THE EFFECT OF DIFFERENT HUMECTANTS ADDITION TO COLOGNES ON SKIN MOISTURE AND MICROORGANISM COUNT

Merve YILDIRIM, Bahar KAFADAR, Aslı Merve ÇAKIR. Özlem ESEN

EVYAP Sabun, Yağ ve Gliserin Sanayi ve Ticaret A.Ş

myilmazer@evyap.com.tr, bkafadar@evyap.com.tr, mcakir@evyap.com.tr, oesen@evyap.com.tr

Abstract: The scented cosmetic products such as colognes are composed of basically ethanol, water and fragrance. The use of colognes is favorable because of the fragrance. However, the need of them has been increased to the global health issues and the purpose of using colognes has differed because of its alcohol content. Frequent use of colognes leads to irritation, dryness and redness on skin. Therefore, the addition of the humectants into the cologne formulations may help to decrease the skin problems. In the study, two humectants, glycerin and mono propylene glycol (MPG) were formulated in cologne. It was concluded that the skin moisture was increased by glycerin addition much better than MPG, but the microorganism count after mono propylene addition was lower than glycerin.

Keywords: Cologne, mono propylene glycol, glycerin, skin moisture, bacterial count

Introduction

The fragrance products consist of a fragrance compound dissolved in ethyl alcohol. Perfume in this form is said to have first appeared in Hungary in the 14th century. It was known as the Hungarian Water and was used by the Queen of Hungary to stay young (Mitsui, 1998).

Today, many cosmetics contain fragrance ingredients. Fragrance products are classified as perfume, eau de parfum, eau de cologne, fragrance powder, solid perfume and perfumed soap according to the perfume ratio they contain. In Table 1, fragrance product groups are given according to different concentration ranges (Wannaruemon et. al, 2013).

Table 1. Types of fragrance products (Mitsui, 1998)

PRODUCT	FRAGRANCE DOSAGE
Perfume	15-30%
Eau de Parfum	7-15%
Eau de Toilette	5-10%
Eau de Cologne	2-5%
Solid Perfume	5-10%
Fragrant Perfume	1-2%
Perfumed Soap	1.5-4%

Since the need for alcohol-containing products is increasing all over the world, cologne is one of the most prominent cosmetic products. Cologne is a product that contains a small amount of perfume but consists of high volumes of alcohol and water. The approximate alcohol content varies between 70-80%. The products are generally used as a refreshing body spray. Colognes have low permanence on the skin, but they are highly preferred due to their low price and pleasant fragrance (Van Der Pol, 2003).

Nowadays, the effects such as irritation, drying and irritation on the skin can be observed due to increasing in cologne consumption. For this reason, it is important to include humectants in cosmetic formulations. Generally, moisturizers such as glycerin, MPG, panthenol and Sodium PCA are added to cologne formulations.

Glycerin is a humectant commonly used in cosmetic applications and has a trihydric alcohol structure. Glycerin is colorless, odorless, viscous and stable under many conditions. Because of pleasant odor and taste, glycerin is used in food and cosmetic application. Glycerin does not show toxic property, it is digestible and eco-friendly. Glycerin is a versatile chemical and good humectant because of degree of hydroxyl groups and high hygroscopic property. There is also an antimicrobial effect. Therefore, it has a wide field of usage (Fluhr et. al, 2005).

MPG is secondly widespread humectant in personal care formulations. It has transparent, odorless, viscous and as water-soluble as glycerin. MPG has limited use in oral care products and lipgloss because of its bitter taste. Because of its bacteriostatic and bactericidal properties, it prevents the development of microorganisms (Yılmazer et. al, 2019).

In this study, it is aimed to improve the moisturizing effect of colognes by adding humectant to colognes taking account of decreasing the microbial count. Glycerin and MPG were selected as humectants and their moisturization effect and the contribution of the microbial count were analyzed.

Materials and Methods

The cologne was formulated with alcohol, water and fragrance. The MPG and glycerin were added as 3% to observe the skin effects and bacterial count significantly.

As first study, the skin moisturizing effect was performed by the measurements of corneometer and transepidermal water loss (TEWL). MPA 5 (Khazaka, Germany) equipment was used for these measurements. In conditioned room of 20°C, 11 people were taken to the tests. In corneometer measurements, the hydration level of the skin is given directly by the equipment which shows the indicative numbers representing the moisture content. The fundemental principle of the method is on the strength of the difference between the dielectric constant of water (81) and other substances through measuring the capacitance of a dielectric medium. The span of variation of the values of skin moistening value is between 0-130 arbitrary units (AU) (Constantin et. al, 2014).

The numbers that gives the hydration level are depicted in Table 3.

Table 3. Skin types according to the result of skin hydration value (Zuang et. al, 1997)

Skin Hydration Value (AU)	Skin Type
< 30 AU	Very dry skin
30-45 AU	Dry
>45 AU	Sufficientyl hydrated

In measurements of TEWL, the tewameter is used and the open chamber assesses the loss of water from the skin according to time and area. Its unit is g/hm^2. TEWL is related to skin barrier function while the corneometer directly gives the moisture content of the skin at that time (Wan et. al, 2014).

Corneometer and tewameter were kept on the forearm and the measurements were read before and after applying the cologne formulations.

As second study, the microbial count were measured by Kikkoman Lumister PD-20. As mechanism of action, it is based on the measurement of bioluminescence, a product produced during the enzymatic decomposition of adenosine triphosphate (ATP) and adenosine monophosphate (AMP) using luciferase and pyruvate phosphate dikinase of all living organisms including fungi, yeast and bacteria. A swab is dipped into water and read as negative control on the equipment. The second swab is dipped into water and the palm is rubbed with the swab to hold the microorganisms. The swab is read by equipment again. Then, 5 sprayings of cologne formulations are applied on the palm for 20 seconds. Third reading is made with new swab. The readings of the equipment are given in Relative Light Units (RLU) (Hyserve Lumitester PD20, 2020).

Results and Discussion

The mean of corneometer readings were given in Table 4. Also, Table 5 shows microbial count before and after cologne application for all three formulations.

Table 4. Mean corneometer and TEWL results

	Cologne without humectant		Cologne with glycerin		Cologne with MPG	
	Corneometer	**TEWL**	**Corneometer**	**TEWL**	**Corneometer**	**TEWL**
Before application	51.5	6.9	48.2	6.0	48.5	6.4
After application	78.0	36.2	93.9	31.1	94.0	33.5
After 30 minutes	45.8	8.3	71.0	3.9	61.4	6.2
After 1 hour	48.1	5.9	66.2	4.2	58.8	5.1
After 3 hours	48.9	8.2	64.8	4.9	55.1	5.5

Before application, corneometer values for all three formulations are almost the same. Considering the values immediately after the application, the highest moisturizing effect was seen in MPG and glycerin. In the cologne sample without moisturizer, there is a decrease in the moisture values after 30 minutes, and at the end of 3 hours moisture value is lower than the initial value. On the other hand, in cologne formulations containing glycerin and MPG, moisturization effect is higher than the beginning after 3 hours. However, while glycerin and MPG give the same moisturizing value after 30 minutes, glycerin has a higher moisturizing effect after 3 hours. It seems that glycerin provides moistening by holding more water in a long time.

Considering the TEWL measurements, it is seen that the water loss of the skin in all formulations after the application is very high. The reason for this is the presence of the product after application on the skin in large amounts. TEWL values decrease in all formulations with the absorption of the product. Although there is an improvement in the TEWL value at the end of 1 hour in the cologne formulation without humectant, the TEWL value after 3 hours indicates that the barrier function of the skin is damaged and the water lost by the skin increases.

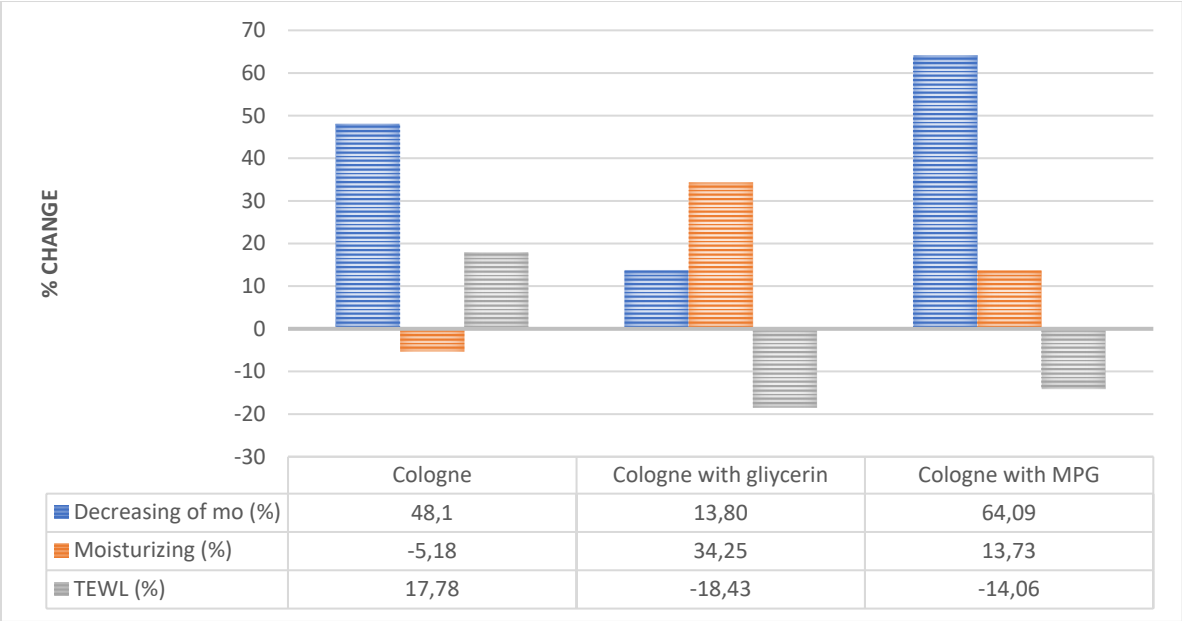
Considering the formulations containing humectants, TEWL values are lower than before the application even after 3 hours. It shows that the formulations do not adversely affect the barrier function of the skin and that the water retention properties of humectants reduce water loss in the skin.

The moisturizing properties of humectants are important parameters for the skin. However, in addition to moisturizing, it is important to choose the right humectant in order not to reduce the effectiveness of the alcohol in the cologne. For this reason, the glycerin and MPG ratio added to the formulations were determined to be 3%in order to better analyze the changes in microbial counts. Table 5. shows the average of the measurement values made in 11 people before and after the application.

Table 5. Mean microbial counts

	Cologne without humectant (RLU)	**Cologne with glycerin (RLU)**	**Cologne with MPG (RLU)**
Before application	4266	4979	5150
After application	2276	4487	1939

In the cologne formula that does not contain humectant, the RLU value decreases from 4266 to 2276 after the application. In the formula with glycerin added, the RLU value decreases from 4979 to 4487 and almost similar results were obtained before the application. In the formulation with MPG added, the initial RLU value was 5150, while the post-application value was read as 1939 RLU. This result revealed the antimicrobial properties of MPG as well as moisturizing properties.



	Cologne	Cologne with gliycerin	Cologne with MPG
Decreasing of mo (%)	48,1	13,80	64,09
Moisturizing (%)	-5,18	34,25	13,73
TEWL (%)	17,78	-18,43	-14,06

Figure 1. Percentage change of microbial count, skin moisture and TEWL

Figure 1. summarizes the decrease in microbial count and rate of change of skin moisture and TEWL. According to the results, the cologne formulation with the addition of MPG provided the highest antimicrobial efficacy, while the cologne formulation containing glycerin provided the lowest antimicrobial efficacy. Regarding the moisturizing results, the cologne formulation with glycerin provided the highest moisturizing, while the cologne formulation without the addition of humectant showed the lowest moisturizing feature. The TEWL value in the humectant-free formulation indicates a serious water loss. It appears that the rate of reduction in water loss is almost the same in formulations containing glycerin and MPG.

Conclusion

Glycerin and MPG are known to have antimicrobial activity. With this study, attempts were made to reduce the negative effects of colognes with high alcohol content on the skin. Within the scope of the studies, it is seen that the antimicrobial activity obtained by adding glycerin to cologne formulations is less than MPG and its effect on skin moisture is higher. Although the effect of MPG on skin moisture is not as much as glycerin, it contributed significantly to the antimicrobial effectiveness of cologne formulations. In this study, it is analyzed that the humectant addition must be performed by considering both the moisturizing effect and the antimicrobial efficacy.

References

Constantin, M. Poenaru, E., Poenaru, C., Constantin, T. (2014). Skin Hydration Assessment through Modern Non-Invasive Bioengineering Technologies. *Journal of Clinical Medicine*. 9(1): 33–38.

Fluhr J.W., Bornkessel A. and Berardesca E. (2005). Glycerol- Just a Moisturizer? Biological and Biophysical Effects, in: Loden M and Maibach (Eds.), Dry Skin and Moisturizers: Chemistry and Function, CRC Press, Boca Raton (FL).

HyServe Lumitester PD20 (2020). Retrieved from https://hyserve.com/files/aLumitester-PD20_EN.pdf.

Mitsui, T. (1998). New Cosmetic Science. Elsevier Science, 439-445.

Wan, D., Wong, V., Longaker, M., Yang, G., Wei, F. (2014). Moisturizing Different Racial Skin Types. *The Journal of Clinical and Aesthetic Dermatology*. 7(6): 25–32.

Wannaruemon, S., Jimtaisong, A., Rachtananpun, P. (2013). Sodium Carboxymethyl Chitosan as a Fixative for Eau de Cologne. *Tropical Journal of Pharmaceutical Research.* 12 (1): 45-49.

Van Der Pol, PA. (2003). History of Roses in Cultivation /History of the Perfume Industry. Elsevier Sience. 410-414.

Yılmazer, M., Kafadar, B., Saka, B. (2019). Hümektan (Nemlendirici) Özellik Gösteren Gliserin, Propilen Glikol ve Sorbitolun Cilt Üzerindeki Etkileri ve Farkları. *Journal of Turkchem.*

Zuang, V., Rona, C., Distante, F., Berardesca, E. (1997). The Use of a Capacitance Device to Evaluate The Hydration of Human Skin. *Journal of Applied Cosmetology,* 15: 95-102.

