

# A NOVEL TECHNOLOGY FOR COSMETIC TRANSFER PREVENTION

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SUGA Tomomi; ISOJIMA Tatsushi; KASAI Takehiko; SHIROYA Toshifumi; TAKAHASHI Nozomi; YOKOYAMA Emilie; NICOLAS Alexandre; ASANUMA Hidehiko; KOIKE Toru  
L'Oréal Research and Innovation, Kawasaki, Japan

## 1 INTRODUCTION

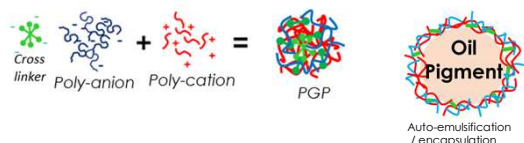
From a survey on Asian women, we identified that 97% of the respondents have been annoyed by transfer and smudge of tinted cosmetic products on wears and surface of objects contacting to the skin (such as cotton mask, smart phone, etc.). Under the Covid-19 situation, the mask users are increasing, and anti-smudge property of cosmetic products will respond to this worldwide discomfort. As for UV filters, transfer is not obvious than pigment by eye, but it causes loss of UV protection performance because of deterioration of protection film.

Most of tinted products contain hydrophobic pigments in outer oil phase of W/O emulsion. To avoid smudge, film formers are often used for lasting performance [1, 2], but it tends to give a heavy texture. In order to overcome such drawbacks of existing technologies, we used **PGP (Polyion complex Gel Particle)** technology, a material that can encapsulate pigments as well as UV filters to avoid direct contact of these materials to outside environment. [3]



## 2 MATERIALS AND METHODS

### POLYION COMPLEX GEL PARTICLE FORMULATION



PGP was prepared by mixing a polycation aqueous solution and a polyanion aqueous solution with a cross linker, and tinted UV protection formula was prepared with hydrophobic pigments and oil soluble UV filters by laboratory mixer. Observation was done using fluorescence dye and fluorescent microscope with SEM.

### IN VITRO COLOR TRANSFER X OPACITY



**COLOR TRANSFER:** Tinted products were applied on artificial leather and rubbed by a piece of masks after dry. Color transfer levels were calculated using  $\Delta E^*ab$  by Spectrocolorimeter

**OPACITY:** Formula were applied onto contrast plates and  $L^*$ ,  $a^*$   $b^*$  value on black and white plates were recorded to calculate opacity.

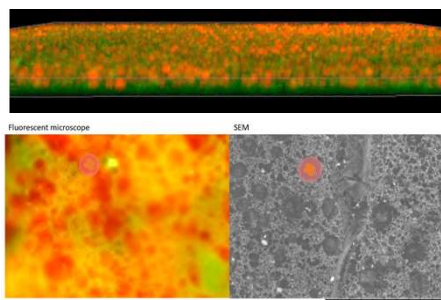
### IN VIVO UV FILTER TRANSFER USABILITY TEST

The lasting of UV protection was evaluated in vivo. Formula contains UV filter with and without PGP technology were applied on each half of Asian women's face (n=20). Panelists were applied three stresses. ①water mist application and put paper towel on the full face to remove moisture. ②walking around 25 minutes and pedaling a fitness bikes to sweat ③wiping by dry cotton two strokes with different contact surface. Before and after those stresses, images were captured using UV-NF and standard 2 mode (VISIA CR, Canfield Scientific). Darkness level of cheek and forehead area of those Images were analyzed by image  
Remaining (%) = (mean gray value after stresses / mean gray value before stresses) x 100



## 3 RESULTS & DISCUSSION

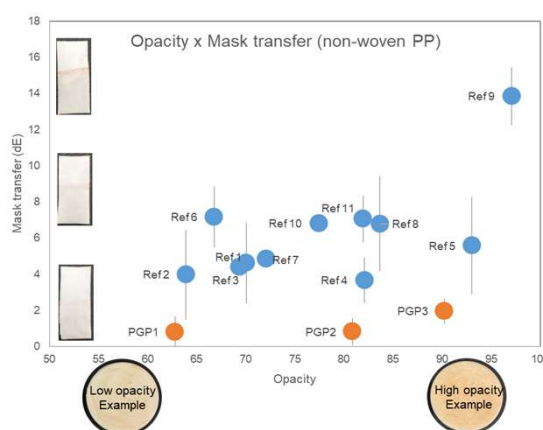
### PGP FORMULATION



PGP particle with oil UV filter applied on model skin. PGP forms film (green) while encapsulating oil UV filter (red).

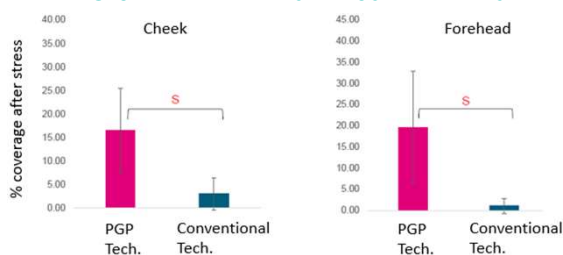
Dried film of anti-smudge formula. Left: fluorescent microscope image, PGP (green) encapsulating oil (red). Right: SEM image, pigments were encapsulated by oil.

### IN VITRO COLOR TRANSFER X OPACITY



Mapping of opacity and mask color transfer level. Even high coverage, PGP technology show low mask transfer level.

### IN VIVO UV FILTER TRANSFER USABILITY TEST



Remaining UVA protection (%) after three types of stresses for cheek and forehead

PGP technology allowed UV-filters to stay significantly higher amount on the skin after three stresses on both cheek and forehead. In other words, PGP technology showed higher lasting effect against water, sweat and friction stresses.

## 4 CONCLUSIONS

Due to difficulties in formulation and usability, conventional W/O type tinted UV protection formula are obliged to put hydrophobic pigments and UV filter in outer phase which results in direct contact on wears or masks. Thanks to high capacity to emulsify oils, PGP can incorporate pigments and UV filters in quantity within inner phase and avoid direct contact to the fabrics. Not only anti-smudge property, PGP technology has lasting effect against water, sweat and friction that means PGP is multifunctional technology to many types of cosmetic application.

#### References:

1. A. Kuroda, H. Yamashita (2003) Development of a long-lasting type make-up foundation. FJ 4:47-52.
2. R. Lockhead, M. Lockhead (2015) Two decades of transfer-resistant lipstick. Cosmetics and Toiletries Vol.130, No.1:18-27.
3. H. Asanuma, et al. (2020) Environment adapting self-healing hydrogel for ultimate skin protection. IFSCC congress 2020: Podium-38.

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