

In Vitro Sunscreen Performance Evaluation

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Objective

To evaluate the SPF, photostability and critical wavelength of selected sunscreens, using in vitro measurements.

Test Products

	Type	Total % Active Ingredients
1. Neutrogena Ultra Sheer SPF 55	Organic	26.8%
2. Blue Lizard Sensitive Skin SPF 30	Inorganic	15%
3. Colipa P3 Standard Sunscreen	Organic	6.3%

Materials and Methods:

The spectral irradiance of a 150 watt xenon arc solar simulator (Solar Light Company, Philadelphia, PA) was measured from 290 to 400 nm at 5 nm wavelength intervals.

Next, approximately 20 mg of test product was applied to a roughened 5 cm x 5 cm PMMA plate with a known transmittance spectrum [1] and the transmittance spectrum of the sunscreen/substrate combination was measured 5 times at regular intervals during irradiation with a UV dose of at least 30 MEDs. (1 MED = 0.02 effective J/cm²) A least squares curve fit equation was derived for the applied UV dose (x) vs. the transmitted UV dose (y):

$$y = \alpha x^{\beta}$$

The SPF is the value of x when y reaches 1 MED. A sunscreen is stable if b is close to 1. [2]

The critical wavelength, λ_c , was then calculated by the method of Diffey [3], and is the wavelength below which 90 percent of the area under the absorbance curve resides. A critical wavelength of at least 370 nm is proposed as the criterion for “broad spectrum protection.”

Results are summarized in Table 1. Transmitted UV Dose vs. Applied UV Dose curves are shown in Figure 1. and Absorbance spectra and critical wavelength after an applied dose of 30 MEDs are shown in Figure 2.

Conclusions:

- Absorbance spectra were similar for Neutrogena 55 and Blue Lizard Sensitive Skin 30 after 30 MEDs.
- Neutrogena 55 and Blue Lizard Sensitive Skin maintained in vitro SPF values above their labeled SPFs after 30 MEDs.
- All were photostable except the Colipa P3 Standard Sunscreen.
- Neutrogena 55 and Blue Lizard Sensitive Skin satisfied the proposed criterion for “Broad Spectrum” labeling, with critical wavelengths greater than 370 nm, even after 30 MEDs.

Table 1. In Vitro SPF, β and Critical Wavelength

Test Product	In vitro SPF		β	Critical Wavelength (λ_c) After 30 MEDs
	Overall	After 30 MEDs		
1. Neutrogena 55	56	56	1.1	372 nm
2. Blue Lizard Sensitive Skin SPF 30	35	35	1.1	372 nm
3. Colipa P3 Standard	17	8	1.43	351 nm

Figure 1. Transmitted UV Dose vs. Applied Dose (MEDs)

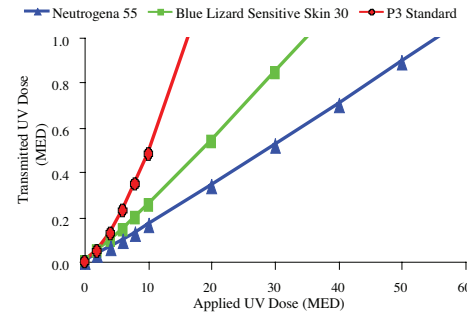
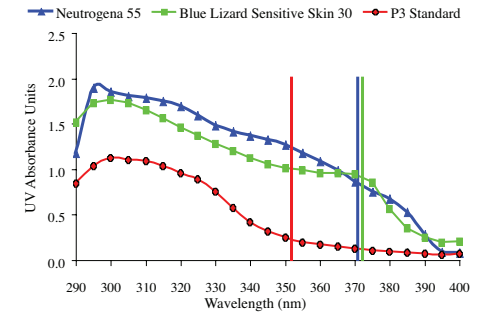


Figure 2. Absorbance and Critical Wavelength After 30 MEDs



References

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