Basic study of transdermal absorption enhancement by using atmospheric microplasma

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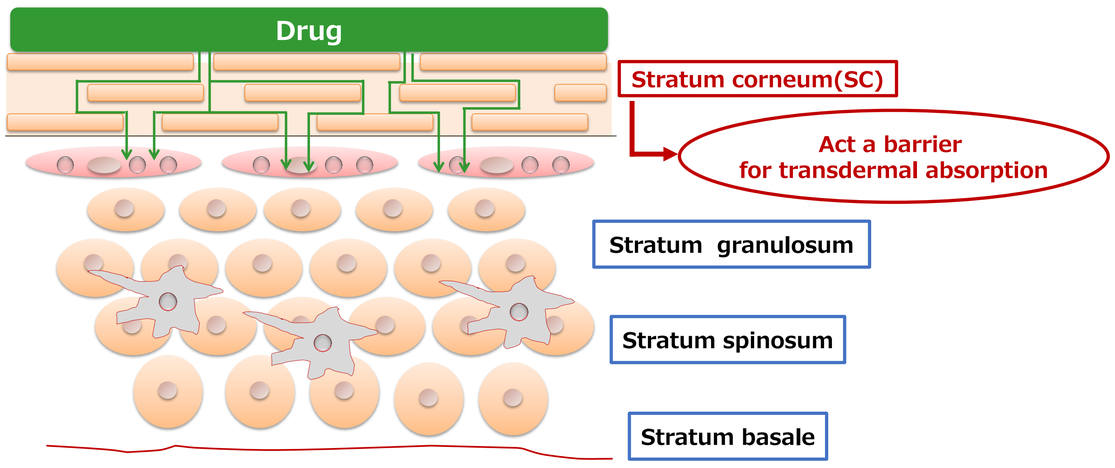
In recent years, medical applications using atmospheric plasma have been intensively studied. Many research has been reported such as blood coagulation, wound healing and treatment of cancer cells. On the other hand, dermatology is one of medical field where the plasma applications exist. Atmospheric plasma application in dermatology includes treatment of acne or wrinkle and of stretch marks in combination with ultrasonic waves. In our experiments, atmospheric microplasma was utilized to enhance transdermal absorption. Transdermal absorption is one of drug administration which penetrates through skin. As a result, penetrating amount of reagent was increased in plasma exposed sample compared with that of control sample.

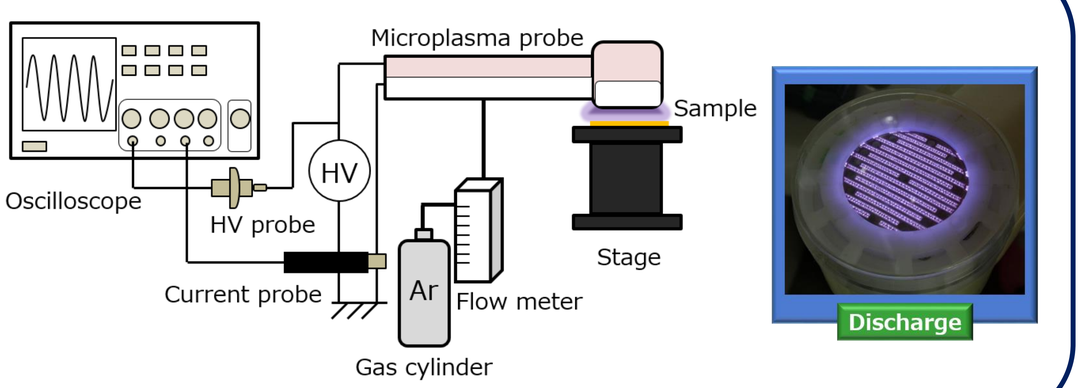
1. Objectives



Transdermal absorption

2. Sample & Methods

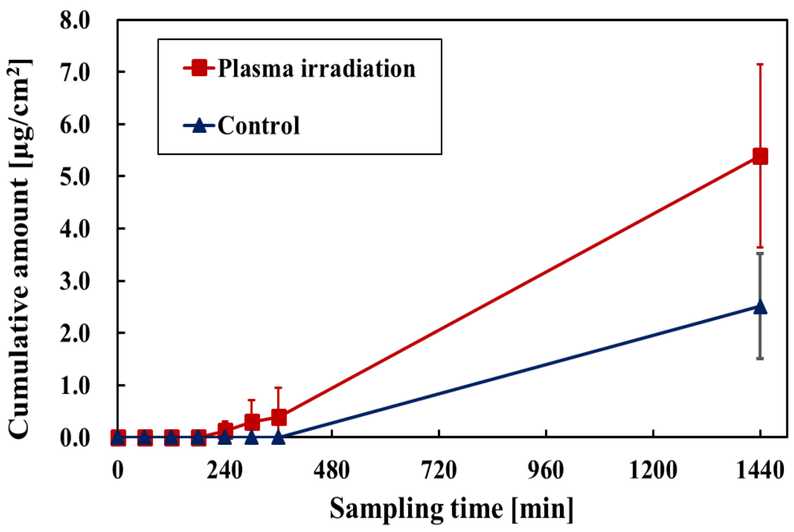
Microplasma Irradiation to SC Sample

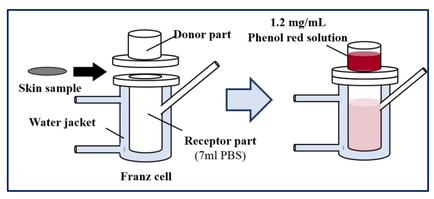


Power supply	Sinusoidal voltage
Applied voltage [kV]	1.2 (peak to peak)
Frequency [kHz]	27.1
Exposed time [min]	0 (Control), 5
Irradiation distance [mm]	0.5
Process gas	Ar
Flow rate [L/min]	5.0

3. Results and Discussion

Transdermal Absorption Test





The number of sample: 3

Expressed value: ave. ± S.D.

Microplasma irradiation

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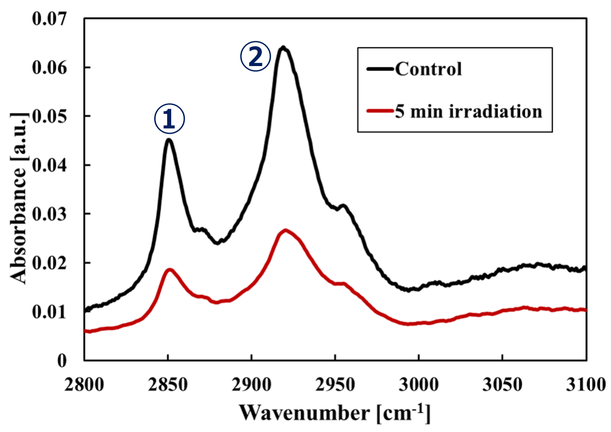
Enhancement of transdermal absorption

Evaluation of the Surface of Skin

FTIR-ATR method (ATR: Attenuated Total Reflection)



①: CH_2 symmetric stretch

②: CH_2 asymmetric stretch

Decrease of CH_2 bonds of lipid matrix of SC

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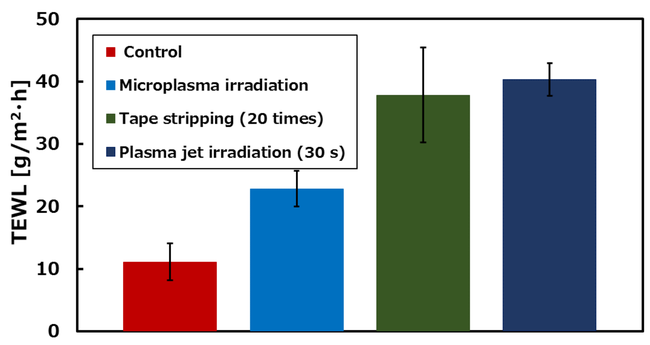
Decrease of barrier performance of skin

TEWL Value (TEWL: Transepidermal Water Loss)

→ **Water evaporation per unit area and time through skin**



Higher water evaporation through skin

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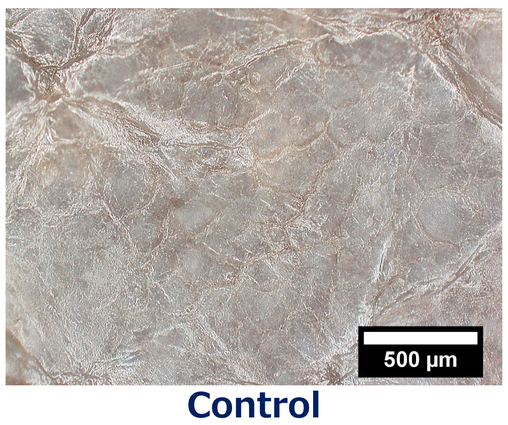
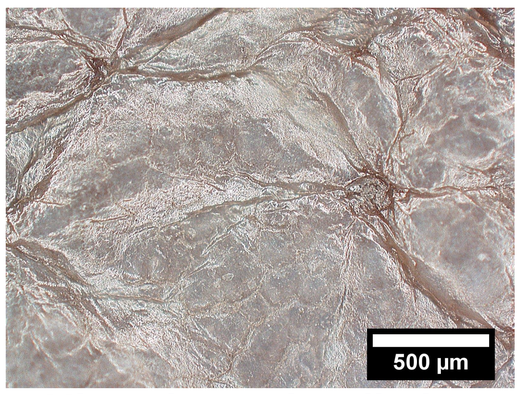
Decrease of barrier performance of skin

Observation of the Skin Surface

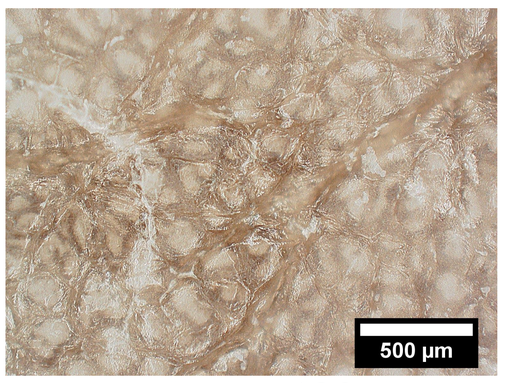


Control



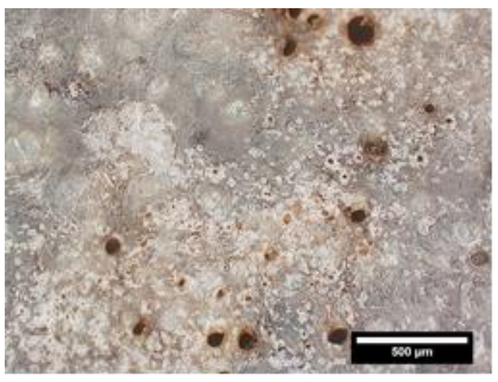
Microplasma irradiation

Low skin damage



Tape stripping (20 times)

SC was removed



Plasma jet (30 s)

Skin damage was observed

Plasma jet irradiation

Decrease of barrier performance and damage were confirmed.

Microplasma irradiation

Decrease of barrier performance was confirmed.

However, **skin damage was not confirmed.**

4. Conclusions

- The penetrating amount of phenol red was increased compared with the control sample.
- After 5 min irradiation, a decrease of the barrier performance of stratum corneum was confirmed.