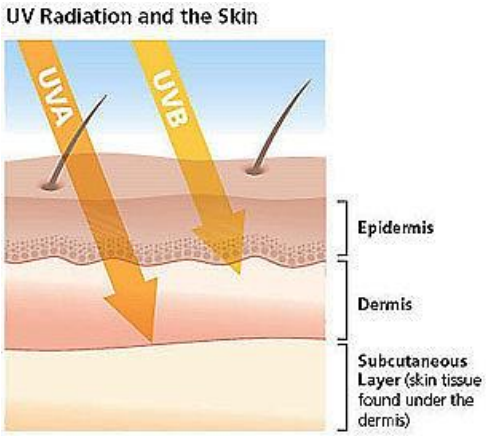
More effective sunscreen: Just add water...

- **Understand consequences of long living exited states**
- **Optimize composition of sunscreens**
- **Detailed and comprehensive insight into dissipation routes**

Skin Damage| UV Radiation| Improved Photo-Protective Properties| Sunscreens

Sun protection

Exposure to UV radiation from the sun is one of the primary factors in the world that contributes to the development of skin cancer. In order to protect the skin against these photo damaging effects large efforts have been put into developing more efficient sunscreens.



A wide range of wavelengths are radiated by the sun. Light of the shorter wavelengths -UVA and UVB- reaches the surface of the earth and causes photo damaging effects to the skin.

Sunscreens applied to the human skin can protect us from the damaging radiation, by absorbing the UV light. This absorption is generally well documented, however several steps that determine how photon energy is dissipated in sunscreens are yet to be understood in detail. The FDA has shown its concerns concerning sunscreens, and feels there is a need to look into the filters' safety more carefully.

New insights

At the basis of the development of sunscreens is a full understanding of their excited-state dynamics. Unfortunately, studies of the excited-state properties of regularly used sunscreen agents are scarce. Researchers from the Molecular Photonics group of the University of Amsterdam have now shown that such studies have a major added value, and lead to a paradigm shift in improving sunscreens. Such studies revealed, for example, that one of the commonly used protective ingredients in sunscreens (octylmethoxycinnamate -OMC- molecule), reacts differently to UV radiation than previously assumed. The molecule has been shown to remain in its excited state for 30 ns, which is 10000 times longer than had been assumed. Such an excited molecule can transfer energy to other molecules such as oxygen, producing very reactive singlet oxygen that may lead to DNA damage. As a result, the efficacy of the sunscreen is reduced and light-induced harmful side effects may occur. Novel microsolvation studies of sunscreen chromophores with water at the UvA demonstrated that embedding the sunscreen in a polar environment markedly decreases the chance on skin damage. These observations could be a first step toward the development of more effective sunscreens with improved photochemical properties and less toxic effects.

Technology

The UvA makes use of advanced laser spectroscopic techniques to elucidate the dissipation pathways of the absorbed photon energy, including the conversion into harmless heat but in particular also the production of unwanted photoproducts in sunscreens.

Project

The UvA has set-up an extensive research program on various commercially employed sunscreen agents. In this program, the UvA has teamed up with the Molecular Structure and Dynamics group of prof. dr. Jos Oomens at the Radboud University to develop a shared and unique power house of experimental techniques, such as high-end mass-spectrometric techniques but also free electron lasers that give access to wavelength regions that normally are not available for spectroscopic studies. In this combined research program, the UvA investigates how the photoactive compounds that are employed in sunscreens dissipate the energy of UV photons, thereby paving the way for a potentially game-changing approach for the rational development of sunscreens.

Looking for partners

The University of Amsterdam is looking for partners to participate in the development of more effective sunscreens with improved photo protective and non-toxic properties.

Principal investigator

Prof. Dr. W.J. (Wybren Jan) Buma leads the Molecular Photonics group at the University of Amsterdam, where he has been highly successful the last 25 years. Furthermore he is professor by special appointment at the Radboud University (Nijmegen)

Key publications

E.M.M. Tan, M. Hilbers & W.J. Buma (2014). Excited-State Dynamics of Isolated and Microsolvated Cinnamate-Based UV-B Sunscreens. The Journal of Physical Chemistry Letters, 5 (14), 2464-2468. doi: 10.1021/jz501140b

Contact

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