

SPF: SUN PROTECTION FACTS OR FICTIONS?

YOU CAN'T BELIEVE everything you read. Until recently, information on sun protection has generally made its way from the top down, passing from industry and academia



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to the consumer via traditional media. Experts with credentials relayed skin care news to a receptive and silent audience. Any debate over sunscreen issues once engaged corporate interests and scientific inquiry in a dialogue between professionals. Things have changed; newcomers have joined the conversation. In today's information age, any individual can freely comment on any sunscreen topic and promote his concerns. Blogging has given voice to

an unheard consumer with such a force as to weigh the online discussion toward the participants with the most internet savvy rather than priv-

ileging those with the most accurate information. With the increased online banter, legitimate warnings must be issued regarding the validity of information on the web. The popularity of blogs has reportedly grown to 112 million blogs as of December 2007, according to Technorati.com. This month, *The Sunscreen Filter* proposes to do just that: filter the sunscreen facts from the fiction.

I get Google alerts every single day and the citations concerning sunscreens, UVA/UVB, photostability and regulations of sunscreens and ultraviolet filters are overwhelming. Clearly, the majority of these citations are not new scientific discoveries; rather they are blogs or newspaper articles commenting on a few reports and studies on the topic. Below are the main issues that have surfaced recently concerning sunscreens and ultraviolet filters:

- The FDA's Final Monograph's Proposed Rule (August 2007);
- The industry's response to the FDA's Proposed Rule (January 2008);
- An Italian study on the effect of sunscreens on coral reefs (April 2008);
- The use of controversial terms such as "natural sunscreens," "organic sunscreens," "chemical vs. physical sunscreens," and "chemical-free;"
- A CDC study on benzophenone-3 (March 2008) and an Environmental Working Group report on sunscreen safety and efficacy (June 2007);
- The Vitamin D controversy;
- Controversy over the use of the AAD seal to promote sunscreen products (February 2008);
- A report on SPF boosters, triplet-triplet quenchers and photostability of Avobenzone (October 2007);
- Litigations in the industry;
- Nanotechnology; and
- Tanning salons.

When it comes to these and other

issues, facts must be separated from fiction and information from misinformation. These issues have received an unprecedented amount of attention on the Internet, in newspapers, and during television programs. Here's a closer look at some of these controversial issues.

Sunscreens and Coral Reefs

Let us begin with headlines ripped straight from the blogs. These include:

- Scientists discover what's destroying fragile coral reefs: Tourist sunscreens;¹
- Oceans under siege: Sunscreens add to toll on reefs;²
- Coral takes a hit from sunscreen;³
- Coral reefs and Coppertone don't mix;⁴
- Swimmers' sunscreen killing off coral;⁵

The actual study prompting these statements was done by Dr. Roberto Danovaro et al. of the Polytechnic University of the Marche in Ancona, Italy⁶ and was supported by the European Union Commission. The amount of publicity that this paper has received is phenomenal.

The study looked at seven common sunscreen ingredients, butyl paraben, octyl methoxy cinnamate (octinoxate), benzophenone-3, methyl benzylidene camphor, octyl salicylate (octisalate), octocrylene and avobenzone. The first four ingredients, they claim, have the ability to awaken dormant viruses in the symbiotic algae called zooxanthellae that live inside reef-building coral species. The ingredients cause the viruses to replicate until their algae hosts explode, spilling viruses into the surrounding seawater, where they can spread out to infect neighboring coral communities. Octocrylene, octyl salicylate (octisalate) and avobenzone

had no bleaching effect on corals. The authors estimate that about 4,000 to 6,000 metric tons of sunscreens wash off of swimmers' bodies annually in oceans around the world.

According to the study, the effect is not dose-dependent. The coral's response to a very small dose of sunscreen is just as dangerous as a high exposure. They estimated that up to 10% of coral reefs are directly threatened by sunscreen-induced bleaching.

They do acknowledge, however, that sunscreens are not the only factor behind declining reefs. The study suggests that action is needed to find UV filters that do not threaten the survival of these endangered species. Interestingly, this paper is being incorrectly cited as evidence that the so-called "chemical" sunscreens should be avoided in favor of "physical" sunscreens.

As a scientist, I want more facts before I critique anyone's research, especially since zooxanthellae, algae and coral reefs are beyond my expertise. However, from reviewing the literature and comments made by others, the following questions and comments about the impact of sunscreens on coral reefs are germane.⁷

Voices of Reason

Terry Hughes, the director of the Australian Research Council, Center of Excellence for Coral Reef studies at James Cook University in Queensland states:

"Any contaminant can experimentally damage a coral under artificially high concentration. The amount in the wild must be tiny due to dilution. Imagine how much water a tourist, wearing one teaspoon of sunscreen, swims through in an hour-long snorkel, compared to threats like global warming, runoff and overfishing. Any impact of sunscreen is unproven and undoubtedly trivial."

Ove Hoegh-Goldberg, a professor

at the faculty of Biological and Chemical Sciences at the University of Queensland, states that Danavaro's research "is stretching the findings and conclusions of this paper to ridiculous extremes—the concept that sunscreens may now be posing a significant risk to marine life are missing the point."

Durwood Dugger, from the University of Florida and the founder of the aquaculture company, Biocept, writes that "the author's conclusions are neither valid or supported scientifically, they are the author's theories." He has a number of valid observations including:

1. The lowest concentration of 10ml per liter is massively higher than is likely to ever occur in ambient sea water in reef areas, considering the enormous dilution factors.

2. There is no large scale sampling from

reefs around the world to determine if sunscreen ingredients can even be detected in those waters.

3. It is simply untrue those chemical compounds contained in sunscreens have been demonstrated to reach detectable levels in both fresh and sea water systems.

4. Separating the effects of sunscreen from other far greater levels of other environmental pollution, or weather-related stress events is not documented or well established in this research.

5. What the researchers do not mention is that many of the same chemicals found in sunscreen are found in many shampoos and body washes. These products are used in many orders of magnitude greater than sunscreens.

According to Dugger, this research promotes the "Peter and the Wolf" syndrome that wears down the public, environmental managers and regulators, keeping them from making scientifically well-informed decisions.

During the past 20 years, coral bleaching has increased dramatically.

Coral reefs are in danger, but there is no proof that sunscreens are to blame.

Possible causes range from temperature change, excess UV radiation, pollution and bacterial pathogens, pesticides, hydrocarbons and other contaminants. This column does not deny that coral reefs are in danger, but puts this research in perspective, critically and scientifically.

Natural, Organic, Chemical-Free

If a sunscreen is labeled "natural" it should have a natural FDA-approved ultraviolet filter. To date, there are no FDA approved natural ultraviolet filters. For consumer products to be labeled "organic" they would have to be made from organically-approved ingredients and certified to the rules and regulations of an official certifying agency. Again, if no "natural" ultraviolet filters are approved in the U.S., then by no means are there "organically certified" sunscreen products. How is it then that companies are selling "natural" sunscreens, "organic sunscreens," and so-called "chemical-free sunscreens" and "physical sunscreens?"

A quick internet search reveals at least a dozen companies that promote such products. They include California Baby, Burt's Bees, Kiss My Face, UV Natural, Sun Shields, Santaverda, Soleo Organics, Alba Botanical, Avalon Organic, Aubrey Organics, Dr. Hauschka, Mexitan, Lavera, Jason Naturals and others. If we review the ingredient listing of some of those products you will note, for example, the following SPF 30 + sunscreen lotion contains:

Active ingredient: titanium dioxide. Other ingredients: aqua (purified water), lysine cocoate (coconut fatty acid), cyclomethicone (water repellent/ silicone), vegetable glycerin (coconut), dipolyhydroxystearate (coconut), candelilla cera (candelilla wax), tocopherol (vitamin E),* cocos nucifera oil (coconut),* squalane (olive oil),* magnesium sulfate (epsom salts), panthenol and allantoin (vitamin B complex factor), magnesium stearate, phospholipid (emollient, coconut source),* polyaminopropyl biguanide (extremely mild antimicrobial; no formaldehyde or formaldehyde donors, non-solvent and non-genotoxic).

The asterisk denotes organic or sustainable.

The immediate problem is the active ingredient. To date, no totally natural titanium or zinc oxide exists, despite the recent efforts of a few companies and entrepreneurs.⁸

Neither titanium dioxide nor zinc oxide can be used in its raw form; rather they are synthesized in order to make them suitable for use in cosmetic formulations. The chemical treatment of the ores followed by micronization to a suitable particle size, coating with aluminum derivatives or silica to reduce the reactivity, pre-dispersion and dispersion in the appropriate carrier or emollient render these products synthetic in character, and negate the “natural” and certainly, the “organically grown” label.

As for “other ingredients,” a review of the product label reveals the presence of synthetic and potentially “non-natural” ingredients such as cyclomethicone, dipoly hydroxy stearate, magnesium stearate and polyaminopropyl biguanide!

The confusion in terms may be a major contributor. For example, “organic” may mean organically grown or simply containing organic (versus inorganic) molecules. In the context of these products, however, the consumer may “naturally” assume the organically grown meaning. “Physical” versus “chemical” filters is a misnomer implying that the physical blockers (i.e. titanium dioxide and zinc oxide) are not chemicals! I have advocated earlier the use of “inorganic particulates” instead of the misleading “physical blockers or filters” precisely to avoid this current confusion in terminology.⁹

In Amy Nut’s article, in *Mauritius Today*,¹⁰ “Are Organic Sunscreens as Effective as Regular Sunscreens?” she writes, “The main difference between an organic sunscreen aside from their ingredients is that organic sun-

screens will break down over time,” she then adds, “you are also not putting inorganic ingredients on your skin. Everything that is inside one bottle of organic sunscreen is just as natural as you.”

Statements such as these are obviously confusing and misleading to the consumer. Solarkat’s Eco blog notes “Some sunscreens contain only a naturally derived source of PABA esters and must contain a combination of PABA and titanium dioxide.”¹¹

Such statements are not only confusing, they are outright incorrect!

Companies are either willingly or inadvertently promoting “natural,” “organic” or “chemical-free” sunscreens, and even some practitioners are per-

petuating these claims by implying that natural and organically grown sunscreens are available on the market and are superior alternatives. The unsuspecting consumer who believes that these products are available and are free from so-called “synthetics” is obviously misled. However, products that contain natural, certified organically grown and botanical ingredients as well as natural antioxidants are available on the market today and play an important role in offering a more “natural” and functional protection from the sun’s harmful rays.

Two Infamous Studies

The literature, especially on the internet, is full of citations and studies on the safety of ultraviolet filters, ingredients and sunscreen products in general. Two studies have been cited repeatedly by thousands of bloggers, newspapers, magazines, environmentalists and others:

1. In June 2007, the EWG studied 910 sunscreen products on the U.S. market and found 84% of them offering inadequate protection,¹² citing the lack of UVA filters or the presence of unstabilized avobenzone, or question-

able product claims about longevity and water resistancy, or possessing questionable ingredients such as benzophenone-3, or octylmethoxy cinnamate (octinoxate) and/or micronized nanoparticles of zinc oxide or titanium dioxide. Yet, the EWG survey was just a compilation of data secured from the literature without independent research or chemical analysis.

2. A Centers for Disease Control (CDC) study on March 21, 2008 reported that benzophenone-3 (oxybenzone) was readily absorbed into the body and detected in 97% of all Americans tested.¹³ Oxybenzone is an extremely popular ultraviolet filter in the U.S. It can absorb both in the UVA (330nm) and the UVB (298nm) regions. Until recently (prior to the approval of avobenzone and Mexoryl SX as UVA filters) oxybenzone was the only game in town for satisfactory UVA protection outside the inorganic particulates (zinc oxide and titanium dioxide).

Safety of Sunscreens

These two studies have been cited repeatedly presumably as evidence that sunscreens are unsafe and that there are no watchdogs or regulators overseeing their use. For the record, the safety of these ingredients have all been reviewed, evaluated and given a clean bill of health by the FDA in 1978¹⁴ and subsequently in a study conducted by the Cosmetic Ingredient Review in 2002.¹⁵ Undoubtedly, as new data surfaces when ingredients are studied in depth and the frequency of use as well as epidemiological studies are conducted, regulations are revised and ingredients are either eliminated or restricted.

Benzophenones have received mixed reviews; their use in sunscreen products now warrants a warning label in the European Union. I have never been a fan of the benzophenones because they are aromatic ketones unlike most other ultraviolet filters that are generally esters in character. Esters are easily hydrolyzed and converted to metabolites that can be excreted safely by the body if they are ever absorbed

FDA gave sunscreens a clean bill of health in 1978 and by the CIR in 2002.

through the skin. Benzophenones, on the other hand, are more resistant to routine metabolism in the body, making their accumulation in fatty tissue more likely.

Healthy Skepticism

A rigorous review of the facts is required when surfing the internet. As seen in the cases above, inaccurate reporting and misquoted scientific studies can mislead the public. Discrepancies and contradictions in the sunscreen information on the internet reveal underlying opposing interests and conflicting agendas. On the anonymous internet, it is rarely possible to obtain a sure handle on the identity of your source: the advocacy group site could be funded by corporate interests or the girl-next-door blogger could be a front for a business competitor. The facts you are quoting could be faulty. The source of

any bit of information you obtain is under question and requires a healthy skepticism.

That said, a greater number of people engaged in enlivening conversation like never before is a positive development in the history of sunscreens. It will stoke the fires of genuine debate and promote the ongoing effort to provide superior sun protection and promote skin health. ●

References

1. www.dailygalaxy.com
2. <http://oceanacidification.wordpress.com>
3. www.abc.net.au
4. www.adventurouswench.com
5. <http://news.nationalgeographic.com>
6. R. Danovaro, et al., *Environmental Health Perspective*, Vol. 116, April 2008
7. <http://www.climateshifts.org>
8. Natural Nano-Sunscreens, a contradiction, <http://www.cosmeticdesigns.com>
9. Shaath, NA. In *Sunscreens: Regulations and Commercial Development*, 3rd Edition, NA Shaath, ed., New York, NY: Taylor and Francis (2005). Also, "The Encyclopedia of Ultraviolet Filters," Nadim A. Shaath, Allured Publishing, Carol Stream, IL 2007
10. "Are Organic Sunscreens as Effective as Regular Sunscreens?" www.mauritustoday.com/news/articles
11. <http://solarkateco.blogspot.com/2008/06/natural-sunscreen-recommendations-all.html>
12. <http://skindeep.ewg.org>
13. Calafat, AM. Et al., *Environmental Health Perspectives*, Vol. 116, March 21, 2008
14. *Fed. Reg.*, 43 (266), 38206-38269, Aug. 25, 1978
15. "PCPC Lambasts EWG Allegations Over Sunscreens," www.cosmeticsdesign.com/news