum SPF of 30 based on concerns that consumers do not apply enough product and therefore label SPF is not achieved.

The SPF number tells the consumer how long it will take them to burn with, as compared to without, a sunscreen. This, of course, assumes that the sunscreen stays on long enough to do its job. As an example, an SPF 15 applied to an individual who would normally burn in 20 minutes will provide protection for roughly 300 minutes, or five hours (SPF 15 x 20 minutes = 300 minutes).

SPF numbers do vary some around the world because of differences in test methods and light sources. In general, however, they agree and consumers should feel comfortable purchasing sunscreens while abroad.

UVA Protection

There are some subtle yet important limitations to the SPF system. The SPF test uses erythema, redness, as its endpoint. Because erythema is predominately a response to UVB and short wavelength UVA (a.k.a. UVAII), the SPF number reveals very little about the amount of total UVA protection a sunscreen provides. It is possible, for instance, to have low and moderate SPF (SPF<15) products that provide virtually no long wavelength UVA protection. As the SPF increase, some UVA II (320 to 340 nm) protection is required because, at high enough doses, UVA II itself can cause erythema. Importantly, UVA I (340 to 400 nm) will not cause erythema under normal circumstances and therefore is not reflected at all in the SPF test.

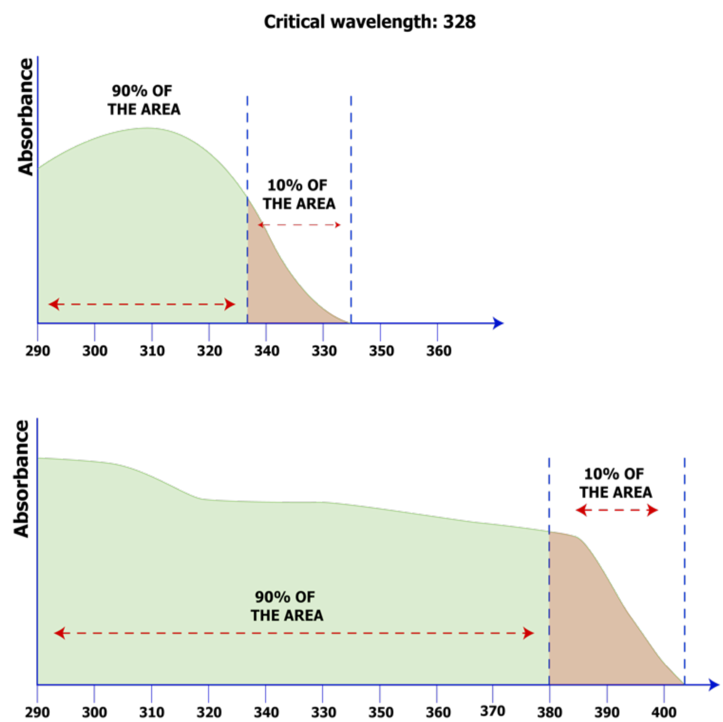

Figure 4

In reality, most commercially available sunscreens in the US provide UVA II coverage but fewer provide enough UVA I protection. Only those containing zinc oxide, titanium dioxide or avobenzone afford true broad spectrum UVA coverage and only zinc oxide and avobenzone can do so transparently. Sunscreens that block enough UVA relative to UVB are labeled Broad Spectrum. To be labeled Broad Spectrum a sunscreen needs a critical wavelength of at least 370 nm. The critical wavelength (λc) of a sunscreen is the wavelength at which 90% of the area under the absorbance curve resides. Put simply, the critical wavelength insures that, relative to UVB, a sunscreen blocks enough UVA to provide protection to consumers (*see Figure 4*).

SPF (Sun Protection Factor)

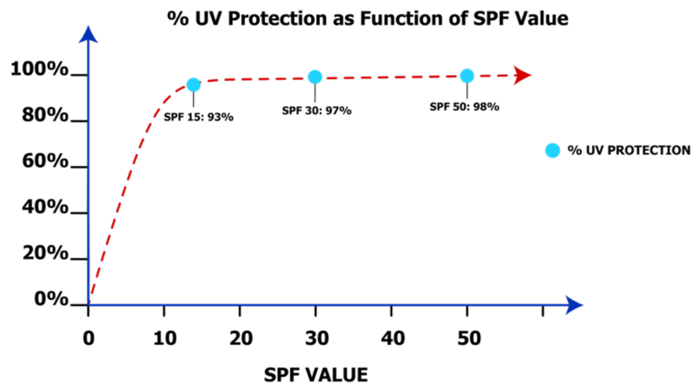

Figure 5

The SPF system tells users what percentage of UVR the sunscreen screens *(see Figure 5)*. The efficacy of a given sunscreen formula depends on proper application. All sunscreens, regardless of the ingredients, must be applied prior to exposure if they are to be maximally effective. For example, an SPF 15 applied to a person who would normally burn in 20 minutes will allow that individual 300 minutes of exposure before they burn. If that person exposed themselves to the sun for 10 minutes before applying the sunscreen then he/she would have already received 50% of their MED. Moreover, such suberythemal exposures are known to have detrimental effects on the skin *(Seite et al., 2010, Lavker et al., 1995)*. That SPF 15 sunscreen would now only provide another 150 minutes of protection instead of the 300 minutes it would have. In other words, the "safe" exposure time was reduced from 5 hours (300 minutes) to 2.5 hours (150 minutes) simply because sunscreen product was applied 10 minutes after sun exposure! Whether or not any sunscreen can survive real use (swimming, sweating, towels, sand…) for five hours is itself debatable. Hence, the almost universal recommendation is that sunscreens be applied liberally and often. More frequent application is advised if swimming or engaging in strenuous physical activity.

…an average tube should last one adult one full day at the beach. We can safely say that very few people apply this much sunscreen.

The amount of sunscreen applied during SPF testing is 2 mg/cm2. This equates to approximately one ounce for a single full adult body application if wearing a swimming suit. Most sunscreen tubes contain only 3 to 5 ounces; thus, an average tube should last one adult one full day at the beach. We can safely say that very few people apply this much sunscreen. It is crucial that consumers be educated on this point.

In addition to the SPF, a "waterproof" claim is often made for sunscreen products. In the 1993 Proposed Rule Making (see Sunscreen History, above) the FDA eliminated the term "waterproof" although some products still use it. The FDA now requires using the terms "water resistant" for water-resistant claims of either 40 or 80 minutes, depending on how long it was tested for.

How UVR Damages the Skin

Sun exposure causes both acute and chronic effects. The acute effects include sunburn, tanning and photosensitivity (photoallergy and phototoxicity/photoirritation) reactions. Sunburn is erythema that becomes obvious soon after UVR exposure and reaches a maximum at 24 to 36 hours after exposure. It usually resolves in 3 to 5 days. On a cellular level, sunburn is marked by intracellular edema, vacuolization and swelling of the melanocytes, and the development of "sunburn cells". These are characteristic keratinocytes with shrunken abnormal nuclei that result primarily from UVB/UVA II exposure. Sunburn is also typified by interstitial edema and other inflammatory responses. Importantly there is a distinct decrease in the number of Langerhans cells and an increase in suppressor T cells following UVR exposure, both of which are signs of a suppressed immune system.

Tanning is divided into two types—immediate and delayed. Immediate tanning is also referred to as Immediate Pigment Darkening (IPD) and results from the photo-oxidation of existing melanin, the brown pigment in our skin. It is a transient UVA response.

Delayed tanning, referred to as Persistent Pigment Darkening (PPD), results from increased melanin production and distribution within the epidermis. The public associates PPD response with sun exposure and is largely unaware of IPD. Both IPD and PPD can be viewed simply as markers for exposure since they do not represent a biological sequel associated with skin damage, i.e., neither IPD nor PPD is associated with a known biological consequence such as DNA damage or cancer. To put this another way, a tan in and of itself is not known to be harmful but getting enough UVR to cause a tan means other bad things likely happened.

Chronic effects of sun exposure include photoaging and photocarcinogenesis, cancer caused by sunlight. Photoaging is thought to occur mostly as a result of chronic UVR (UVB + UVA) exposure. It's estimated that 90% of the visible changes we associate with aging are actually the result of sun exposure. Recent evidence suggests that the action spectrum for photoaging includes the far UVA region (340 nm to 400 nm). Most sunscreen actives (see Sunscreen Chemicals, below) do not effectively block far UVA radiation—microfine zinc oxide does.

…a sunscreen needs to proportionately block to 370 nm (long UVA) to make a UVA claim. Micro- fine zinc oxide meets and exceeds this requirement.

Photocarcinogenesis, or light induced cancer formation, quite likely results via several mechanisms. UVR has been shown directly to cause DNA damage including thymine dimer formation. UVR, especially UVA, also provides reactive oxygen species which are capable of causing DNA lesions. The exact wavelengths responsible for these various phenomena are not yet well defined. For this reason alone, it seems prudent that, when sun exposed, we use sunscreens with the broadest protection available.

Phototoxic/photoirritation reactions account for the majority of photosensitivity disorders. Here, light directly harms the skin. Either this occurs through specific damage to macromolecules such as DNA or by light induced formation of toxic photoproducts which, in turn, damage the skin. The photo- products can result from topically applied compounds or substances that are first ingested before migrating to the skin where they interact with ambient light.

There are also a number of very significant diseases, the Photodermatoses, that render those afflicted very sensitive to sun exposure. These include Polymorphous Light Eruption, the Porphyrias, Solar Urticaria, Chronic Actinic Dermatitis, Persistent Light Reaction, Lupus Erythematosus, Xeroderma Pigmentosum, and Albinism. A discussion of each of these is well beyond the scope of this review. It is hoped, however, that new and effective sunscreens can allow those afflicted with these diseases to lead more pleasant lives.

Sunscreen History and Regulation

The first reported use of sunscreens in the United States was in 1928, soon after appearing in Australia and then in France. PABA (p-aminobenzoic acid) was patented in 1943 and, for a long time, was the major active sunscreen ingredient used. Currently there are dozens of active sunscreen ingredients available around the world, although only a handful are used with any frequency *(Wang et al., 2013)*.

In the US, sunscreens were designated as drugs very early when, in 1940, the FDA stated that “Articles that refer to sunburn or any other disease state are drugs…” That same FDA correspondence also stated that “…articles which are represented exclusively for the production of an even tan will be regarded as cosmetics under section 201(I).” Evidently, in 1940, tanning was considered to be a benign event, something we now know to be incorrect. Importantly, while FDA designates sunscreen products as drugs, only 1 in 10 adults in the US consider them as such *(Norman et al., 2023)*.

For the next 38 years, very little happened on the regulatory front. Then, in 1978, the FDA published the Advanced Notice of Proposed Rule Making for OTC Drug Sunscreen Products. This document listed, among many other things, the names of allowed active sunscreen ingredients and described the SPF method for testing consumer sunscreen products. One purpose of the document was to elicit comment from the public and from industry regarding the proposed rules.

The next major FDA publication on the subject, the Notice of Proposed Rule Making for OTC Drug Sunscreen Products, came in 1993. This document incorporated many changes based on submitted comments and the scientific advancements that had occurred since the 1978 notice. Among the changes, it expanded the definition of a sunscreen to include virtually any product that implied it was protecting the skin from sun damage. This placed “tanning” products under the same scrutiny as sunburn prevention products. The 1993 notice also contained the FDA's proposed stipulation that a sunscreen will need to block to at least 360nm (long UVA) in order to make a UVA claim.

Micro- fine zinc oxide's attenuation spectrum meets and exceeds this requirement. No new ingredients were added to the list of Category I (safe and effective) sunscreen ingredients in 1993, and several were either eliminated or restricted in their use. Remedying a prior oversight, zinc oxide was added as a Category III ingredient which meant that it could be used and labeled as an active while the FDA was awaiting more efficacy data. Interestingly, zinc oxide has always been accepted as a sunscreen in virtually every other country.

sunSmart, a company founded by Physik's owners, and other concerned companies, submitted data to the FDA on zinc oxide as both a UVA and a UVB sunscreen. In December 1996, the FDA reacted favorably to the data and published the rules for using zinc oxide as a sunscreen. As expected, zinc oxide was recognized as safe and effective and allowed in combination with all other Category I sunscreens. In addition, it was accepted as both a UVA and a UVB sunscreen. With an unequaled history of safe use, zinc oxide is today the only active sunscreen ingredient also recognized as a therapeutic Category I skin protectant. A year later, in May 1997, the FDA cleared the use of avobenzone (an organic chemical UVA sunscreen) at concentrations of 2 to 3% for use with some, but not all, other sunscreens.

The final monograph for OTC sunscreens was published in 2011. One controversial point that was clarified in the 2011 publication was how UVA protection was measured. Prior to that, “broad spectrum” claims were being made for sunscreens providing what we now know to be less than optimal UVA coverage. For instance, many products claimed UVA protection based on oxybenzone which only effectively attenuates the short UVA (<340 nanometers) and leaves the user exposed to those wavelengths longer than 340 nm.

As of 2023, zinc oxide is one of two sunscreen active ingredients considered Generally Recognized as Safe and Effective (GRASE) by the FDA. Other common sunscreen agents are awaiting additional data before being considered for GRASE status.

Figure 6 shows the absorption curves of a typical OTC organic based sunscreen (uses benzophenone 3 a.k.a. oxybenzone as the UVA sunscreen) vs. that of a pure microfine zinc oxide-based screen.11

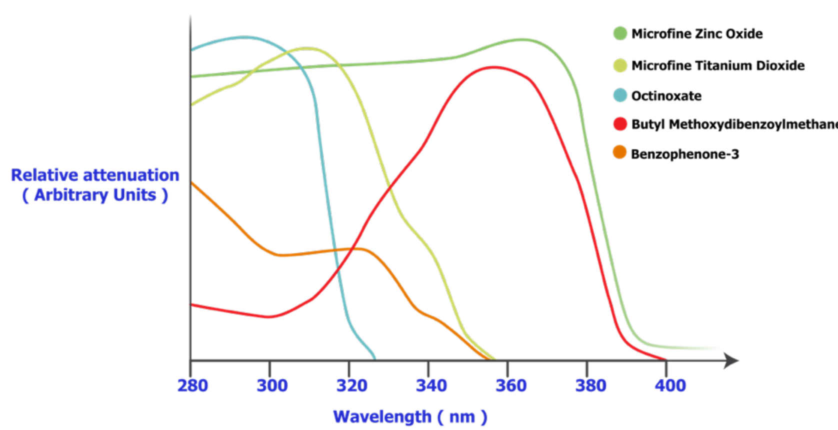

Figure 6

Sunscreen Chemicals

There are two types of sunscreen agents: organic sunscreens and inorganic sun- screens. The organic sunscreens are also referred to as soluble or "chemical" sunscreens. The inorganic sunscreens are also known as physical, mineral, insoluble, natural or "non-chemical." The term "non-chemical" is obviously misused in this case because every substance is a chemical but the term has nonetheless gained some industry acceptance.

Organic sunscreens have been the mainstay of sunscreen formulation for decades. Despite this long history of use, they have recently come under increased scrutiny with respect to human and environmental safety/toxicity. At least some of them are known to be systemically absorbed and questions have been raised as to the long-term effects of this. Just how warranted these concerns are is not yet clear.

In the last 15 years the inorganic sunscreens have come to be used more frequently. The popularity of the inorganic screens stems from their lack of toxicity and their effectiveness, especially that of zinc oxide, in attenuating UVA. With the advent of fine particle zinc oxide, its popularity has soared because it can now be used in more aesthetically pleasing formulations.

Organic sunscreens can be classified generally as derivatives of the following: anthranilates, benzophenones, cinnamates, dibenzoylmethanes, camphors, p-aminobenzoates, and salicylates. These chemicals are very efficient UVB absorbers (*see Figure 6*) but only a few provide any UVA protection. The benzophenones (discussed above) and avobenzone are the two organic screens with the most UVA activity.

The inorganic blocks are insoluble particulates. They generally provide broad spectrum protection and can be applied without any adverse reactions. They work by both absorbing and scattering UVR.

The two most common particulate sunscreens are zinc oxide and titanium dioxide. Although both are metal oxides, they have different optical properties, especially when in microfine form. As seen in figure 6, microfine zinc oxide provides protection far out into the UVA spectrum. It attenuates to about 380 nm whereas microfine titanium dioxide attenuates out to about 350 nm. Larger particle titanium dioxide will block a greater portion of the far UVA than microfine titanium dioxide. Unfortunately, larger particle titanium dioxide is also very white, making it cosmetically unacceptable. The broad attenuation band of zinc oxide is very important given the growing body of evidence supporting the far UVA as a contributing factor in both photoaging and photocarcinogenesis.

Microfine Zinc Oxide

Zinc oxide has an unparalleled 300-year history of safe use on all types of skin, first as a component of Calamine and then on its own in various preparations. In fact, zinc oxide is the only sunscreen active that is also an FDA recognized Skin Protectant. Today, zinc oxide is still widely used as a topical therapeutic. It may be the most commonly used topically applied compound of all time. An estimated 5,000,000 pounds per year are used on people in the US alone without incident.

In the "Pharmacopea Londinesis" published in 1681 for the London College of Physicians, lapis Calaminaris is mentioned as a component in three of 42 therapeutic ointments. Zinc oxide is also mentioned, as a component of calamine, in the U.S. Dispensary of 1883.

Prior to the invention of zinc oxide in microfine form, it was produced with particle sizes ranging from 1 micron to several hundred microns. Referred to as pigmentary grade, this zinc oxide is rough in texture and tends to thicken formulations. Pigmentary zinc oxide scatters light very efficiently making it very white and unsuitable for daily wear products such as sunscreens, moisturizers, and makeup. Thus, pigmentary zinc oxide has received relatively little use because of its aesthetic limitations. In addition, larger particle zinc oxide is an inefficient UVR screen compared to the microfine form.

Microfine zinc oxide has an average particle size of less than a micron. Because of this, it scatters light poorly, is inherently "transparent" when applied to the skin, and is an excellent ultraviolet (UVA, UVB and UVC) block. This allows its incorporation into virtually all topically applied products including sunscreens and other daily wear formulations. Microfine zinc oxide can be used alone or in combination with other sunscreens. Often, to get the most visually appealing and elegant formulations, microfine zinc oxide is combined with the better-known organic sunscreens.

Summary

In summary, by incorporating sun protection measures into daily routines, individuals not only reduce their risk of skin cancer and premature aging but also promote overall skin health. When using a sunscreen, make sure to apply it before you go out, its broad spectrum, preferably contains zinc oxide and is appropriate for your given activity, i.e. water resistant if swimming. These simple yet effective strategies are a long-term investment in one's well-being, emphasizing the importance of being sun-smart for a healthier future.

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