

Particle-mediated transport of dissolved active agents into hair follicles

transport into hair follicle, delivery of active agents, particle-mediated transport, pharmaceutical application, cosmetic application

INVENTION NOVELTY

As can be seen from the prior art, although it is possible to deliver particles into the hair follicle efficiently, there has been no efficient means of delivering dissolved active ingredients, such as dissolved drug molecules or cosmetically active molecules, into the hair follicles, e.g., for effective and prolonged skin penetration or sustained skin disinfection.

The new solution's unique feature is that any dissolved active ingredient can benefit from improved follicle penetration. Until now, this was reserved for active ingredients that could be encapsulated in particles or covalently bound to them. Substances that would not penetrate the skin without follicle penetration and are not suitable for conventional particle penetration can now penetrate the hair follicle and reach their target via the weaker barrier in the hair follicle or its target directly in the hair follicle.

VALUE PROPOSITION

The invention is highly useful for administering active agents to a subject via topical administration. The hair follicle as a site where an agent can have direct influence on the anatomical structures and cells of the follicle can serve as an entry site for agents that are active in the skin, but also act systemically.

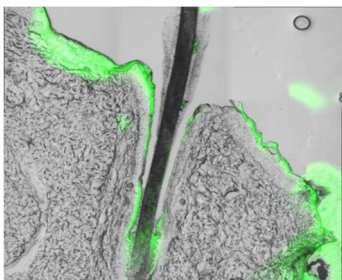


Fig. 1: Confocal microscopic image of a hair follicle after application of a fluorescein-particle composition.

TECHNOLOGY DESCRIPTION

Lipid nanoparticle and nanocrystal-containing formulations were applied as dispersions in a liquid or semi-solid dispersion medium. Among others, fluorescein (as a small molecule surrogate, see **Fig. 1**), green fluorescent protein (GFP) and FITC-BSA (as large molecule surrogates) have been used to prepare particle-containing formulations where the agent is dissolved in the dispersion medium containing the particles. In contrast to other compositions known, the active agents are not directly coupled to the particles nor they are incorporated in the particles. The compositions were applied on fresh porcine ears; skin sections and hair follicle sections were analyzed by epifluorescence microscopy. Images were taken and the penetration depth of the fluorescein-containing molecule was directly measured. Both spherical and non-spherical particles have been shown to significantly improve penetration depth of dissolved active agents irrespectively of small molecules or protein-based ingredients.

COMMERCIAL OPPORTUNITY

The inventive composition can be useful for pharmaceutical and cosmetic applications concerning hair growth, hair loss, acne, acne inversa, hair coloring or other interventions where efficient delivery of active agents are necessary and beneficial. In addition to an enhanced uptake of active agents the hair follicles can serve as a reservoir where an active agent can remain for prolonged time while continuously diffusing into the surrounding tissue. Furthermore, the hair follicle is a shunt to viable tissue that acts as an elevator, bringing substances such as painkillers into the tissue more quickly. The new technique could also be used for deep skin disinfection, as surgical side effects could be due to microbes repopulating the skin from the hair follicle.

The technology is open for licensing, further co-development is highly welcomed.

DEVELOPMENT STATUS

The influence of size and amount of the particles on penetration depth and efficacy of the active agent is under investigation. Actually, the technology can be classified as being TLR3: identification and characterization of the product candidate.

PATENT SITUATION

Patents are pending in US and EP with priority of June 24, 2021.