Bridging the Gap Between Long Lasting and Active Ingredients Delivery in Color Cosmetics: and In-Depth Study Using In Vitro and In Vivo Permeation Techniques

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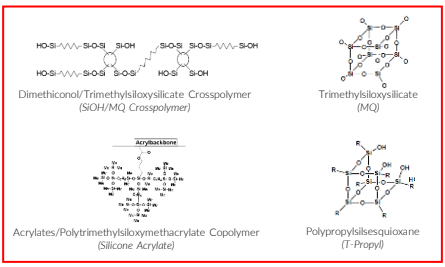
Introduction:

With the increase of interest for multipurpose or hybrid make-up in the last few years, the world is evolving at a faster pace and pushing beauty trends at the same speed. Consumers are more concerned and looking for multi-functional cosmetics. Color cosmetics are more than ever linked to skin care and the search for make-ups that go beyond decoration is rising and must be urgently addressed. It is well known by the skilled in the art that silicone-based film formers are key ingredients to achieve long lasting in color cosmetics, however, what role will they play in the delivery of anti-aging actives when these are added to color cosmetics? Little is known about it.

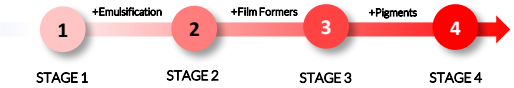
This work aims to address this puzzling question by determining the influence of silicone-based film formers on the delivery of skin care actives added to color cosmetic formulations and it´s long-lasting properties.

Materials & Methods:

The following silicone and silicone acrylate film formers were included in this study and tested at 5.0% active levels in the water-in-silicone emulsion (W/S):



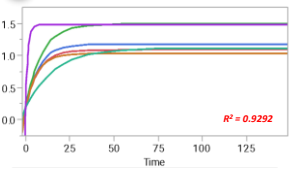
Key formulation ingredients were identified, and their concentrations were assigned based on conventional use levels in color cosmetic products: Niacinamide, emulsifier and film former concentrations were kept constant at 3.00%, 1.25% and 5.00%, respectively.
To mitigate the complexity of make-up products, the test formulation was deconstructed, and permeation studies were carried out in four stages:



Permeation of niacinamide from staged formulations was determined using quantitative in vitro and in vivo techniques, as depicted below. Rub-off resistance studies and film morphology (SEM) were also determined.

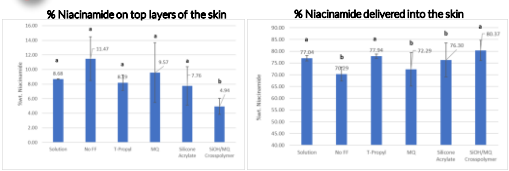
Results & Discussion:

1 IN VITRO ATR/FTIR



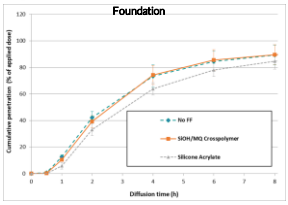
Emulsification slows down permeation and decreases saturation point. There is no significant difference in the permeation kinetics and saturation concentration when any of the silicone film formers are added.
Silicone acrylate boosts the delivery of Niacinamide to the membrane.

2 IN VIVO TAPE STRIPPING



Emulsified niacinamide is delivered more slowly compared to its aqueous solution. SiOH/MQ in the W/Si emulsion significantly decreases the concentration of niacinamide in the reservoir, pushing it faster towards the epidermis, acting as booster. An apparent similar performance is seen for T-Propyl and Silicone Acrylate, however, statistical significance was not achieved.

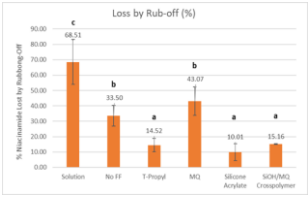
3 IN VITRO FRANZ CELLS



Film formers did not impact the delivery of niacinamide from the W/Si emulsion, neither foundations or liquid lipsticks. Permeation kinetics among treatments are equivalent. Positive effects from silicone acrylate and SiOH/MQ Crosspolymer identified by ATR/FTIR and tape stripping, respectively, did not replicate.

4 RUB-OFF RESISTANCE

68.51% of niacinamide was removed from the silicone membrane when delivered in solution, meanwhile loss significantly decreases when delivered from a W/Si emulsion (33.50%). MQ film broke down and was not effective. SiOH/MQ Crosspolymer, T-Propyl and Silicone Acrylate significantly decreased the loss of niacinamide from 33.50% down to 15.16%, 14.52% and 10.01%, respectively.



Conclusions:

This work demonstrated that silicone-based film formers improve the delivery of niacinamide from water-in-silicone emulsions and prevent its loss from abrasion. Morphology of the films were also significantly improved. It is believed that this study opens a new frontier for make-up with valuable knowledge for the development of color cosmetics with skincare benefits. New insights for the development of sunscreen formulations with physical filters and skincare attributes can also be correlated.

Acknowledgements:

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Main References:

1. XIANG LU, Shao. The science behind transfer-resistant color cosmetics. Society of Cosmetics Chemists Annual Scientific Meeting: SCCS, 2014. 64 p.
2. EEMAN, Marc; VAN REETH, Isabelle. Silicone film-formers: new approaches for measuring film barrier properties. IFSCC: Poster presentation, 2010.
3. Zhang, Y.; Kung, C.-P.; Iliopoulos, F.; Sil, B.C.; Hadgraft, J.; Lane, M.E. Dermal Delivery of Niacinamide: In Vivo Studies. Pharmaceutics 2021, 13, 726. https://doi.org/10.3390/pharmaceutics13050726.
4. Wiedersberg S; Nicoli S. Skin Permeation Assessment: Tape Stripping. Transdermal and Topical Drug Delivery: Principles and Practice (2012): 109-131.
5. Schalau II G., Bobenrieth A., Huber R, Nartker L.;Thomas X.. Silicone Adhesives in Medical Applications. Applied Adhesive Bonding in Science and Technology (2017). DOI: 10.5772/intechopen.71817.