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### Methods of Assessing Efficiency of UV-Protecting Products

Joanna Kurpiewska<sup>a</sup> & Krzysztof M. Benczek<sup>a</sup>

<sup>a</sup> Department of Chemical and Aerosol Hazards, Central Institute for Labour Protection, Warsaw Poland

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NOTES

## Methods of Assessing Efficiency of UV-Protecting Products

Joanna Kurpiewska  
Krzysztof M. Benczek

Department of Chemical and Aerosol Hazards,  
Central Institute for Labour Protection, Warsaw, Poland

A few aspects of skin protection against ultraviolet (UV) light and methods of assessing efficacy of UV-protecting cream or gels have been discussed. UV-protection in cream and gels is not only a strategy of the cosmetic industry but a necessity because of human occupational activity and daily habits.

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UV-radiation    sun protection factor    sunscreens

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### 1. INTRODUCTION

Sunlight is composed of many wavelengths spread across the electromagnetic spectrum. As it passes through the earth's atmosphere, some of these wavelengths are filtered out. The remaining radiation reaches the earth as ultraviolet (UV), visible, and infrared light. UV light is of particular concern because it can interact with skin cells and cause a variety of damaging effects. It consists of wavelengths grouped into the following three categories: UVC light ranges from 200 to 280 nm, UVB from 290 to 320 nm, UVA light is composed of wavelengths between 320 and 400 nm.

The action spectrum for UV-induced erythema is well known and largely confined to wavelengths from 290 to 330 nm. Whereas UVB is responsible for most sunburns, high doses of UVA can also cause reddening. Chronic exposure, particularly to the UVA range, results as UV-induced

photoaging, which occurs when key support matrix elements are damaged by radiation. The erythema action spectrum is nearly identical to that proposed for DNA damage.

Man can also be excessively exposed to ultraviolet rays from natural radiation (part of the solar spectrum) or radiation from artificial sources, the quantity of which quickly increases together with technological development. Knowledge from the field of protection against radiation concerns all of us, especially people working in open spaces, for example, such professional groups as farmers, roadworkers, builders, welders, sportsmen, and soldiers.

The effects of overexposure to the sun range from effects such as erythema mainly due to UVB radiation to long-term effects such as photoaging of the skin and cancer involving UVB and UVA.

## 2. EFFICIENCY OF UV-PROTECTING PRODUCTS

UV protection provided by sunscreen products requires a reliable and reproducible procedure for determination and classification of its UVA and UVB protection level. Product labeling based on proper classification would provide the consumer with the ability to select the correct product.

One of the primary measures for products designed to protect against the damaging effects of UV light (mainly UVB) is the Sun Protection Factor (SPF). It indicates how much longer you can remain in the sun before you get sunburned when wearing a sunscreen compared to no sunscreen. Generally a product's SPF is equal to the ratio of the time it takes to burn if wearing the product versus the time it takes to burn without any product. The SPF value can be affected by a variety of factors including the amount and the type of sunscreen active, skin type and individual sensitivity, the type of delivery vehicle, and so on. The most important and difficult to obtain feature of sun care products is their high efficacy. In the case of UVB radiation the SPF coefficient can be determined in accordance with the topical, standardized method recommended by the European Cosmetic Toiletry and Perfumery Association (COLIPA). The COLIPA (1994) method includes experiences obtained during creating the FDA method in the USA, and standards AS/NZS 2604 in Australia and New Zealand, JCIA in Japan, and DIN in Germany (as cited in Christ & Piwowar-Baryłko, 1995, and Finkel, 2000)

To obtain SPF rating biological evaluation involves the use of volunteers. In this test, the lower back of a non-sunburned volunteer is subjected to UV light until a minimum amount of erythema or redness develops. Light-proof barriers are placed around a measured section of the skin so clear margins are visible.

The amount of energy required to produce this effect is determined and provides a base line for the SPF calculation. The sunscreen formula is put on the volunteer's skin and allowed to dry. The skin is then irradiated with UV light at the estimated SPF value. A preliminary value for this number is obtained by using visual or spectrophotometric absorption estimation. The amount of UV light required is recorded and the SPF is determined.

Methods of marking the coefficient of protection should be standardized (nowadays it happens that products labeled, e.g., SPF No. 8 by one firm do not give comparable protective effects with products from another firm's product labeled with this SPF number, which can perhaps result from differences in the SPF marking tests) and is desirable so that consumers receive a standard valuable photostable protecting product, and use it properly. Short tests have already been done in the laboratories of the Central Institute for Labour Protection (CIOP). Figure 1 shows the efficacy of

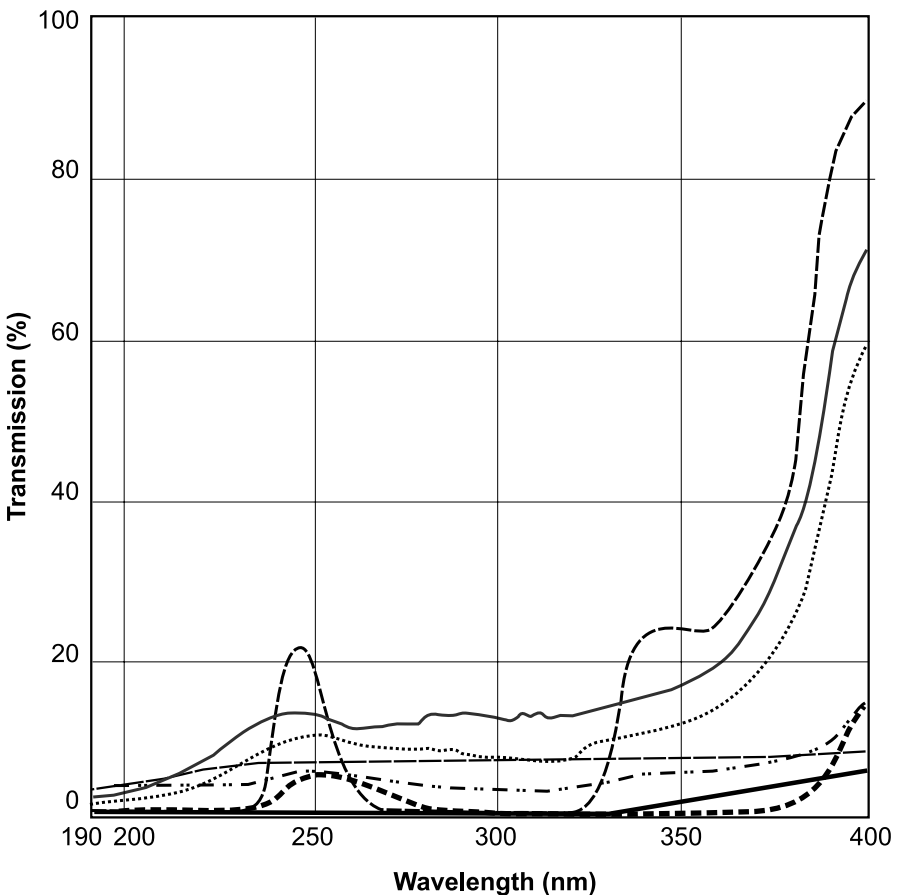


Figure 1. Transmission of different UV-protecting creams.

different UV-protecting creams and differences in their protecting properties can be seen. One should be aware that articles offered by the cosmetic industry are efficient, but still imperfect. Investigations conducted and planned by COLIPA help to create legal regulations, which will make better estimation of UV protection possible, to undertake activities preventing adverse results of UV radiation in future.

It is much more difficult to determine the coefficient of protection against UVA radiation mostly because there is no terminal determinant of the effect of the activity like erythema, which occurs under the influence of UVB range activity. Nowadays various spectrophotometric research is undertaken to create standardized, more sensitive, and quicker methods for testing and labeling the level of UVA and UVB protection provided by sunscreen products. These methods contrary to *in vivo* methods do not require any specially selected group of people, a layer of cream can be standardized and the effect of photostability can be observed (Wiechers, 2000). A new technical method will be developed in CIOP. It will allow quick assessment of the efficiency of a UV-protecting product for recommendation for workers at workplaces where there is a UV radiation hazard.

#### 4. CONCLUSION

Lately more and more frequent are reports about adverse reactions (photosensitivity and photoallergy) to practical sunscreens. As the ozone layer in the atmosphere continues to get thinner, global progressive warming increases and more damaging radiation reaches the earth's surface, more effective protection against solar radiation will be required to protect the public. So sunscreens should be examined especially carefully to assure the best protecting effect. New sunscreens are necessary to assure safe and effective products for users.

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