

The best compatibility between formulation type and efficacy: an appropriate formulation type brings better efficacy

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Introduction:

There are different types of formulation of skin care products, such as toner, serum, lotion, cream and so on. From the technical characteristic of the formula, it can be divided into toner (single water phase), oil in water, water in oil and water in silicone oil. They have different effects on skin physiological parameters due to their respective technical characteristics. Toner brings instant moisture to the skin. Oil in water system usually brings fresh skin feeling, while water in oil system tends to moisturize the skin. Water in silicone oil system has the characteristics of both sides, and the skin feels fresh and keeps the moisturizing performance.

In fact, even if the efficacy of the active ingredients is confirmed, adding it to the formula may not be able to play a practical role[1]. At the same time, the same efficacy active ingredients in different types of formulations, and the actual effect of the final products will be different. In this study, the effects of different types of formulation on skin improvement were analyzed by the changes of skin texture and micro-morphology after single application, and give advice on which type of formulation is more appropriate for different efficacy.

Materials & Methods:

Subjects

Thirty healthy female volunteers were recruited, aged from 23 to 50 years (32.2±6.49 years). All participants were in good general health without skin diseases; were not pregnant or breast-feeding; had no scars or cuts on the test sites, or other matters which would impact the measurements.

Test samples

Four samples with different formulations were prepared (Table 1): toner (sample A), water in oil cream (sample C), oil in water cream (sample D), water in silicone oil cream (sample G). Table 1 shows the draft formulations, as well as the concentration of hydration agents and liquid emollients and silicone oil. These components have a large influence on the skin texture and micro-morphology.

TABLE 1. FORMULATION OF THE EVALUATED FORMULATIONS

RM	Formula Types	Toner	W/O cream	O/W cream	W/Si-O cream
		A	C	D	G
	AQUA	87	50	65	50
	POLYOLS	10.4	16.4	12	16.4
	OIL		31.5	8	5.5
	SILICONE OIL			4	26
	TROMETHAMINE	Adjust pH 5.5	Adjust pH of water phase 5.5	Adjust pH 5.5	Adjust pH of water phase 5.5

Instruments measurement

The test 4 different types of formulation, included toner, O/W cream, W/O cream, W/Si-O cream, were applied on the volar forearm. The skin hydration and skin texture parameters were collected by Corneometer CM825 (Courage & Khazaka Electronic GmbH, Cologne, Germany), Biox epsilon model E100 (Biox Systems Ltd, England) and Visioscan VC98 (Courage & Khazaka Electronic GmbH, Cologne, Germany) at Baseline, immediately after application, 30 minutes, 60 minutes and 120 minutes.

The parameters of skin moisture include skin hydration obtained from CM825 and skin capacitance by epsilon. Anisotropy from epsilon indicates skin texture structure. Anisotropy increases with age. The cutaneous lines included primary lines and secondary lines tend to a specific direction (45° and 225°) and no longer maintain all directions, the anisotropy increases[2]. When this trend expands, the cutaneous lines will form obvious wrinkles. Sew is the skin texture parameter, measured by VC98. The higher the Sew, the more fine lines on the skin.

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics 22 (International Business Machines Corp. USA). To compare the differences among samples, before and after sample's application, if the data is normally distribution, ANOVA was used, otherwise used wilcoxon rank sum test. Data were expressed as mean±SD, with p<0.05 considered significant.

Results & Discussion:

Fig.1 SKIN HYDRATION OF 4 TEST SAMPLES APPLIED IN 2 HOURS.

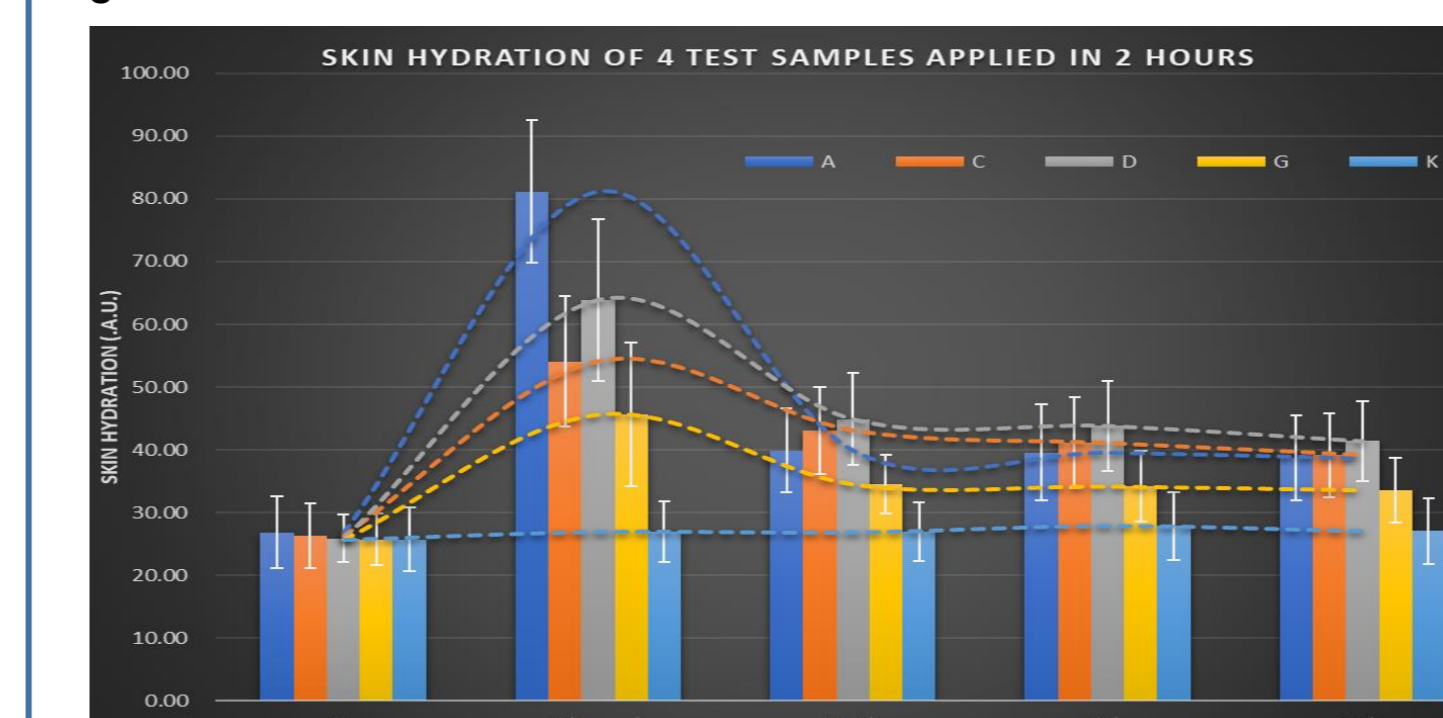


Fig.2 SKIN CAPACITANCE OF 4 TEST SAMPLES APPLIED IN 2 HOURS.

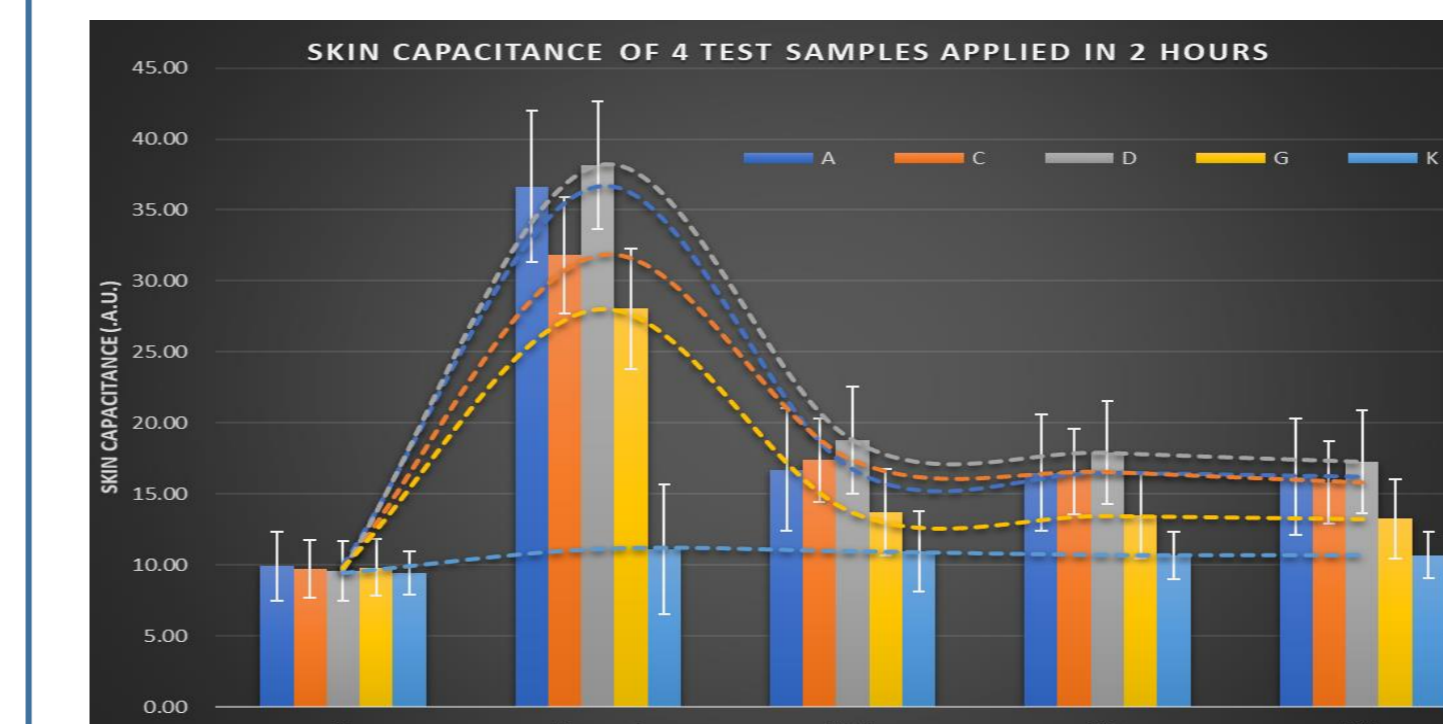


TABLE 2. THE TREND OF MOISTURE EFFECT OF EACH SAMPLE AT DIFFERENT TIME POINTS AFTER APPLICATION COMPARED WITH THAT AT Timmed.

Moisture effect trend = $\Delta_{T-BL} / \Delta_{T-Timed-BL}$

	Skin hydration			Skin capacitance		
	T _{0.5h}	T _{1h}	T _{2h}	T _{0.5h}	T _{1h}	T _{2h}
A	4.16	4.26	4.58	3.94	4.07	4.30
C	1.66	1.88	2.16	2.88	3.23	3.61
D	2.00	2.12	2.45	3.10	3.43	3.75
G	2.26	2.35	2.53	4.68	4.98	5.32

W/O and W/Si-O are more sensitive to the change of skin capacitance, and toner is more sensitive to the change of skin hydration. TABLE 2. shows the trend of skin hydration and skin capacitance of different formulation types relative to the immediately after use. This may suggest that we can select more sensitive indicators and instruments to evaluate the moisturizing efficacy of different types of products, so that we can more easily detect the differences between products. For example, the

differences of skin moisture efficacy between formula of different active ingredients in W/Si-O may be more suitable to use skin capacitance from Epsilon for comparative analysis.

Fig.3 ANISOTROPY OF 4 TEST SAMPLES APPLIED IN 2 HOURS

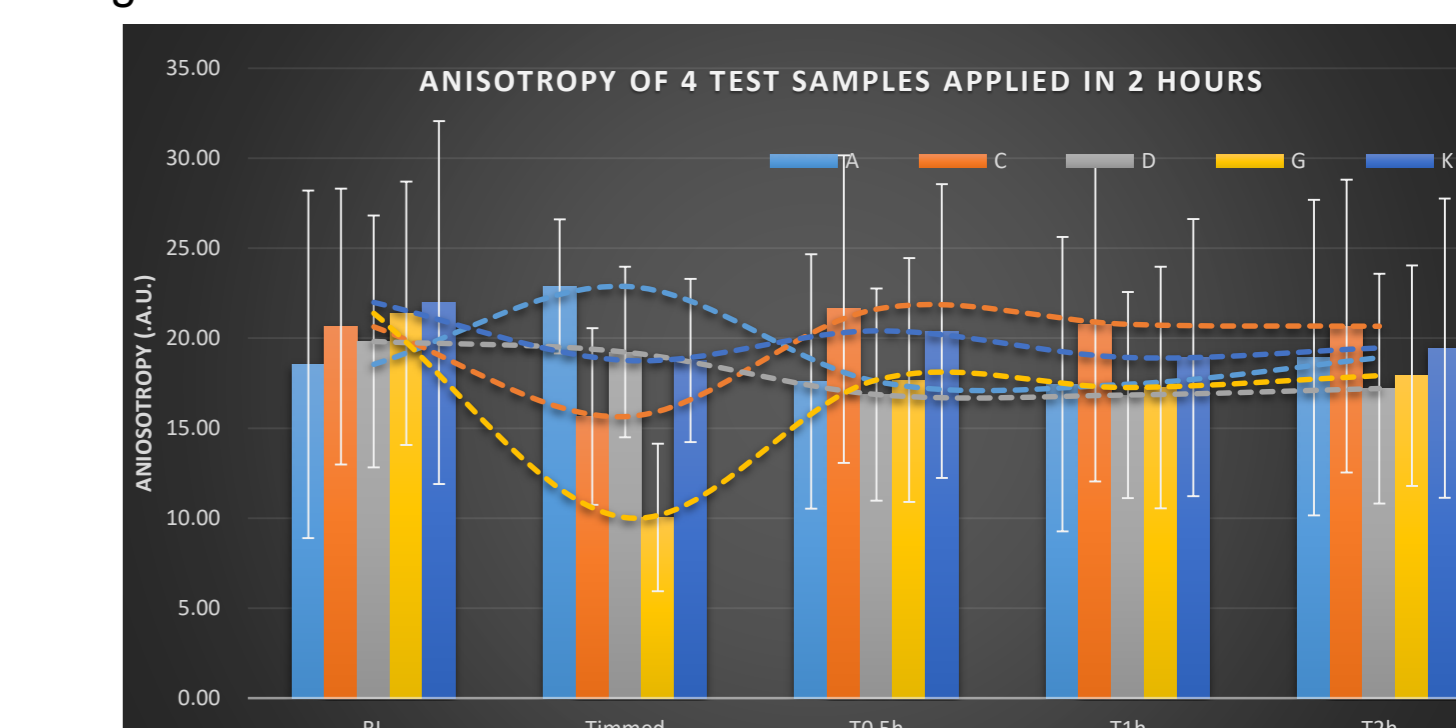
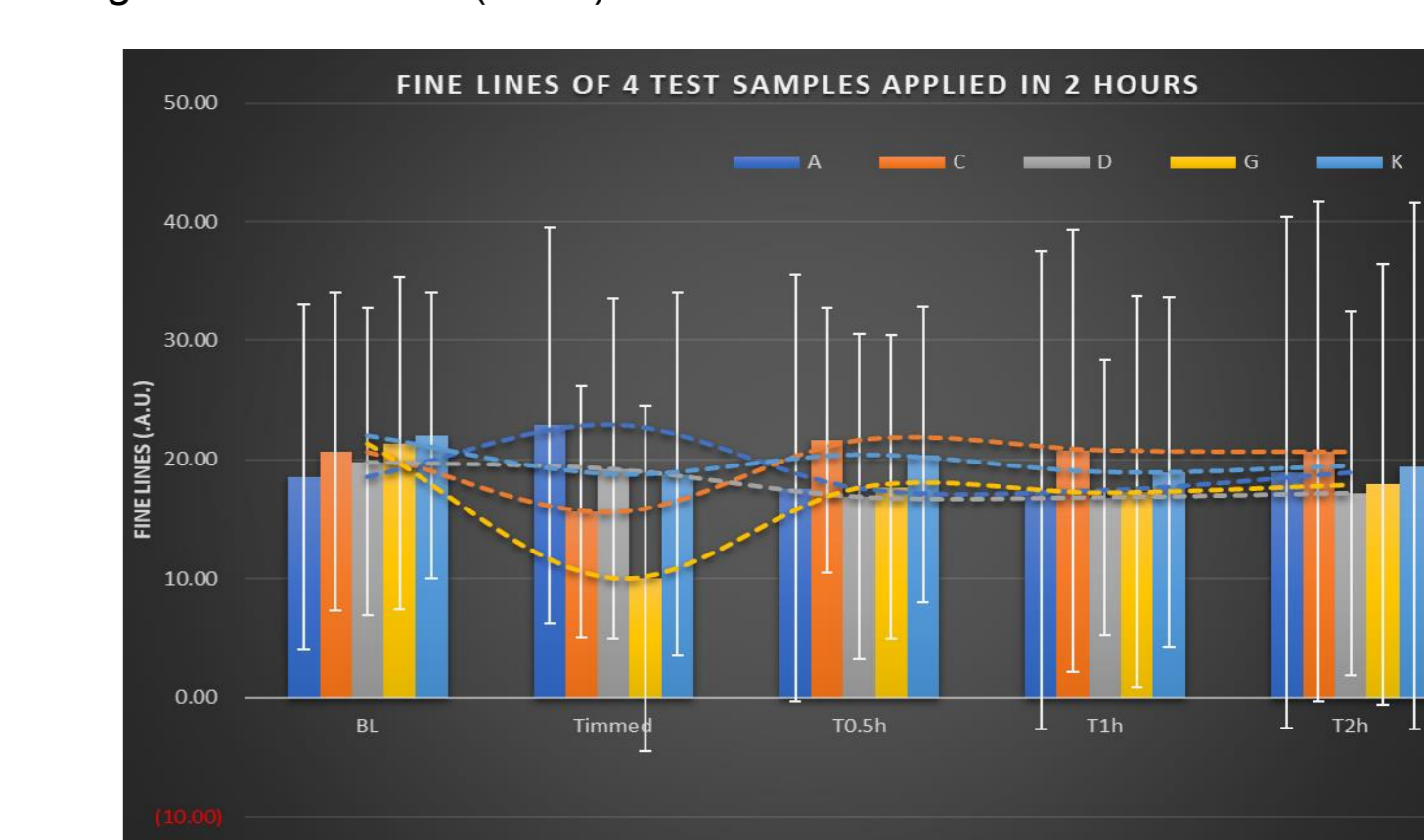


Fig.4 FINE LINES (SEW) OF 4 TEST SAMPLES APPLIED IN 2 HOURS



For anisotropy improvement, W/Si-O had the best performance. With the extension of time, O/W system gradually showed a trend of effective. On the contrary, W/O had a relatively obvious improvement effect immediately after use, but from 0.5 hours to 2 hours, the sample had no effect on anisotropy improvement.

On the improvement of fine lines, W/O had the best immediate improvement effect (P<0.009), and after 120 minutes O/W showed the best performance (P<0.002). O/W has been maintaining a good effect of improving fine lines. It speculated that it may be due to the good moisturizing effect of O/W. After the stratum corneum was fully hydrated, fine lines were significantly reduced. At the same time, from the low skin hydration value in baseline, the forearm skin of volunteers is relatively dry, and the fine lines are more caused by dry skin. Therefore, after full hydration, moistening with oil can better improve the fine lines of skin.

Conclusions:

Different types of formulation have different effects on improving skin texture, according to the efficacy claims of the product, to choose the appropriate type of formulation, with the efficacy of active substances, to better achieve the effect of improving the skin.

In terms of moisturizing efficacy, O/W is more effective; while W/O is more suitable for anti-wrinkle products, and W/Si-O is more effective in improving skin texture, such as skin roughness.

- The improvement of skin hydration was associated to the proportion of water in the formula, while the long-term effect was the result of the combination of the proportion of water and the content of oil. For toner and O/W cream, during the spreading, the water was rapidly absorbed into the skin, making skin instant hydrate, increasing the immediate hydration and capacitance. The occlusive effect of the emollient film when the water evaporated maintained the hydration level for a short time, which can be explained by the measured increase in skin hydration and skin capacitance.
- W/Si-O system did not show obvious advantages in skin moisturizing and improving fine lines, except pleasant experience brought by a large number of silicon elastomers. With the same water content, the instant and long-term moisturizing effect of W/Si-O was lower than W/O. W/Si-O achieves better immediate improvement of anisotropy than other formulations.
- In the aspect of skin fine lines improvement, W/O took the best immediate effect, and O/W was more effective in long-term improvement. The immediate improvement of fine lines of W/O may be attributed to the large amount of ester oils used in the formulation. Emollients soften and smooth the skin by filling the spaces between desquamating corneocytes and provide increased cohesion leading to a smoother surface with less friction[3]. With the extension of time, O/W showed long-term improvement, which indicated that the improvement of fine lines was the dual effect of water and ester oil.

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