

Improving Skin Appearance of Indonesian Women using Soft Focus Effect in Powder Foundation Formulation

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Abstract

Background: Indonesian women pay a lot of attention to their appearances and use high coverage powder foundations to hide skin imperfections such as hyper pigmented spots, lines and wrinkles, scaring, blemishes, etc. “Soft Focus” powder foundation is designed to hide skin imperfections without looking unnatural. It contains several raw materials to acquire harmony between opacity and transmittance resulting in blurring the visibility of imperfections. The objective of this study was to achieve a blurring on skin termed ‘soft focus’ which indicates improvement of facial skin appearance.

Methods: Twenty six materials with different particle shapes and sizes were screened to determine the blurring effect with a subjective scoring ranged from 1 to 7. The best raw materials were formulated in the form of a powder foundation and tested in vivo. The formulations were applied on the full face followed by photography using the VISIA imaging system.

Results: Based on the evaluation, five Soft Focus agents appeared to impart the highest blurring effect scored between 3.5-7 in the initial in vitro fast-screening study such as talc coated with PCA dimethicone (A); titanium dioxide encapsulated with porous spherical silica (B); nylon-12 (C); porous spherical silica coated with methicone (D); and titanium dioxide (and) aluminum hydroxide, coated with triethoxycaprylylsilane (E).

Conclusion: Based on the confines and conditions of this study, five soft focus ingredient combinations in powder formulations can improve facial skin appearance for Indonesian women.

Keywords: Skin imperfections; Soft focus; Refractive index; Indonesian women; Indonesian ethnic

Introduction

Face is an important part of the body for a person's physical appearance, so face becomes a very special thing in everyday life, especially for women [1]. Every woman wants to have a beautiful face without facial skin problems. They are competing to get the perfect face in various ways, such as doing facial treatments or using skin care [2]. However, not all women like to do facial treatments because it takes a long time and must be done regularly, so many Indonesian women prefer faster ways to get a beautiful face such as using makeup [3]. Makeup can make the user look more attractive and thereby increase self-confidence [4].

The best makeup that can successfully cover facial imperfections was foundation [5]. According to the NusaResearch data on 2020, 40.2% of Indonesian women use foundation so it is ranked 3rd most widely used cosmetic in Indonesia. There are many types of foundation in the market, ranging from liquid, cream, stick, and powder. Foundation can make skin appear smooth by covering imperfections such as wrinkles, freckles, pores, or spots [6]. Foundation can also be used to change skin tone, cover dark shadows around the eyes and hide hyper pigmented skin [7]. To obtain smooth and long-lasting makeup, it is necessary choose the correct type and colour of the foundation.

Soft Focus powder foundation has been developed to produce a natural finish. Soft Focus is a technology used to cover skin imperfections by filling pores or wrinkles with particles contained in cosmetic products. Soft focus particles will scatter the incoming light and increase diffuse reflectance so that pores or wrinkles will appear disguised or give a blurring effect [8]. Blurring effect of raw material is affected by many factors and can be achieved by combining raw material with certain characteristics, such as flake type powder with a low refractive index, spherical powder with a low refractive index, flake type powder with a high refractive index, and sub-micron powder with a high refractive index, to acquire harmony between opacity and transmittance resulting in blurring the visibility of imperfections such as wrinkles, freckles, pores, spots, while maintaining a natural finish [8].

Based on research by Cho et al (2012), titanium dioxide with high refractive index can create a blurring effect in cosmetic application, it can cover imperfections, impart matte finish, and protect the face from sun exposure, however, it also presents high opacity with unnatural results [9]. For best results, a combination of materials with low refractive index such as talc, silica, or nylon a

needed [8]. Silica spherical powder and nylon impart a smooth quality to the makeup which can absorb sweat and disguise pores [10].

An optimum combination of these materials is required to achieve full coverage, perfect blurring effect, and natural finish. This has been achieved in the Soft Focus formulation as evaluated both in vitro and in vivo.

Materials and Methods

Materials

Powder foundation formula is prepared by combining several materials such as talc coated with PCA dimethicone (Talc 2K PD®), titanium dioxide encapsulated with porous spherical silica (SH 219®), nylon-12(Orgasol 2002 Exd Nat Cos®), porous spherical silica coated with methicone (SI-5 Sildex H-52®), titanium dioxide and aluminum hydroxide coated with triethoxycaprylylsilane (Micro TiO2 060 AS®).

Methods

In Vitro Test

Blank Preparation

Films were made without sample particles and using the same carrier as the test sample. Mix water, xanthan gum (Keltrol CGSFT®), and EDTA until homogenous in the main tank. Heat up the mixture to 50° C then slowly add polyvinyl alcohol (Gohsenol EG40C and Gohsenol EG05C®) while heating up to 50° C. Mix until homogeneous. In the other tank, mix polyethylene glycol-75, glycerin, and 1,3 butylene glycol (premix B). Mix Premix B to the mixture in the main tank while stirring then cooling up to 40° C. Then aging for 8 hours, and it was applied on glass slides using a 200 µm bird applicator from BYK.

Sample Preparation

26 types of particles were evaluated with light-diffusing properties, each type of particle was incorporated into a separate thin polymer film. Films are made as blank film and after that we added 45% concentration of each particles into the film formula. Then, the sample film was applied using a 200 µm bird applicator on glass slides with a thickness of approximately 5 µm.

Preparation and assessment of soft focus scoring standard

Assessment was conducted subjectively based on the sample's ability to give a "blur" effect. The five samples were placed over a paper printed with the logo which was blurred due to the product. The blurring was scored and compared to the standard series visually by four trained clinical grading technicians. The scoring scale was from 1-7 with 1 having the least and 7 as the highest blurring effect.

In Vivo Test

Questionnaire research

200 Indonesian women were recruited from various ethnic groups using inclusion and exclusion criteria listed in Table 2. The subjects answered specially constructed online research questionnaires designed as instruments for data collection. The questionnaire addressed baseline skin history including skin type (oily and dry are different types, oil/dry), skin imperfections, and types of imperfections that could be covered with makeup.

Test use the Visia instrument

The test was carried out in controlled room temperature conditions (24°C). Prior to evaluation, the subjects were asked to wash their face using water only. The subjects then acclimated in the controlled environment (22°C, RH 52%) for 30 minutes and then baseline photographs were obtained. The subjects were provided with a moisturizer to apply and smooth on the full face followed by application of the test powder containing five ingredients deemed best in the in-vitro study. Photographs were obtained again after treatment.

Photo analysis with Image-Pro 10 analysis

Before and after pictures from Visia Gen 7 instrument was analyzed by Image Pro 10 which identified and measured four parameters skin problems including acne scar, uneven skin tone, blackhead, and large pore. Each data obtained was tested for normality using Shapiro-Wilk test with a confidence level 99% ($p<1\%$). Data from the test materials was compared before and after application of formula via statistical analysis using a two-tailed paired sample t-test (if normal distribution) or using the Wilcoxon test (if not normal distribution). The difference is considered significant if $p < 0,05$.

Result

In Vitro Test

In vitro testing was conducted to observe the blurring ability of the ingredients in the powder foundation formulation in a predetermined paper printed with the logo. Each material produces a different blurring effect and is classified based on soft focus scoring, the higher the soft focus score, the greater the resulting blurring effect. The soft focus scoring observed by trained clinical grading technicians (table 1).

Table 1. Soft focus scoring for 5 samples

Formula	INCI Name	%	Soft Focus Scoring
A	Talc, PCA Dimethicone	45	6
B	Titanium Dioxide, Silica	45	7
C	Nylon-12	45	7
D	Silica, Methicone	18*	3.5
E	Titanium Dioxide, Aluminum Hydroxide, Triethoxycaprylylsilane	25**	7

*Concentration of sample D was not increased to 45%, because there had been lumps in mixture causing an uneven film layer

**Concentration of sample E was not increased to 45%, because in 25% concentrated already reach 7 score

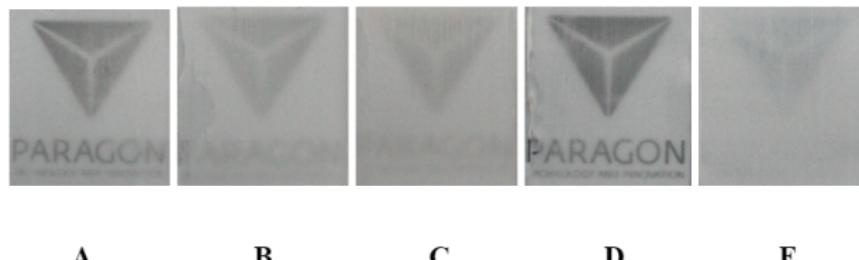


Figure 1. Soft focus effect of each sample

Based on figure 1, sample B, C, and E covered the logo printed on the paper perfectly so that they were given a score of 7. Sample A and D produced a moderate but still higher blurring effect than other samples, so these five samples were continued to the in vivo testing stage.

In Vivo Test

Questionnaire Research

Perception of facial concerns was reported by 200 Indonesian women (figure 2). The most common facial problems among respondents are acne spots, uneven skin, and large pores. Based on this result, further study was conducted in 30 subjects, using inclusion and exclusion criteria listed in Table 2, to evaluate the effect of test powder on improving skin appearance of people with said common facial problems.

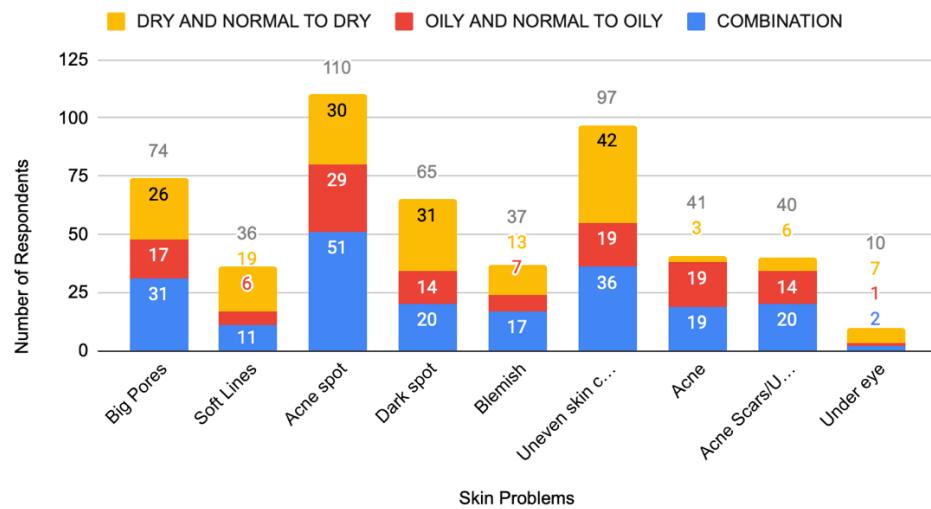


Figure 2. Skin problems of 200 Indonesian women respondent

Table 2. Exclusion and inclusion criteria in vivo respondent

Exclusion Criteria	Inclusion Criteria
<ul style="list-style-type: none"> · A systemic illness that contraindicates participation · Any dermatological disorders in the test areas; including psoriasis, vitiligo, etc · Have any form of suspicious lesion or skin cancer on the treatment area · Under a dermatologist care for any conditions the test areas · Any infections, burns, cuts, tattoos, visible scars or excessive acne in the test areas · Pregnancy, lactation, or attempting to get pregnant as reported by the subject for three months prior or for the duration of the study · Use of OTC (over the counter) topical treatments other than sunscreen such as OTC Acne medication in the test area in the past month · Participated in a study involving the face in the last 1 month prior to baseline visit · Receipt of any skin treatments in the last 6 months (i.e. skin peels, skin resurfacing on the face) · Market Research Companies, and Cosmetic/Personal Care Manufacturers are excluded from participation in clinical studies 	<ul style="list-style-type: none"> · Indonesian female between ages of 17 – 30 · Have skin problems with facial skin problems such as: uneven skin tone, large pores, wrinkles, acne scars, acne, textured skin, blackheads, or whiteheads · Have dry, normal, oily, combination, sensitive, or oily and acne-prone skin types · Be in a good health · Willing to avoid sun exposure (as best as possible) to the face and including sunbathing; using tanning booths, and self-training products for the duration of the study · Express willingness to cooperate with the investigator and comply to study requirements · Demonstrate the ability to understand what risks associated with the participation · Demonstrate the ability to read and understand all the items in the informed consent document · Agree to use the test product as directed · Give consent by signing the statement letter

Statistical Analysis

The results of image analysis were analyzed using SPSS (IBM® SPSS® Statistics version 28) as shown in table 3. Based on the results of SPSS analysis the use of powder foundation was able to even out facial skin color up to 17.68% better and reduce the number of uneven facial skin areas up to 12.60% from baseline. The appearance of pores and blackheads were reduced by up to 15.51% and the number of facial pores and blackheads were reduced 5.62% compared to baseline. The use of powder foundation was effective in disguising the appearance of acne and acne scars on the face by 44.08% and reduce the number of pimples and acne scars and blackheads were reduced by 42.25% from baseline.

Table 3. Statistical analysis of skin evenness, big pores, and acne scars

Parameter		Before		After		P-value*	Delta (%)
		Mean (Pix ²)	SD	Mean (Pix ²)	SD		
Skin Evenness	Sum	366987,90	183012,91	302096,90	166516,44	0,002	-17,68
	Number of element	8,20	1,65	7,17	2,21	0,004	-12,60
Big Pores	Sum	94075,87	47101,23	79487,23	38990,07	0,000	-15,51
	Number of element	2059,77	656,69	1944,00	644,10	0,000	-5,62
Acne Scars	Sum	11174,40	9387,53	6248,57	6405,53	0,000	-44,08
	Number of element	14,20	11,62	8,20	8,42	0,000	-42,25

*p-value <0,05 statistically significant

Discussion

At present, the most widely used method to evaluate soft focus test results is visual evaluation, which is subjective. Clinical grading technicians were trained and had experience of evaluating products. A minimum of 2 technicians conducted the measurements visually to avoid biased results [11]. There are always emerging skin problems that cannot be evaluated visually. In vitro testing

employed object glass as a representation of human skin. Based on soft focus scoring, titanium dioxide encapsulated with porous spherical silica (B), titanium dioxide and aluminum hydroxide, coated with triethoxycaprylylsilane (E), and nylon-12 (C) give the best soft focus effect because they have high refractive index which means it is able to scatter light very well [12]. When ground into a fine powder, they can be a very useful pigment with a white finish. This powdered form of pigment takes advantage of its excellent light scattering properties for applications requiring opacity and vibrant colors [13].

Titanium dioxide (white) provides color to match with skin, titanium dioxide functions as particulate inorganic sunscreens in cosmetic products. It has relatively low transmission indicating good light diffusion, but low overall transmission resulting in a high level of opacity. Titanium dioxide also exhibited high overall reflectance, with a high percentage of scattered reflection producing a white film appearance. These results indicate that titanium dioxide is not well suited for use as a soft-focus particle, but it can be combined with other particles for better results. Addition of silica microsphere leads to good spreadability and a silky feel [14]. Therefore, titanium dioxide combined with aluminum hydroxide and coated encapsulated with porous spherical silica (a non-nano microsphere) provides an excellent soft focus effect. Soft focus powders reduce the appearance of skin imperfections such as fine lines and wrinkles by diffusing optical light [15]. Hybridization technique was used to improve the dispersibility and ball bearing effect of silica. So, it can create a blurring effect with natural appearance [17].

Porous spherical silica coated with methicone is a hybrid powder for cosmetics, used as skin adhesion; it provides cushioning, and water repellence [16]. Talc is an inorganic powder so it gives a frictional feel and unpleasant powdery sense to the skin. Talc was coated with pyrrolidone carboxylic acid dimethicone has transparency and serve to avoid excessively opaque. It can enable imperfections to be masked and can provide color without rendering the makeup particularly visible. A relatively natural appearance of a made-up surface can thus be conserved.

Nylon 12 exhibited a high level of total transmission with a low percentage of specular transmission, resulting in a high degree of diffusion. Nylon also exhibited high contributions from the scattered reflection component. Using nylon as soft focus material gives skin complexion a smoothness for a soft and comfortable finish [14].

The results of in vivo test showed that instrumental testing is more sensitive to detecting the value of the effect of using powder foundation on respondents with skin problems. The in vivo test of powder foundation formula using visual image analysis of photographs presented a statistically significant reduction in the imperfections of the subjects. Formulas with 5 combination materials even out facial skin, disguise the appearance of pores, and acne scars on the face.

Conclusion

Based on the confines and conditions of this study, powder formulations with five soft focus materials can improve facial skin appearance for Indonesian women. It was able to even out facial skin color, disguise big pores, blackhead, pimple, and acne scar, and also reduce the number of that skin problems statistically significant. This method can be a platform for evaluating soft focus effects on complexion makeup products.

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