

# Next-Generation Broad-Spectrum Photoprotection & HEV Blue Light Shielding — Engineering Review 2021

Por Cristiano Ricardo · Publicado em 25/09/2021

Technical dermocosmetic engineering lecture by Prof. Cristiano Ricardo on next-generation broad-spectrum photoprotection & hev blue light shielding (Photobiology & Photoprotective Technology), featuring colorful schematic diagrams and clinical data.

Versão online e eventuais atualizações:

<https://cristianoricardo.com/post/next-generation-broad-spectrum-photoprotection-hev-blue-light-shielding-2021-09-25>

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Photobiology & Photoprotective Technology · Cosmetic Engineering & Science

Modern sunscreen engineering extends beyond UVB erythema to tackle long-wave UVA1 photoaging and high-energy visible light.

## Engineering Mechanism & Kinetic Flowchart

UVB

290-320 nm

UVA II / I

320-400 nm

HEV Blue

400-500 nm

IR-A

760-1440 nm

## Photostable Polymeric UV Filters

Modern organic filters such as Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine (Tinosorb S) and Methylene Bis-Benzotriazolyl Tetramethylbutylphenol (Tinosorb M) exhibit superior photostability, dissipating absorbed photons without decomposing into photo-allergenic radicals.

## Mineral Filter Micronization & Surface Functionalization

Zinc Oxide (ZnO) and Titanium Dioxide (TiO<sub>2</sub>) nanoparticles are coated with triethoxycaprylylsilane, silica, or alumina to suppress surface photocatalytic activity,

preventing lipid peroxidation of formulation oils.

## **Iron Oxide Pigment Blends against HEV Melasma**

In Fitzpatrick phototypes III–VI, high-energy visible blue light (400–500 nm) induces sustained hyperpigmentation via opsin-3 photoreceptors. Surface-treated yellow, red, and black iron oxides provide the only clinically validated barrier against HEV radiation.

Prof. Cristiano Ricardo

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