



# The Transdermal Absorption of Retinol and Retinyl Palmitate in Cosmetics Formulations

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## Introduction:

Since The Cosmetic Ingredient Review (CIR) Expert Panel concludes that retinol and retinyl palmitate are safe as cosmetic ingredients in the present practices of use and concentration in 1987. There are numerous studies concerning about the safety and stability of retinol and retinyl palmitate thereafter.

Retinol and retinyl palmitate are commonly used in topical antiaging preparations. Retinol and its derivatives have shown great benefit in treating the signs of aged skin.[1][2] In 2016, the SCCS issued the opinion SCCS/1576/16 on Vitamin A concluding that its use as a cosmetic ingredient is safe at given concentrations for body lotions and face creams, leave-on (other than body lotions) and rinse-off products.[3] Transdermal absorption can be affected by numerous factors including the structure and concentration of active ingredients, type of formulations, temperature and etc.. The transdermal absorption efficiency can be increased by using enhancer. The enhancing mechanism can be due to a single model or combined with multiple models.[4]

Therefore, a clear understanding about the transdermal absorption of retinol and retinyl palmitate is essential for the safety evaluation of these ingredients in cosmetics.

## Materials & Methods:

### procedure chart

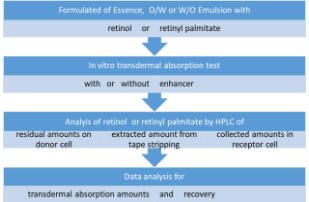


Table 1. The results of transdermal absorption of all different formulation type with retinol

Formulation	No.11	No.12	No.13	No.14	No.15	No.16	No.17
Applied amount (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residue mass in donor cell(%)	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
amount on cotton (µg/g)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
amount effused into the skin(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
amount collected in receptor(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
transdermal absorption amount(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Recovery (%)	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000

Table 2. The results of transdermal absorption of all different formulation type with retinyl palmitate

Formulation	No.11	No.12	No.13	No.14	No.15	No.16	No.17
Applied amount (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residue mass in donor cell(%)	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
amount on cotton (µg/g)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
amount effused into the skin(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
amount collected in receptor(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
transdermal absorption amount(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Recovery (%)	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000

## Results & Discussion:

Table 3. The results of transdermal absorption of all different formulation type with retinol

Formulation	No.11	No.12	No.13	No.14	No.15	No.16	No.17
Applied amount (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residue mass in donor cell(%)	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
amount on cotton (µg/g)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
amount effused into the skin(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
amount collected in receptor(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
transdermal absorption amount(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Recovery (%)	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000

Table 4. The results of transdermal absorption of all different formulation type with retinyl palmitate

Formulation	No.11	No.12	No.13	No.14	No.15	No.16	No.17
Applied amount (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residue mass in donor cell(%)	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
amount on cotton (µg/g)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
amount effused into the skin(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
amount collected in receptor(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
transdermal absorption amount(%)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Recovery (%)	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000

The results show that retinol has stronger transfer ability to diffuse into and delivered across of the dermal layer than retinyl palmitate. Higher molecular weight of retinyl palmitate is harder to move cross the stratum corneum, which is demonstrated by the determined amount on stripping tape, which is around 3-6% for retinol and around 11-20% for retinyl palmitate for all the tests.

Without enhancer, the transdermal absorption amount, the amount diffused into the skin and the amount delivered across the skin, of retinyl palmitate is around two third of that of retinol. With 5% propylene glycol as enhancer in essence, the transdermal absorption amount of retinol and retinyl palmitate are both increased to around 20% and retinyl palmitate is all stayed at the dermal layer.

For comparing the effect of formulation type on the transdermal absorption, the transdermal absorption amount of retinol is almost the same for essence and o/w emulsion, however the transdermal absorption amount of retinyl palmitate is slightly lower in o/w emulsion than in essence. Nevertheless, the transdermal absorption amount of retinol and retinyl palmitate in w/o emulsion is the lowest among the three formulation types.

About the effect of enhancer type and concentration on the transdermal absorption, it was studied only for essence. Generally, essence with enhancer, propylene glycol gives better transdermal absorption result than 1,3-Butylene glycol and then glycerin. 5% propylene glycol, 1,3-Butylene glycol or glycerin also shows better transdermal absorption result than 10% propylene glycol, 1,3-Butylene glycol or glycerin. It was also noticed that retinyl palmitate is all retained on the dermal layer without transfer across it. Furthermore, 5% propylene glycol and 5% glycerin are giving higher amount delivered across the dermal layer.

## Conclusions:

The retained amount in dermal layer of retinyl palmitate from essence and o/w emulsion are higher than retinol. For cosmetics, use retinyl palmitate as active gradient with enhancer may be able to decrease the active gradient concentration in the formulation and still achieve the effective concentration with less safety concern.

## Acknowledgements:

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## References:

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