Sun Protection Technology

Ultraviolet Radiation

Ultraviolet radiation is not visible, but it affects all living things. Ultraviolet radiation is broken into three groups:

UVA (320-400 nm)
UVB (280-320 nm)
UVC (200-280 nm)

The shorter the wavelength is, the higher the energy of the energy of the wave. Shorter wavelengths are, typically, more damaging to the skin; however, longer wavelengths penetrate deeper into the skin. The shortest rays are **UVC** rays. These rays are filtered by ozone in the atmosphere, so they are of no danger. When you spend time in the sun, you are exposed to **UVA** and **UVB** rays.

UVB rays affect the upper layers of the skin. The body produces melanin to protect skin cells from UVB rays. Over-exposure to UVB rays result in sunburn. UVB rays are vital to the body by aiding in forming Vitamin D3.

UVA rays are the deepest penetrating UV radiation. Their longer waves penetrate deeper into the skin than the other types of UV radiation and break down elastin and collagen within the skin. Over-exposure to UVA rays can result in wrinkling, spotting and, in the worst case, melanoma or skin cancer. The dangers of UVA rays are only just now becoming known.

Sun Protection Factor (SPF) Ratings

"Sun Protector Factor" is a number that indicates the amount of protection offered by a sun protection product. The SPF measures the effectiveness of a product at blocking UVB rays. In order to know how long you can stay in the sun, with a specific SPF, you must know your Medical Erythmal Dose (MED).

To determine your MED, you must first find out how long it takes for your exposed skin to start to "pinken." This test is to be performed at noon, when the sun is directly overhead. Let's presume that it takes 15 minutes in the sun, at noon time, to notice a perceptible "pinkening" when you touch your skin: then your MED is 15 minutes. If you apply a sunscreen with an SPF of 10, this product should protect you 10 times your MED (15) = 150 minutes or 2-1/2 hours. If you stay longer in the sun, you will begin to burn.

SPF is a percentage of the sun's UVB rays that are blocked. The equation is as follows:

SPF rating-1 = % of sun's rays blocked
SPF rating

Example:	SPF 15	15-1 / 15 =	93.3% of rays block	
	SPF 5		80%	
	SPF 10		90%	+10%
	SPF 15		93.3%	+ 1.3%
	SPF 23		95.6%	+ 2.3%
	SPF 33		96.9%	+1.3%
	SPF 36		97.2%	+ 0.3%
	SPF 45		97.7%	+ 0.5%

As the SPF rating rises, the percent of the sun's rays blocked does not increase incrementally. This is one of the biggest misunderstandings about sunblock. The customer perceives a big protection difference between SPF 33 and SPF 45. In reality, the SPF 45 only block 0.5% more of the sun's rays.

Water Resistant Testing Procedures

The FDA has established a testing procedure to determine the level of water resistant protection offered by sunblock. The "test procedure" is performed on humans who elected to participate in this procedure. First, the SPF of the product is testing "static" – on the skin but not in water. Then the subject's exposed skin is submerged in a whirlpool tank of tepid water for 40 minutes. The exposed skin is then tested to determine the amount of SPF protection remaining. If the "static" reading is SPF 17 and the rating, after 40 minutes, was 16.5, then one could claim an SPF 16 "water resistant." The testing can be continued, in the whirlpool, for an additional 40 minutes, and the last reading is made. Now, if the SPF is 15.1, the product could be labeled SPF 15, "very water resistant."

FDA Regulations

It should be noted that the FDA has issued a "Final Monograph," which spells out what claims can and cannot be made. These new guidelines were to come into effect in December, 2002. Instead, the FDA has put off a final decision on finalizing the Monograph. The testing procedures for UVA are still in limbo.

Sunscreen Active Ingredients

Sunscreen active ingredients are separated into two groups, depending upon their chemical type. Inorganic blockers stay on the surface of the skin and work by "physically" blocking the sun's rays. Organic sunscreens work, primarily, by absorbing UV radiation and releasing it as energy, before it penetrates the skin.

Inorganic Sunscreens

Zinc Oxide

A particulate inorganic sunscreen; it is a UVA/UVB blocker. Zinc Oxide has been used for hundreds of years to soothe and protect the skin. The FDA classifies it as a skin protectant. Z-Cote is a micro-fine form of zinc oxide, which becomes transparent when rubbed into the skin. Z-Cote is becoming the standard for inorganic UVA protection.

Titanium Dioxide

An inorganic sunscreen; it is an effective UVC screen. When applied, it will leave the skin a light grayish tint.

CHEMICAL BLOCKERS

Additive	Blocks UVA	Blocks UVB	Comments
Padimade O		yes	
Octyl Medhoxycinnamate	yes		
Cinnoxate		yes	
Octocrylene		yes	
Ectocrylene		yes	
Methylanthranilate	yes	yes	Weak absorber
Oxybenzone	yes	yes	
Dioxybenzone	yes	yes	
Sulisobenzone	yes	yes	Water soluble
Octyl Salicylate		yes	
Triethanolamine Salicylate		yes	Water soluble
Homosalicylate		yes	
Avobenzone	yes		Strong UVA
Tert-Butylmethoxydibenzoylmethane	yes		Strong UVA, not allowed in the USA
4-isopropyldebenzoylmethane	yes		Strong UVA, not allowed in the USA
Ensulizole		yes	Water soluble