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New emulsion type liquid lip formulation with gloss and stain effect using shear stress-induced phase separation phenomenon

Poster 492

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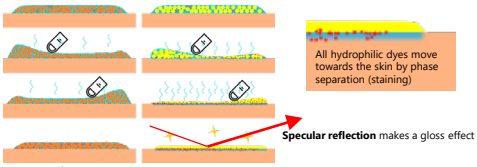
Introduction:

Recently, "emulsion type liquid lip" is getting attention in the color cosmetics market for lips. Emulsion type liquid lip is a type of lip color cosmetic formulation that has recently gained popularity. This formulation can create unique colors and textures. However, there has been a limitation in that gloss and stain, one of the important properties of lip color cosmetics, has a trade-off relationship with each other in this formulation.

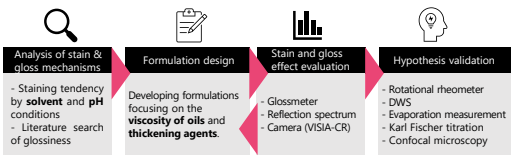
The goal of this study is to develop an emulsion type liquid lip formulation that simultaneously enhances the stain effect and the gloss effect by using the phase separation phenomenon of the formulation. The phase separation of the formulation is caused by the shear stress. Shear stress with the appropriate strength can be easily created by users when they rub their lips. Therefore, users can easily create the phase separation phenomenon.

This formulation does not contain relatively high viscosity and high refractive index oil for gloss effect, unlike conventional high glossy formulations. Low viscosity, low density oils were applied to this formulation instead of it. In addition, we adopted unusual methods of controlling the pH and salinity of the formulation to induce a strong stain effect.

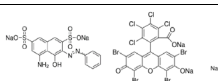
---------- Hypothesis ----------

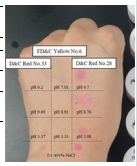


Materials & Methods:



Three acid dyes used in the liquid lip formulations

Name from FDA color additive list	D&C Red No.33	D&C Red No.28	FD&C Yellow No.6
CAS No.	3567-66-6	18472-87-2	2783-94-0
Color Index Number	CI 17200	CI 45410	CI 15985
Solubility in water	Very soluble	Very soluble	Very soluble
Solubility in 1,3-butylene glycol	Slightly soluble	Slightly soluble	Slightly soluble
Molecular structure			



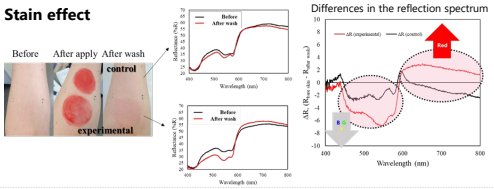
The degree of ionization of the acid dye has a great effect on the stain effect.

Composition table of experimental formulation and control formulation

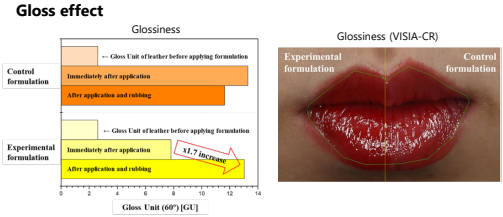
Control formulation (common O/W emulsion)		Experimental formulation	Modified experimental formulation†
Name	wt%	Name	wt%	wt%
Water	43.4	Water	39.3	39.5
surfactants	4	Surfactants	2.5	2.5
Silicone oil (high viscosity)	40	Silicone oil (low viscosity)	38	38
branched-chain fatty alcohol		Ester oil		
Lipophilic thickening agent	2.5	branched-chain fatty alcohol		
Hydrophilic polyacrylate Thickening Agent	5	Hydrophilic polyacrylate Thickening Agent	2.5	2.5
preservative	2.4	Lipophilic thickening agent	0	2.5
Acid dyes	2.7	Polyol	12	12
		Preservative	3	3
		Acid dyes	2.7	0

Results & Discussion:

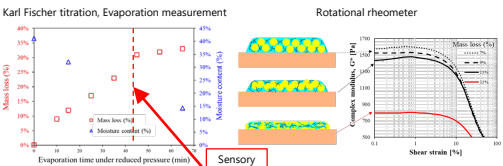
Stain effect



Gloss effect

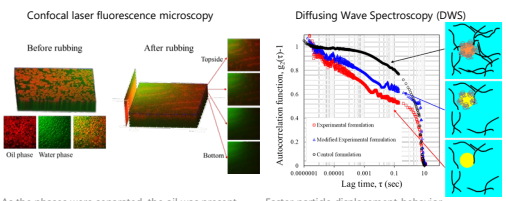


Hypothesis validation



When water was almost evaporated, sensory was also changed.

The sensory was changed because the structure was destroyed. (=phase separation)



As the phases were separated, the oil was present in the upper layer, and the hydrophilic ingredients was present in the lower layer, indeed.

- Faster particle displacement behavior
- Faster particle relaxation behavior
→ The rapid mobility of the emulsion leads to phase separation of the formulation by coalescence.

Conclusions:

We have developed a emulsion type liquid lip formulation that simultaneously stain and gloss, a make-up effect that is difficult to achieve at the same time.

The causes and mechanisms of the two makeup effects of the experimental formulation were analyzed.

Gloss effect and the stain effect were enhanced due to the phase separation phenomenon by shear stress.

During phase separation, almost acid dyes were able to move to the part close to the skin rather than existing in the formulation structure. → stain effect.

The oil layer was formed due to the phase separation, and a lot of specular reflections were occurred. → gloss effect.

Acknowledgements:

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References:

1. R. T. Tregear and P. Dirnhuber (1962) The Mass of Keratin Removed from the Stratum Corneum by Stripping with Adhesive Tape, J. Invest. Dermatol., 38, 6, 375–381.
2. K. P. Ananthapadmanabhan, K. K. Yu, C. L. Meyers, and M. P. Aronson (1996) Binding of surfactants to stratum corneum, J. Cosmet. Sci., 47, 4, 185–200.
3. R. Christie (2015) Colour Chemistry, Royal Society of Chemistry, 180.
4. A. C. Chadwick and R. W. Kentridge (2014) The perception of gloss: A review, Vision Res., 109, 221–235.
5. T. J. Keane, COMBINED GLOSS AND COLOR MEASURING INSTRUMENT, U.S. Patent 4 886 355, Dec. 12, 1989
6. R. Sève (1993) Problems connected with the concept of gloss, Color Res. Appl.,18, 4, 241–252.
7. K. Ikeuchi (2014) Computer Vision. Boston, MA: Springer US
8. H. E. Bennett and J. O. Porteus (1961) Relation Between Surface Roughness and Specular Reflectance at Normal Incidence, J. Opt. Soc. Am., 51, 2, 123–129.
9. G. Lérondel and R. Romestain (1999) Fresnel coefficients of a rough interface, Appl. Phys. Lett., 74, 19, 2740–2742.
10. H. de Clermont-Gallerande, S. Abidh, A. Lauer, S. Navarro, G. Cuvelier, and J. Delarue (2018) Relations between the sensory properties and fat ingredients of lipsticks, OCL, 25, 5, D502.
11. Tomoko, I. (2010) Development of lipstick that barely leaves a color mark on cups using two-phase separation mechanism. in 26th IFSCC Congress.
12. K. Hasegawa and S. Inasawa (2020) Evaporation kinetics of continuous water and dispersed oil droplets, Soft Matter, 16, 37, 8692–8701.