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Plant oils in cosmetics

Systematic testing of natural oils on in vitro skin models

For some years now, the trend in the cosmetics and skincare sector has been toward transparency and natural, sustainable ingredients. A growing number of consumers are rejecting cosmetics that contain petroleum-derived mineral oils and silicone oils. As a result, manufacturers are increasingly turning toward plant-based oils, fats, and waxes as substitutes. Working in tandem with Kneipp GmbH, a well-known producer of cosmetic products and other items, the Fraunhofer Translational Center for Regenerative Therapies TLC-RT at the Fraunhofer Institute for Silicate Research ISC is conducting the first-ever systematic tests of the general protective and regenerative effects of plant oils on the skin. The researchers are using a 3D skin model cultured *in vitro* for their work.

It has long been known that plant-based oils can have a positive influence on the skin. They also help to conserve resources and do not harm the environment, unlike refined mineral oils. And yet, until now there has never been a systematic study providing scientific proof of the effects of various natural oils. To bridge this gap, the Fraunhofer Translational Center for Regenerative Therapies TLC-RT at the Fraunhofer Institute for Silicate Research ISC is now working with Kneipp GmbH to systematically test natural oils to compare and demonstrate their influence on the skin. The team is using lab-grown epidermal 3D skin models, which simulate the top layer of skin, to study how the plant oils affect skin. "The objective of our research is to screen various plant-based oils and identify those that show superior effectiveness in this test model in terms of strengthening, protecting, and renewing the epidermal skin barrier. The ultimate goal is for this to serve as a basis for developing innovative cosmetic products," says Dr. Dieter Groneberg, group leader of the Skin department at Fraunhofer TLC-RT in Würzburg. The team evaluated both carrier oils and oils claimed to have particular effects that are already contained in certain percentages as additives in oil-based skincare products and are very well known, along with substances that have been lesser known to date.

***In vitro* test models grown from human skin cells**

The researchers at Fraunhofer TLC-RT grow their *in vitro* skin models from human skin cells, which can be used to identify harmful substances or demonstrate positive effects on the skin. A modular approach allows the team to simulate various skin types with different characteristics. In all, 50 plant oils were evaluated using the epidermal skin models.

Contact

Thomas Eck | Fraunhofer-Gesellschaft, Munich, Germany | Communications | Phone +49 89 1205-1333 | presse@zv.fraunhofer.de

Marie-Luise Righi | Fraunhofer Institute for Silicate Research ISC | PR and Communications | Phone +49 931 4100-150 | Neunerplatz 2 | 97082 Würzburg, Germany | www.isc.fraunhofer.de | marie-luise.righi@isc.fraunhofer.de

Standardized testing using scientific methods

The oils were applied to skin models and then analyzed using a specific testing method with an eye to general, protective, and regenerative effects. To study the regenerative effect, for example, the epidermis — the skin's outermost layer — was damaged and then treated with the oils. Then the researchers examined the skin to determine whether the oils had improved the skin's protective function and/or regeneration.

"During our *in vitro* tests on human skin cells, we were able to identify oils that have positive effects by strengthening, protecting, and helping to renew the skin barrier. This represents the first scientific proof of their emollient, protective, and regenerative effects," Groneberg says. Some of the plant-based oils performed very well overall in strengthening, protecting, and regenerating the skin, while others were impressive in one out of these three areas. The positive test results for some oils, such as almond oil, give manufacturers a better window on the effectiveness of existing products, along with pointing the way forward for development of innovative and effective new products.

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Fig. 1 Lab-grown skin models are used for systematic testing of the effects of plant oils on human skin.

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Fig 2 Fraunhofer TLC-RT uses a modular approach to culture skin models tailored to different research questions, which are then used to test various substances.

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